Cheese Machines and Cellos:

Technical Craftsmen and Craft Technicians

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Abstract

The study is based on a period of ethnographic research among approximately thirty tradesmen, apprentices, supervisors and related personnel at a medium-sized precision engineering company in Hamilton, New Zealand. The company specialises in high quality niche products and machinery for the dairy, aviation and medical technology industries. Its work involves a wide variety of engineering crafts and practices.

My aim was to better understand the work that was done there, the elements of skilled and expert practice involved in it; how these skills were learned and from whom, and what they meant to those who held them. I wanted to find out which people and what conditions and environments best enabled the acquisition of skills and a good learning experience. By way of comparison to this main group, I interviewed a smaller number of craftspeople in the wider community: a fine furniture maker, a printmaker, a ceramicist and two luthiers, all of whom worked independently.

This ethnography is located within a wider literature on apprenticeship, skill and education, and about what it means to be a “maker of things” (e.g. Beeby 1992; Biesta 2006; De Munck, Kaplan and Soly 2007; Dormer 1994, 1997; Keep 2007, 2009; Sennett 2008). I also draw on ethnographic discussions by other scholars who have described skilled practices and ways of learning in diverse social and cultural contexts (e.g. Coy 1989; Crawford 2009; Eraut 2001, 2002; Keller and Keller 1996; Lave 1988, 2011; Marchand 2003, 2010).

My ethnographic data provides a rich description of a contemporary industrial workplace where learning involves both practical and theoretical knowledge and creative ability. The findings demonstrate that successful learning on the shop floor (and in the other examples given) is the result of a complex amalgam of disparate elements. The learning and teaching in these workplaces are sometimes structured and sometimes serendipitous. They are embedded in and arise from the processes of creativity, analysis, manufacture and reflection. They involve not only what takes place at the worksites but also the qualities and dispositions and histories of learning, both formal and informal, that the participants bring to their work.

The development of skill and the acquisition of knowledge are shown to be complex and deeply personal and individual phenomena that are best nurtured in environments rich in materials, opportunity and experience, and in cooperation with interested, capable and expert “others”. This complexity is not easily represented in or catered for by current forms of educational assessment in New Zealand.

A further and largely unexpected dimension of the study was my growing awareness of my own apprenticeship as a practitioner of ethnography, including my location as a participant observer in the actual field of study. This experience invariably led me to reflect further on the processes of apprenticeship, education and learning.

Keywords: Ethnography, Apprenticeship, Skill, Craftsmanship, Learning, Assessment, Good Work, Precision Engineering.

Acknowledgements

My thanks first and foremost to my chief supervisor, Associate Professor Michael Goldsmith, who first suggested that I expand on my original idea of researching apprenticeship learning, by comparing this with that of a group of artists. This has proved to be a fruitful approach.

Fieldwork research is the form of apprenticeship which anthropologists undertake as their rite of passage to that profession. Like that of the apprentices on the workshop floor, it is learning in the form of “learning by doing”; the watching, the listening, the talking, the reading, the thinking, and, in this case; the writing. Like any other form of apprenticeship a good “Master” is critical to the quality of the experience. I could not have wished for a better one. I greatly appreciate the invaluable mentoring, support and editorial expertise that Mike has provided throughout. I have also appreciated the additional discussions with my second supervisor, Dr Tom Ryan.

Without the participants and a fieldwork site there would not be an ethnography. For this, I am grateful to the artist/makers; Ruth Davey, Susan Flight, David Fowler, Ian Sweetman and Noel Sweetman who shared their experiences and took time to describe their work to me. In particular, I am grateful to Roger Evans, CEO of Stafford Engineering, who was willing to allow my fieldwork research to be carried out at his factory. Along with apprentice coordinator John Crombie, technology teacher Steve Andrews, and Danny Ryan the CEO of a related company, Roger contributed valuable insights about the engineering industry and the “making” of precision engineers.

However, it was with those on the shop floor that I spent most of my time at the company. For their tolerance of being “watched” while they worked, their willingness to describe what they were doing, and the sharing of their stories of learning over a period of three years, I am most thankful. It was an enriching experience for me and I learned as much from the men as I learned about them and their work.

This research was supported by a University of Waikato Doctoral Scholarship along with another from the New Zealand Federation of Graduate Women, Waikato Branch. Members of the University library staff have also provided valuable assistance.

Lastly, I thank my patient and caring family and friends who have listened and given their encouragement and support throughout.

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Abbreviations

AEWS	Army Education and Welfare Service
DOL	Department of Labour
E & T	Education and Training
GNP	Gross National Product
FND	Field note diary
ITF	Industry Training Federation
ITO	Industry Training Organisation
NEETS	People not in employment, education or training
NZCTU	New Zealand Council of Trade Unions
NZCER	New Zealand Council for Educational Research
SS	Stainless Steel
WECA	Waikato Engineering Careers Association

Notes on Terminology

The Use of the Maori Language

I have not italicised Maori words, as Maori, along with English, is recognised as an official language within New Zealand. Where I have used Maori words a translation or similar meaning is given in English either within the text or as a footnote.

Gendered Terms

The majority of participants in the research were male. Within the engineering workshop, for most of the period of the research, the entire workforce, apart from the receptionist/office manager, was made up of men. In general, the majority of those working in this field are men. In general discussion I have mostly used masculine pronouns as these fit most appropriately in the context of this field site.

Towards the end of the research, a young woman was employed by the company as an engineering cadet. I had already completed most of the fieldwork at the time she arrived and while I spent time chatting with her about her work I did not formally include her with those I interviewed. She had settled quickly into the workshop and appeared to be accepted fairly readily by the men. She soon had her “place” in the lunchroom and appeared to hold her own very confidently in whatever discussions were taking place.

Among the craftsperson/artist group there were three men and two women. Again, I have generally used the terms craftsman/woman as applicable, and craftsperson in other discussion, or, female pronouns where I am discussing the female participants. I also use “artist” which is gender neutral but is not a value-free description in itself; it is used in this case simply to describe a group of mixed gender “creative craftspeople” who also often produce what we may consider “works of art”. However, this has still not resolved the dilemma completely as I have retained the mixed terminology of “Master craftsperson”.

Discussions of the many issues relating to gender are not included in my analysis. Gendered language is evident throughout and I believe that this is largely a reflection of the engineering industry as it has operated over the last few hundred years. A telling example of this is described by Clarence Beeby (1992:186) in his recollection of the commission he set up in 1944 to enquire into trades apprenticeship:

> In this case the male possessive pronoun is correct; there were no women on the commission. As far as I know, there were no women apprentices, and it never occurred to most of us that there might be![1]

[1] This is an interesting observation in itself as during World War II many women undertook work in engineering factories and many other traditionally male occupations to make up for the domestic shortage of male workers.

A Note on Style:

Headings and sub-headings are bolded.

The main body of the text is in this font.

> Quotes from both the participants and the literature are indented and in this font.

> *My interview questions and comments are indented and italicised.*

> Quotes from my fieldwork diary (Field Notes Diary) are indented and in this font and script and are indicated thus (FND date).

Footnotes are in this font.

Chapter One

Introduction

> …the function of ideology is to simplify the world and the function of research is to discover its complexities.
>
> William Form (1980:155)

Hamilton is located in the central North Island of New Zealand, in the wide river basin of the Waikato River. The area has been one of agricultural activity from the days when it was first occupied and cultivated by Maori settlers.[2]

The Waikato area has since become a major producer of dairy products, and also produces meat, fruit, vegetables and other crops. A number of large dairy processing factories are located in the region and, more recently, there has been an increase in smaller scale, artisanal production of dairy goods.

The geographical location of the city of Hamilton (population approximately 143,000)[3], with its close proximity to Auckland, the largest centre of population in the country, and its rail links to the nearby port of Tauranga, has recently been the focus of an awareness of its strategic value in what is described as a "golden trade triangle" (Fox 2010:13).

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[2] King (2003)
[3] Hamilton City Council 2012

It is within this growing mix that Stafford Engineering, specialising in providing engineering solutions for these primary industries, is located.

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At the time I began the research, the economy and job market had been relatively buoyant with frequent complaints about the lack of “skilled” workers in many areas. However, skill shortages and gaps have been evident throughout history as the techniques and the technologies of production have changed over time.[4] In the early to mid-2000s in New Zealand, it was the shortage of trained trades people which seemed to be the focus of discussion.

My goal in embarking on this research was to find out more about the work of precision engineers and that of a group of artist/craftspeople or, those who “work with their hands” and how they learned to make the things they produced. I had a feeling that such work is often undervalued and even misunderstood because of the long history that constructs physical or manual work as something less than mental work. There are, on the other hand, the instances where “physical work” is constructed as “real work” while less physical work, of a lesser value.

Given this background and my initial goal, the questions I set out with were the following:

- What is the fieldwork site like?
- What does the work being undertaken involve?

[4] In just one example, Greenfield (2006:72) describes the effects of shortages of skilled dyers in Spain after their discovery of cochineal as a dye-stuff in South America in the early 1500s. Such shortages were common in the textile industries of the following centuries. The vast population shifts of eighteenth and nineteenth century Europe, as industrialisation increased, provide many more examples.

- What does skilled and expert practice look like in this field?

- What are the conditions and environments that best enable a good learning experience?

- Who are the people that best enable a good learning experience?

- What do the participants think about their learning and work?

While the original idea was to compare the two groups of makers – the craftspeople/artists and the precision engineers - as the research took shape I began to realise that my comparison was no longer a neat one. The engineer group comprised the full range of levels of learning from new apprentice through to very senior and master tradesmen, some of whom still practised their craft and in turn mentored others as well, and some who had moved to more management type positions. This fieldwork site contained approximately thirty-five participants along with a few associated persons such as business colleagues and training staff from a separate company.

The artist/craftsperson group had a core of only five participants, all of whom can be described as late career artist/makers. If there is any neat comparison at all it would be perhaps best considered between this group and some of the senior engineer/tradesmen. In the end, what I gained from having the two groups was the ability to reflect on the enterprise of crafting skill as a whole and on what it meant for them to be “makers of things”. The aims and starting points or reasons for making were often completely different but the mental, physical and phenomenological processes, and the personal rewards, were often very similar.

In addition, inclusion of the artist participants alerted me to a variety of elements I might not otherwise have taken into consideration. This arose largely because the age range of the artists was a much narrower and older one than that of the majority of the Stafford staff. The era the artists had grown up in, and the form of education and social environments which they had experienced, led me to consider more carefully the importance of the biographies of the participants and the opportunities which had been available to them.

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Reflecting on the literature as a whole I have found that much of the research and commentary on factory work focuses on large and often highly automated companies with very large and hierarchically structured workforces (Aitken 1985; Braverman 1974; Burawoy 1979, 1985; Chinoy 1955; Hobsbawm 1984; Hoxie 1966; Kunda 1992; Noble 1979, 1984; Roy 1969; Schultz 1985; Whalley 1986).

Many studies of manufacturing work also either ignore or skip over the theoretical and analytical nature of such work and focus instead on power relations or other political aspects involved in the labour processes. This was particularly evident after Braverman's seminal analysis of Taylorised work systems in 1974. Other studies which emanate from the field of management studies tend to have a top-down perspective and continue to exhibit lingering echoes of Taylorism and the later systems of Fordism and Toyotaism.

More recent research into trades training, which has as its focus the processes of learning in the workplace, still tends to treat manufacturing as a field where people "work with their hands" and accords little agency to those who work on the shop floor. Education and training policy and workplace learning discussions of this area of work emphasise the need for "basic skills" while the theoretical and analytical aspects of the work are accorded less emphasis.[5]

While Stafford is a medium sized company of its type for this country, it is tiny in comparison to overseas examples. The company produces a range of niche products within a model which compares more closely to an area of specialist production. The tradesmen in this instance work semi-autonomously so that their work is of a more artisanal nature. It thus exhibits an entirely different workplace structure than would be the case in a larger, more automated factory. The nature of the work undertaken in the company also underpins the structure of human relations within the company.

Practices that may be available to management in larger production companies of the type described by the authors noted above are neither applicable nor desirable in this instance. It was also apparent in the conversations of the tradesmen (and even the CEO) that there was resistance to ideas of instigating some of the managerial practices that are favoured in larger production companies. That is also why the literature which describes smaller-scale artisanal production has been of greater analytic value for my research.

In relation to the artist participants, three had taught within the formal education system. The artist participants were educated in New Zealand during the "Beeby years" which saw a gradual but dramatic reformation of

[5] Paul Harris (2002:42) also pointed out the lack of recognition of the skilled trades as sites of "knowledge" work in his comparison of New Zealand fine furniture makers with those of Italy and Denmark, arguing that "both skill and design are forms of knowledge".

the education system from one which was based on a narrow range of formally taught subjects, to one where the curriculum embodied the ideals of a more democratic, progressive and experiential form of education advocated by philosophers such as John Dewey (1859-1952).[6]

The biographical histories of both groups of participants are included and my findings suggest that these histories and early learning experiences have contributed immensely to later success. On the strength of these findings I argue that a background and education rich in opportunities for experiential learning among interested and expert others provides the best ingredients for later success.

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The "Anthropological Turn" in Studies of Learning

Much of the research about learning, in the earlier part of the twentieth century, emanated from the field of psychology and focussed on cognition – on what happens in the mind. Much of the research was carried out in laboratories and schools and involved psychometric forms of testing (Lave 1988:1). By contrast, around the same time, John Dewey's insistence on paying attention to the immanent, experiential and social nature of learning provided an often controversial alternative view.

[6] Clarence Beeby (1902-1998) was the architect of this reform of education in New Zealand from the 1940s until the 1960s. His reforms stayed largely unchanged until 1989. William Renwick, who served as Director of Education during some of these years describes Beeby as a "practical-minded empiricist [who had] the luck to have genius and the genius to have luck [and who embarked on a] grand policy of educational reconstruction" (Renwick 1992:vii, viii). Further anecdotes referring to Beeby and his philosophy are evident in the stories of the artist/maker participants.

From the literature I have covered there is an obvious trend in learning research which appears to have gathered momentum around the 1970's. Articles by Marilyn Notkin, Jack Haas and Hannah Marshall in an issue of *American Behavioural Scientist* (1972) on "situational learning", provide early examples of the further recognition of the importance of social context in the processes of learning and skill acquisition. In Jean Lave's (1988) study of the use of mathematics in everyday activity, the author set out to create a "social anthropology of cognition [recognising the possibility that] cognition is in fact a complex social phenomenon" (Lave 1988).[7]

It is from these studies and the many similar ethno-methodological examples that ensued, that researchers have been able to gain a fuller understanding of how people learn, and what may constitute a good learning environment. This emphasis on the situational nature of learning elicited a response from a number of cognitive scientists, resulting in a 1993 special issue of the *Journal of Cognitive Science* focussed entirely on the debate between proponents of the two different world views - symbolic representation and situated activity - in accounting for learning in humans.[8] Debates about the contextual/activity theory/situational versus the phenomenological nature of learning have continued.

Keller and Keller (1996), in their study of artisanal blacksmithing, recognise the need to make use of both world views, arguing for a

> higher order intellectual synthesis to be derived from a complementarity of theoretical positions and comparative investigation of empirical settings … Both symbolic representations and situational action are essential to an adequate account of the acquisition and application of domain-specific knowledge (170, 171).

[7] It is noted that Lave's work was also influenced by educational philosophers such as John Dewey.

[8] e.g. Vera and Simon (1993).

Anthropologist Gregory Bateson argued that the combination of various fields of thought was the best strategy for making new discoveries: "…combination is the most precious tool of science" (Bateson 1972:75). Or, as Sennett (2008) would argue, "the border is where learning occurs".

Bateson argued that not only should the experimental psychologist's findings be taken into consideration but also that these should be combined with those of anthropologists working in the many different cultures around the world. This provides another early example of a theorist arguing for the utility of interdisciplinary considerations, in this case that the cognitive and the social sciences should be intertwined in any analysis of action. In other words, he believed that rather than thinking "logically" about how the mind works, we should think of the "mind" more in terms of an ecological system, or, "an ecology of mind" (Donaldson 1991:xii).[9] Or, as Bateson also nicely sums it up, "that *wider knowing* […] the glue holding together … the total biological world in which we live and have our being" (cited in Donaldson 1991:xiii, emphasis in the original).

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Ideas of the situated nature of learning have, as noted above, arisen from the many ethnographic accounts of practised activity, demonstrating the value of the ethnographic method. Fieldwork enables the ethnographer to produce rich and "thick" descriptions (Geertz 1973) where the field is regarded in an holistic manner and where all elements may be of potential importance and of analytic value.

[9] Bateson defined his concept of "an ecology of mind" as "a new way of thinking about the nature of order and organisation in living systems, a unified body of theory so encompassing that it illuminates all particular areas of study of biology and behaviour. It is interdisciplinary, but not in the usual and simple sense of exchanging information across lines of discipline, but in discovering patterns common to many disciplines" (Donaldson 1991:xii, citing Bateson).

Michael Coy (1989) Bill Haase (1998), Jean Lave (1977, 1988, 1996, 1997, 2011) and Jonathan Singleton (1998) are among the writers who have applied wider recognition to the concept and the value of apprenticeship as a form of learning. Building on work carried out by earlier researchers such as Esther Goody (1982, 1989), Jack Haas (1972), Eugen Herrigal (1953) and Gladys Reichard (1934), a number of these writers also demonstrate the usefulness for anthropologists of undertaking apprenticeship themselves in the fields which they chose to study.

More recently, these works have been joined by those such as Greg Downey (2007, 2010) Anna Portisch (2010) Nicolette Makovicky (2010) and Trevor Marchand (2003, 2007, 2008, 2009, 2010a,b,c; Erin O'Connor 2005). The aim of these latter writers was to understand better those forms of knowledge represented in the physical techniques of making that were not easily described in words. Downey and Marchand's work also utilises findings from the study of neuro-science. Marchand argues therefore that:

> engagement with this knowledge calls for good-old-fashioned fieldwork with an expanded critical notion of what 'intelligence' is and where we might seek to find it … this engagement is characterised by participation, coupled with close observation and detailed description of the multifactorial factors that inform the production and reproduction of the expert knowledge *in situ* … We need to investigate how knowledge is constituted, under what conditions and in which contexts, and how systems of knowledge are produced and reproduced (Marchand 2003:46, 47).

I did not set out to undertake an apprenticeship in precision engineering. This would have entailed that I be (most likely) a young man under the age of twenty with a strong affinity to metalworking and that I would need to follow a pre-apprenticeship course for at least six months. I did not particularly wish to learn to use engineering machinery even while I greatly admire those who do. However, I have undertaken various forms of apprenticeship and learning in the past and feel that I have a strong understanding already of what it means to learn to be a maker of things. I have also had experience with various forms of machinery.[10]

In addition, as Coy points out, when fieldwork is being carried out as a part of "learning to be" an ethnographer, it is effectively the "doing" part of the apprenticeship, the "rite of passage" (Coy 1989:xi:),[11] to becoming an anthropologist, and comprises a number of similar elements to other forms of apprenticeship. I became aware early on of this aspect of my study. I was discussing the apprentice assessment processes with James, one of the apprentices, and we had this exchange:

> I mean if you can do it on paper, doesn't necessarily mean you'll be good at it in practice which is why I think the apprenticeship is better than going to uni or something – for what I do anyway. Someone like you there's not really any way you can do workplace training.

I replied immediately, even though I had not previously given this a lot of thought:

> In a way this is my apprenticeship. That is what I am doing, although I have done research before, this is a big lot. I have supervisors and I have a six month progress report due in at the moment … I guess it's just a different sort of apprenticeship.

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[10] My list of holiday jobs included work in a shearing shed and cleaning work in a geriatric hospital ward. The latter required the use of heavy industrial floor polishers and a keen awareness of torque and speed. I trained and practised as a children's dental therapist and as such became very aware of the fine balance of speed and pressure that is required in the use of a dental drill and the care to be taken in the preparation and polishing of silver amalgam fillings. I have also had a long term interest in various forms of crafting and have both taught and exhibited in the area of textiles.

[11] Coy draws on the work of Johnson who pointed out that "our field research is the rite of passage that permits us access to our own occupation".

Thus, at various points I will identify some of the parallels of my own experience as an apprentice ethnographer to those of the engineering apprentices.

> …apprenticeship is interesting for anthropology because it is also the method by which an anthropologist learns about a different culture … An ethnographer is indeed a learner in the society he or she tries to understand (Iguchi 2000:147, following Fukushima).

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The New Zealand Policy Context

As my research continued against a backdrop of economic crisis the discussion of skills needs changed to include “low productivity” as an additional factor to be blamed on the “lack of skills”. Education and training continued to be seen as the solution to the problem. However, less attention was paid to the state of labour relations, conditions of work, or of remuneration for that work.

Labour relations have become a largely no-go area in contemporary New Zealand. Perceptions of the value of different types of work also lead to some being framed as of much less value than others and subsequently these workers are given considerably lower remuneration for that work.[12] This also results in various types of work being viewed as less attractive career options at the level of high school where such choices are often made.

[12] Sayer (2011:7) would describe this phenomenon within “…the theory of contributive justice … a normative theory concerning divisions of labour between jobs of different qualities that provide their holders with unequal possibilities for realising their potential”. And, one might add, unequal rewards. As Sayer notes: “Once this division is normalised it can easily appear that the inequalities are merely reflections of individual ability and effort” (7).

Comparatively lower wages also lead to a constant outflow of trained and experienced workers to other countries. In many instances the reason for this outflow is simply the wish of graduates and other young workers to experience life and travel in other countries, and for some, to gain further professional experience. Many in this category do eventually return after a few years, often with improved knowledge and employability, and greater maturity, but a high proportion do not.

For these others the decision to work overseas is one that is based on seeking better remuneration for the work that they do. This group comprises a much broader demographic which includes whole families leaving so that more lucrative opportunities are available for the breadwinner(s). Thus, companies often lose experienced and valuable staff, especially at times of economic downturn when available work declines and jobs are threatened. It often takes considerable time to rebuild the capability of a company to achieve adequate staff levels or to meet its production targets, if this has occurred.

Blaming the current education system itself is another line of argument that is frequently put forth for the lack of productivity and suitable job applicants. There is a pervasive argument at policy level that our state education system is not meeting the needs of many of our young learners and that this reflects a deficit in the system and even in the teachers themselves. It is then currently argued that this situation would be best corrected by increasing the number of private education facilities which would then operate within a market model (Clark 2010). These institutions may then be judged through a “robust” system of audit in the same manner as other businesses.

In bringing together my knowledge gained from the ethnographic research undertaken, along with extant related literature, I provide a corrective to prevailing misconceptions in regard to precision engineer apprentices. There are misconceptions and assumptions implicit in related policy discourse that as a trade this may be taught to those who have otherwise failed at formal schooling. As such, more of this and other forms of trade training are argued to be an answer to the social problems that beset this group.

My findings support my arguments that the histories and early learning experiences of apprentices (or learners in any field) are critical to their later learning and that a broad experiential form of education provides a strong basis for success. My findings also suggest that insufficient attention is paid to the availability and quality of those who will be the teachers and mentors in such workplaces. Lastly, it will be seen that the availability and quality of work are necessary elements in the processes of workplace learning and that these require more careful consideration.

A number of the participants commented on policy issues at various points. In addition, as I was researching a group within my own society I was also frequently reminded of the political background to the study. While I provide some background information of the relevant policy areas, in depth analyses of them does not form a part of the thesis. Rather, I focus on relating the stories of learning and skill development told and demonstrated by the participants. In so doing the ethnography provides an example of places where good learning occurs and high quality work is produced.

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Apprenticeship, Education and Manufacturing – an Overview

As noted later in the discussion of apprenticeship, the first major European emigration to New Zealand began during the nineteenth century. While education in Europe had a long and rich history which placed emphasis on studies of the arts, politics, philosophy and ethics, the move to educate a greater part of the population in Britain at the time was driven by the needs of industrialisation. Thus, New Zealand inherited an education system that was designed largely to serve industry and instil a strong work ethic.

The notion of the work ethic appears to be still strong as it is mentioned by a number of Stafford men from both management and the shop floor as being something that is a necessary attribute for the apprentices to be successful. The notion of a work ethic may have lost its attachment to "religion and ethical meaning" (Modrack 2008) but as in the past and as is noted above, not all hard work is well rewarded from the point of view of those who do the work.

Views of education have changed over the years. It can be argued to be either a private or a public good. A change from the first view to the second can be seen to have occurred in the strong wave of egalitarianism which was a feature of mid-twentieth century New Zealand. As unemployment began to rise during the latter half of the century, education was argued to be capable of ameliorating social disadvantage. Then, as neo-liberal, market ideology began to emerge, education became again to be argued to be at least to some extent a private good and thus a larger portion of the cost of it was transferred to students at tertiary level.

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The history of manufacturing in New Zealand is a chequered one. Geoffrey Thornton's (1982) study of historical industrial architecture highlights the extent of industrial manufacture that flourished in the country during the third quarter of the nineteenth century as the growing population sought to become self-sufficient.

However, the story of manufacturing during the twentieth century is one of fluctuating fortunes. In a country where the main export was primary produce, manufacturing, apart from during times of war such as World War II and the Korean War, was largely a secondary industry to serve the needs of the domestic market.

Many goods manufactured in the "mother country" were promoted as being superior to those made locally but were often relatively expensive and subject to import restrictions at various times. As the result of this difficulty in obtaining items or because of the length of time it took for them to arrive, there was a great deal of "making do and mending", or, what is known as the "No. 8 wire" strategy (Bridges and Downs 2000).[13]

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Many reasons other than skill levels and supply can be given for the low productivity that is argued in a comparison of New Zealand with, for example, Australia. First and foremost, the population is a relatively small one. This represents a smaller available number of customers and consumers so that economies of scale are not always an available business strategy.

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[13] This description arose from the frequent use of No. 8 fencing wire as a valuable mending material.

New Zealand is at a distance from large markets and the country was slow to respond when Britain, the destination of the majority of exports, joined the European Union in 1973. For New Zealand, where primary produce was *the* major export, this meant a huge reduction in earnings. The rising oil prices of the 1970s added further to the economic downturn. From this time, increasing globalisation was driven by corporations and large companies seeking low wage, low compliance locations offshore to manufacture their goods. This resulted in a huge reduction in domestic manufacture as it became cheaper (at least in the short term) to import many goods.

Until relatively recently, and likely because of the emphasis on primary produce production, there has not been as much emphasis on the invention and development of new forms of manufactured products. The need and impetus for such activity has really only been in evidence since the upheaval of the 1970's and the more recent engagement in the area described as "hi-tech" (Callaghan 2009).

From the employees' point of view in New Zealand, another major impact was the introduction of the *Employment Contracts Act 1991* and its subsequent iterations as the *Employment Relations Act 2000* and the *Employment Relations Amendment Act 2004* (Walker 2007) which have had the effect of keeping wages progressively lower in relation to other OECD countries and in particular, to Australia, our nearest neighbour. The legislation also effectively undermined the power of collective bargaining, making union membership optional, and contractual employment arrangements a matter between employer and each individual worker (Anderson 1991; Law 1991).[14] It has also resulted in an ever widening gap between the lowest and highest earners.

[14] Anderson notes of the original Act, that in addition to "changing the focus from the collective to the individual level … The Act also alters the nature of labour law in two significant ways: it

In addition, changes to the socio-political landscape of the country resulted from the swift adoption of neo-liberal financial policies introduced by the Labour Party in the late 1980's, on the pretext that with the country in a near bankrupt state "there [was] no alternative" (Kelsey 1993). The fall of this Government in 1990 saw the ideology extended to all areas of government policy by the more right leaning National Governments of the next nine years (Hazledine and Quiggin 2006; Jesson 1987, 1999; Kelsey 1997, 2002).

As Buchanan and Jakubauskas observe:

> One of the major legacies of the 'new right' ascendancy was the denial of choices about the future … [and the frequently heard assertion that] … 'there is no alternative' (TINA) to increased reliance on market mechanisms (2010:32).

As they also note, that belief grew to become "conventional policy wisdom … [and] … a part of wider 'market populism' with deep roots in civil society" (32). These roots can be seen to extend to the shop floor and beyond as workers themselves appear to believe in the primacy of the importance of business profitability. Wary of unions that in the past lost public support through sometimes unreasonable practices, and with the knowledge of the recent decades of manufacturing instability, they largely appear to place their belief instead in a strong employment "market" based on productive businesses, to provide the work they want.

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abandons the system of registered awards enforceable in their own right and instead opts for enforcement through the law of contract, albeit with separate procedures, and it brings all employment contracts within the new regime" (Anderson 1991:127). The ability of unions to act for workers appears to be reduced mainly to issues of safety, along with some input into training programmes (Piercy 2000). An example of this is the involvement of union representatives in the Industry Training Federation (itf). Only in those areas where union (or collective) activity remains relatively strong (such as education, medicine and law) are members able to collectively argue for improved working conditions or to seek or set higher levels of remuneration for the work they do.

However, it is not only workers who are affected by these changes, but also the smaller businesses themselves. The “race to the bottom” (Brecher and Costello 1994; Seabrook 1990) that is the reality resulting from the rise of market ideology and global corporate power, sees many businesses succumb to forces outside their field of control. Likewise, the constant need to reduce production costs, while appearing to affect most immediately the wage rates of those who do the work, also causes worry for business owners.

The CEO at Stafford Engineering commented at the time when the 2008 downturn had begun to have an impact on the company, that even he was somewhat perplexed about how events were affecting his operation. He appeared to feel that much about the situation was beyond his control:

> *I haven't really got my head around it yet but I always thought – we make things – that will always be needed – but with this happening I feel like we're just a cog in a money-go-round (FND 10.3.09).*

Although he had taken over the company during a time of economic recession and had since weathered other difficult periods, this time it appeared to be having a different effect and one which he did not yet fully understand.

He has since identified a number of the global and political issues which present challenges to the company. I have summarised these from a recent newspaper article:

> The exchange rate: the weakness of the US dollar which is affecting the strength of the New Zealand and Australian dollar.

> The effects of globalisation: the rate of and constant nature of change is difficult to manage.
>
> Global changes in company ownership structure affect relationships that take years to build.
>
> The impact of low cost economies affects traditional manufacturing supply chains offshore, and import substitutions.
>
> The New Zealand cost structure is making us uncompetitive (cited in Blake 2011).

*****

In recent discussions relating to skills and training, the literature is beginning to reflect an awareness of, and address, wider issues in the skills discussion. The problems with supply-side focussed policy were being signalled some time ago as a number of authors (Higgins 1993, 2001; Keep 1999, 2006, 2007, 2009; Murray 2004; Strathdee 2005a, 2010) identified issues around the demand for, and utilisation of, skill rather than simply the lack thereof. The need for policy that would stimulate the demand for skilled workers has been recognised for some time but the education and skills rhetoric as a solution to both productivity and social problems remains, as it has provided an ideologically neutral policy platform for successive governments (Keep 2009). As Keep argues, increasing skill levels through increased education and training is one of the “grand narratives” of neo-liberalism.

Governments in a number of countries including New Zealand have been slow to acknowledge this problem, although New Zealand has been noted

(Keep 2007) for its broader approach with its involvement of training providers, businesses and unions (through the Industry Training Federation) in the organisation of industry training.[15] The actual involvement, however, has turned out to be less than was at first envisaged. Industry Training Organisations (ITO's) were set up during the early 1990's with the view that individual industries would eventually fully fund and take over the responsibility for them. Now, twenty years later, most of the funding for these is still taxpayer provided. Also, during a time when the size and power of most unions as an effective voice for workers has been decimated, it is difficult to ascertain to what degree the unions can influence any policy.

While approaches such as that of Bryson (2010)[16] with the notion of capability, provide useful contributions, I argue that more emphasis must be placed elsewhere. Writers such as sociologist Richard Sennett (2008) and Matthew Crawford (2009) and the authors of recent ethnographies (e.g. Iguchi 2000; Keller and Keller 1996; Lave 1996, 1997, 2011; Marchand 2010b, 2010c; Orr 1996; Singleton 1998; Stout 2002), through their rich descriptions and analysis of skilled practice, describe a more complex reality than is currently recognised. In recognising their work and adding to their discussions, this is an area where my research can make a useful contribution. The ethnography provides as its major focus a picture of a contemporary industrial workplace and the learning that occurs there.

By giving recognition to the biographies of the participants and their histories of learning I will demonstrate the need for a much broader approach to be considered in arguments about education and training. My

[15] The Industry Training Federation was set up to involve representatives from training organisations, industry and trade unions in the development of effective training policy. They appear to provide a major source of policy advice to government. "The Industry Training Federation (ITF) is a membership-based organisation, representing Industry Training Organisations (ITOs) to government and working with agencies and sector groups to improve the policy for and delivery of industry skill development and workplace learning" (Industry Training Federation 2009).

[16] Also, Bryson and O'Neil (2009a, 2009b).

findings show that at the level of family and community, in terms of creating what has often been aimed for – a vibrant creative/knowledge economy/society - this approach must begin with an understanding and acknowledgement of, and an investment in, the real needs of the younger members of society, their families and communities (whatever their structure).[17] In other words, we need to pay more attention to the building blocks of society itself.

Two major discussions of skill are identified in this thesis. While both focus on skill, they appear at first to belong in different realms. The two realms I identify are, firstly, one where the teaching of skills is simply an under-theorised tool of the education and training policy which shapes the environment of education and skill development; and, secondly, one where the very nature of skill and its acquisition and development are considered in terms of physiology, cognition and phenomenology and the way these may affect human development, learning and education. There is often a lack of recognition that the conditions necessary for the development and emergence of skill depend on recognition of interrelationships between the realms.

The focus in the definition of skill given in many policy documents is on the individual, and as such is therefore something presented as able to be changed at the individual level (no doubt through sufficient training), rather than on the context in which the individual becomes a part of his or her community and wider society. In other words, this individual appears devoid of familial and communal ties, as a malleable entity upon which can be overlaid or instilled, any number of "skills".

[17] An initiative developed by the Otorohanga Council to reduce what they saw as the wasted potential of many of their school leavers, has seen the town reduce the unemployment and crime statistics in this town considerably (Macfie 2011). The scheme attracted endorsement and funding from central government within the education budget. However, in the recent wholesale slashing of budgets, the scheme is now under threat (Carson and Gardner 2012).

A number of literature reviews of "workplace learning" have recently been published (e.g. Harris et al. 2009)[18]. While these provide useful contributions, they do not attempt to provide particularly holistic analyses of what education may be (e.g. Beeby 1992; Biesta 2004, 2006, 2009; Dewey 1916, 1959, 1966, 2009; Edwards 2010; Renwick 1986). Instead, many continue to espouse and rely on what has been termed the training "gospel" (Strathdee and Hughes 2000).

At the same time, an international trend in labour usage has been the huge increase in work in the service sector, in contract and outsourced work (which through contestation and competition drives labour prices down), and in supposedly lesser skilled and part-time jobs which often provide little financial or job security for those workers (Crouch, Finegold and Sako 1999; de Bruin, Dupuis and Spoonley 2004; Strathdee 2010).

Also, it has been found that contract and part-time work are, for the most part, barriers to improving the life chances and the development of workers' "capabilities" (Bryson 2010).[19] Effectively, education and training are promoted as a magic bullet to improve economic and social problems, but the target is one that has been slowly disintegrating around us.

[18] Gemma Piercy, Michael Law and the late Paul Harris (Harris, Piercy and Law 2009) of Waikato University's Centre for Labour and Trade Union Studies, provide an overview of a number of these including Fenwick and Rubenson 2005 (Canada); Vaughan 2008 (New Zealand); and Misko 2008 (Australia). Harris et al. also note the recent increased interest in the topic of workplace learning, the number of different academic disciplines contributing, the overwhelming result of this flood of interest, and the often diverse and contradictory nature of the analyses, conclusions and recommendations that has resulted (Harris et al. 2009:10).

[19] This recent volume and related publications by Jane Bryson and her colleagues was based on a research project which involved a number of different employment sectors. Using Amartya Sen's notion of "human capability" as a theoretical tool for analysis, she and her colleagues and co-authors have devised an improved Human Capability Framework as a way of assessing what does and doesn't support the development of human capability in the workplace. Their research demonstrates that many of the labour practices favoured and promoted within management literature are not only drivers of human capability but are also at the same time, barriers to its development in its widest sense.

> …neo-liberalism produces losers as well as winners in the deregulated market it creates. Indeed, some might go further and argue that a labour market configured along the lines recommended by neo-liberal doctrine needs a large tier of low end, low paid work in order to function (Keep and James 2010:24).

The types of skills that are required for many jobs are not always those that may be learned within an institutional setting (Grugulis and Vincent 2009).[20] Matthew Crawford, a philosopher who worked at a Washington think tank and who left this work to open his own motor cycle repair shop, summed up this situation well:

> The college student interviews for a job as a knowledge worker, and finds that the corporate recruiter never asks him about his grades and doesn't care what he majored in. He senses that what is demanded of him is not knowledge but rather that he can project a certain kind of personality, an affable complaisance. Is all his hard work just for show …? There seems to be a mismatch between form and content, and a growing sense that the official story we've been telling ourselves about work is somehow false (Crawford 2009:9).

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The Research and the Methodology

> …we are all of us, researchers and subjects alike, in traction across the fields of our lives. There never was and will never be a material 'there' and a mental 'here': they make and remake each other at every step.
>
> Paul Willis 2011[21]

[20] Rob Strathdee (2005a:437) has also questioned "the ability of new qualifications frameworks and assessment systems to promote innovation and social inclusion". He concludes that in the contemporary labour market, qualifications, while important, are not enough. "…qualifications tend not to measure the qualities employers require … Qualifications do not measure the qualities, knowledge or dispositions associated with innovation" (Strathdee 2005a:453).

[21] Cited in Lave 2011 (cover review).

The Research Participants

My research at the engineering company resulted from a direct approach to the CEO. I explained that I wanted to find out more about how people learn the skills they have and that I had read about the company and was interested because of his ideas about apprenticeship. On my first meeting with him, the CEO gave me a tour of the shop floor where I met a number of the men. He supplied me with a blue tradesman's work coat and informed me that I would have to obtain some more appropriate footwear before spending time there.

At the engineering company, while I had the agreement of the owner to carry out the research, I did not initially have the individual consent of those who worked within the company. For this reason my early interactions with the men were fairly tentative. Visitors to the shop floor were frequent so it seemed my presence there would not be unusual. Effectively, I remained a "visitor", albeit one who for a while was around more than many.

While a small number of the men did not wish to take part in a formal interview they were mostly still happy to talk about their work, at work. As I moved around the shop floor I made a point of greeting all but took care to keep out of the way whenever I sensed it was not appropriate to engage further with them. Not everyone was comfortable about being watched while working. At other times it was simply that all their concentration had to be on the task at hand.

While the majority of the participants chose to use their own names, a small number chose pseudonyms. However, because the company has a relatively small staff and because of their diversity in terms of age and work history, along with the positions they held at the time of the research, most of the men could be identified. To avoid identification, in these cases I have used several pseudonyms for each of those individuals. While this may cause some confusion to the reader, I have chosen this strategy in preference to leaving out what I believe are valuable comments and anecdotes. In other instances I have avoided identification of individuals by summarising groups of comments which are similar, or, have included such material in more general discussion.

Being in a field I am more familiar with, my engagement with the artists was not intended to be as extensive as the time I would spend at the factory and would likely require only a few visits to their workshops and consist mainly of an interview. Three of the artist participants were known to me through a variety of connections. I approached one of the instrument makers after reading about his work in a newspaper and then found that his son was also a luthier, so subsequently contacted him as well.[22] The consent process with the artist/makers was straightforward.

All participants gave written consent before their interviews which were carried out in the place of their choice – some at work, some at their homes or studios, some at my home, one at a pub.

Photographs

I have interspersed the text with photographs as they add another dimension to the verbal descriptions. They show the wealth of artefacts which constitute the environments in which the various participants work. In the workshop I always asked permission of those I was photographing. I did the same before I photographed assemblies or parts since I did not

[22] Letters of information were provided to all prospective participants. Copies of these and the consent form and confidentiality statement are provided in Appendix 1.

want to inadvertently disclose something that might be of a confidential nature.[23]

The Interviews

In conducting the interviews I prepared a number of questions and topics for discussion but these were used only in a semi-structured manner as the interviewees also sometimes introduced their own topics. [24]

An interview conversation is a different entity from the conversation that takes place at the field site. We may argue that when we ask people to sit down and explain what they do, how they do it and what they think about it, they can be endlessly creative in their responses. However, I believe that this representation of ideas and thought is no less valid than my representation of my observations and interactions with the men on the shop floor. Any account will be selective to some degree, even with the best of intentions. Grasseni (2007) notes that good analysis results from "good looking", but that the insights that can potentially result from good looking may also take time to rise to the level where we become aware of them or are able to make sense of them; at any one time, analysis and therefore representation, may be incomplete.

In reflecting on their learning, the tradesmen and apprentices were constructing an account of what they thought about their learning. However, their accounts during the interviews followed the nature of the content of the many comments I heard informally in the first few days at the company, when my questions were new to them and thus answered

[23] Douglas Harper (1987) also used photographs as a means of eliciting more detailed and accurate descriptions from the man whose workshop he studied. As time went by I also found that the Stafford men were interested in the photographs I took and at the interviews they provided an opening for further discussion. At a later point I also used large cards to display copies of the photographs in the lunchroom and the men took home those they wished to keep.

[24] Examples of the interview questions and topics are in Appendix 2.

more spontaneously. At the same time, both these comments about learning and the comments, opinions and expectations of others, were sometimes contradictory in themselves. Rather than reflecting error or inaccuracy in the accounts, they highlight the very individual nature and contexts of their learning and work experiences and beliefs.

The interviews also provided me with a much enriched understanding of both the work and the men who did it. In the busy, noisy workshop where earplugs are worn to counteract that noise, conversation was not always easy. The information I gained through the interviews expanded my knowledge of the men and the work considerably and seemed to increase their understanding of, and the trust they had in, my presence in their workplace. And, I believe that in the process of those interviews they could also gain from their reflections on their learning and practice.

Encountering the "Field"

In Bronislaw Malinowski's ethnography of the Trobriand Islands (Young ed. 1979:119) there is a photograph of Malinowski among canoes and men on a beach. He is apparently talking to an informant. The ethnographer stands, somewhat aloof, dressed in white shirt and trousers; observer of all around him. However, it is also evident that those he is observing are equally mindful of his presence and are equally observers in the scene. Whether he was aware of this or not, we cannot tell. However, it is a photograph that came to mind very early on in the research as I thought about my first visits to the shop floor and feeling very much a visitor.

On the first day of my fieldwork visits the CEO was away and Luke the human resource manager went through the company's standard induction process. This included signing a form to say I had been made aware of possible hazards in that workplace, and a full tour of the facility and helpful explanations of the various parts of the business. As we went around he also introduced me to a number of the men and explained briefly what I was doing there. I reported the following in my fieldwork diary:

> *I wandered about to see what others were working on but I did not feel entirely comfortable as I was aware that a number of the men did not know exactly why I was there. Two incidents reminded me that I was in someone else's workspace. One of the men came over at one point and reminded me to always wear my safety glasses when watching someone working. He said if I was not in control of the machine I had no control over when something might fly off. I thanked him and found out later that a number of the men had been concerned about the safety aspects of my presence, not realising that I had been made aware of these.*

> *The other incident occurred at morning tea break when alongside the men I made a coffee then placed the used spoon on the bench.*[25] *I was immediately told, 'We put all the dirty dishes over there in the tray to be washed'. I guessed they were used to 'training' all new staff members and I realised I was already being told 'how things work around here'. These incidents also reminded me that I too was being 'watched' (FND 21.11.07).*

I was always aware that I was a visitor in someone else's domain and I always tried to be considerate of the men's reactions to being watched. The topic came up on a number of occasions and it was also something

[25] At this point the new lunchroom was under construction so that everyone was making do with some available space to one side of the shop floor.

that I often discussed during interviews. Below are some of the comments that gave me a general sense of how the men perceived my presence.

I mentioned to apprentice James that I had appreciated being able to watch what he was doing and asked about it.

> Sometimes it can put you a bit on edge but generally speaking it's all right. I think the worst thing is if you make a stuff-up and someone's watching you, you feel pretty stink about it. You know, you might be doing something that's not strictly the right way to do it…

I assured him that at that stage that since it was all new to me, I probably wouldn't know the difference. At the same time, from my point of view, mistakes are a part of learning and were of equal interest to me. Greg, another apprentice at the time, felt quite strongly about being watched. He had previously worked in a company where he had found supervision to have been invasive.

> I don't mind it as in a person like what you do … but … I suppose if it was the boss putting his nose over… yeah I would have a problem. Most of them, like even the older guys there, don't like people looking over their shoulders. It's all right to go up to them and say, 'How's it going [name], blah, blah, blah', but to look over and watch him while he's working … well, no. Everyone has their own space.

I commented that everyone also needed to be careful around the machinery as well.

> Yes, [it's] very dangerous. A lathe is one of the most dangerous machines.

Greg was here reinforcing the need for safety to always to be considered, and, of the potential for distraction to cause an accident. Although I was aware of this from the beginning I soon came to realise that it presented a challenge to any observer and took care when approaching the men at their machines.

Some time later while asking a tradesman about doing an interview and commenting that it was often difficult to have conversations on the shop floor he commented, “Yes, you really need all your concentration or you can make a mistake, get distracted.” I was talking with another apprentice one day and he identified a further hazard as he worked. He was turning a part on one of the lathes.

> *Small curls were flying off the machine. ‘They’re about 500 degrees’ (He was not using lubricant at this point and there was smoke coming from the part). ‘The first thing you learn is to keep your mouth shut. If a piece of that flies into your mouth the first thing your tongue does is move it out and it’s twenty times worse than getting burnt by a hot drink, and it’s sharp … I set my goatee on fire once when a piece flew off and landed on me’ (FND 5.2.08).*

On one occasion while watching someone at a lathe, I was hit in the face with a small bundle of swarf[26] (not hot in this case) and was grateful for all the advice about safety measures. The safety glasses protected my eyes from any damage.

[26] “Swarf” is the metal or plastic curls which form and drop off as material is milled or turned. Metal swarf is razor sharp and usually hot. The shape and colour of these metal shavings provide valuable information about the process. They must be constantly removed or they can be caught back up in the spinning machine and cause damage to both machine and the component under manufacture.

While observing the work on the lathes and mills did not present many problems, watching the welders at work was more difficult. Because eyes must be protected from the effects of the welding arc, the welders always wear hoods which protect them from it. However, even at a distance and reflected, this light can cause eye damage. For this reason, every welding alcove is screened and the fabrication section is separated by a high wall. While I spent time in this area when there was no welding going on, I did not spend a lot of time watching welding work close up. I found the masks heavy and somewhat claustrophobic and even had difficulty seeing through the darkened visor.

I had decided that I needed to take some notes while on the shop floor so carried a small notebook and pencil at all times. However, I kept the note-taking to a minimum. If I wished to write more I would go to the lunchroom. On one occasion a tradesman was explaining about measuring while he worked at a mill:

> *I was writing some of his comments in my notebook. [He] said, quite seriously, 'I hope you're writing good things about me, nothing bad'. I said that I had to write things down or I would forget about them later. He seemed reasonably happy, if not entirely convinced by my explanation. I made a mental note to be ready with a better answer to this question for the future – or, to make my explanation first (FND 4.12.07).*

On this same occasion I also had cause to be concerned that I was interrupting his concentration on the job.

> *He had almost completed the piece he was machining and placed one more tool on the shank. He carefully measured*

the distance of the cutting edge. However, instead of the tool being free of the component as he had thought, when the machine started, the other end of the tool was protruding and caught the component and sliced the top off the carefully made piece. We both stepped back as the pieces flew.

I had simply been watching at this point but wondered if my presence was a distraction. It was also mid afternoon and a hot day so it was also possible that attention levels are affected by this as well (FND 4.12.07).

Despite these challenges I gained immensely from the opportunity to spend time on that shop floor. I learned about the men and the work they did, what they thought about it and how they thought it was best learned. Some appeared comfortable carrying on their work while I watched, sometimes talking about what they were doing. Others would stop what they were doing when I paused to watch them so I sometimes also felt I was holding up work. As time went by I did feel more comfortable about being there and apparently the same could be said for most of the men, of my presence.

I had remarked to Kaleb [the shop floor manager] that I was always a bit concerned that I might be in the way. He said, 'Oh no, you're just a part of the furniture now. We're used to you being here' (FND 22.1.08).

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The shop floor was a new world for me to some extent but because it was a place where people made things and worked with materials I felt an affinity with many of its elements. I was not unused to large machinery, having been brought up in environments that included the machinery of farms, sawmills and gold dredging. I also had a history of operating small machinery of various types so was aware of the need for consideration of speed and feed, and had some knowledge of working with metals and of their physical properties.

In addition to considering these elements and the social aspects of the shop floor, the first and continuing impressions of being there are also sensual ones. The shop floor engages all the senses. A written description can provide only pieces of this experience. As will be described in the discussion of the sharing of practical, embodied knowledge itself, the viewer (or, in this case, the reader) will assemble their own impression from their perceptions of the available information I have provided.

Along with this thesis I would like to have also provided a box of artefacts from the shop floor which would have given readers an opportunity of having more than a verbal description of the multisensory experience of that site. This box would have contained some of the more commonly used materials such as stainless steel and Umpy,[27] so that the reader could appreciate the feel and qualities of those materials; the slippery soapiness of the white, slightly translucent plastic Umpy and the cold, clean feel and the weight of the stainless steel. The reader might gain a sense that one could achieve precision in machining such a piece of metal and that it could be polished to a fine and pleasing finish. Some curls of metal swarf might alert the viewer to the razor sharpness of this by-product of the machining processes, and its colour to the heat that may have been generated during its removal.

[27] UHMWPE – ultra-high-molecular-weight polyethylene – is a tough, non-toxic, thermo-plastic material which has wide industrial application including use in the food processing industry and even in human implant technology.

There would be a separate container holding a cloth soaked in coolant, the fluid that flows in a system of piping and tubes throughout the shop floor and because of its constant use, the smell of which permeates the air at all times. It is a clean, almost disinfectant smell, not unpleasant but with undertones which identify it as some form of petroleum based liquid.[28]

A sound recording would have provided a helpful but sometimes less pleasant sensory experience than that of the other items. At times there is a busy loud hum of the lathes and mills rising and falling as they wind up or down in their engagement with plastic or metal as pieces are milled and turned. There is the soft heavy clunk of the folding machine, the hissing of the laser and the clanking sounds as frames and sheet metal are moved into place. At other times the sound level requires full ear protection as a particular operation such as sawing or grinding produces a much louder, more discordant racket. There is at some points clanging and the sound of other machinery such as the forklift being driven about the shop floor, or of the gantry crane gliding along overhead.

Like touch, sound is a part of the embodied experience of the men and is integral to their work. Discussions about the prevalence of the use of sound as a diagnostic tool or as a consideration in safe working practice are evident in the stories of the men and my descriptions of the work. Sound on the shop floor is an undercurrent which signifies for the workers the status of the machinery and the safety or otherwise of their environment. As noted above, for an observer, sound often provided a challenge in terms of discussions with the men. Like them, I wore soft earplugs most of the time as I moved among the machines. However, these are constantly being removed and replaced as conversation ebbs and flows in the course of the work.

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[28] Coolant is also known as metal working fluid (MWF) or metal removing fluid (MRF) and is a mix containing oil and water, generally in a ratio averaging about five percent oil.

An Analysis of Terms

- Tradesmen, Engineers and "Masters"

I will use the words tradesman and engineer to describe those on the shop floor who have completed an apprenticeship either formally or informally. This is the way the men describe themselves. It appears that they use the word tradesman when talking about their immediate colleagues, and engineer when they are talking about their trade more generally. However, this is not a neat division as the terms appear often to be interchangeable even within these circumstances. In some instances the men are described according to their area of work within the workshop e.g. welder or polisher. Further confusion may arise when we include "professional" engineers who have followed degree qualifications and passed professional exams or related assessment and may act as independent consultants. These divisions may also be seen as socially constructed according notions of meritocracy, to the way different forms of work are valued by society, or of the degree of personal responsibility they involve.

I also believe that the best of those who practise in this field have talent and expertise which may be considered equal to many of those whom we call "professionals" albeit within a somewhat different realm of practice. Quantifying and comparing such expertise and talents is however, a very difficult exercise for the reasons noted above. Within the traditional guild system these individuals were considered "Masters" and had reached the highest level of expertise and status within their field – effectively, a "professional" craftsperson. For this reason I have chosen to capitalise the word in places to emphasise this status. It is also useful to keep in mind the use of master in the sense of being in charge of another person, master as a verb, as in mastering a task, and Master as being in possession of expert knowledge.

- Craft

The word craft appears to be thought of in a number of ways. As a noun it is sometimes used almost disparagingly when applied to some handmade goods which may be of varying quality and of arguable aesthetic or practical value. It may also be used to describe those items made in a domestic, studio or workshop situation but which are considered to be at the opposite end of this spectrum of quality, aesthetics and value (Dormer 1994, 1997).

As a verb the word describes the process of crafting and may equally apply to the way we may build or “craft” our selves in our professions or occupations and even our lives in general (Sennett 2008). In the context of this research I find this latter use of the word particularly relevant as it is effectively what is occurring on the shop floor in the crafting of quality components and machinery. At the same time, it can be seen that the men are also making or crafting their social and work environment. These dynamics are equally at work in the studios and workshops of the artist/makers interviewed.

- Craftsmen, Artists and Makers

As indicated above I will describe this group variously as “craftsmen/women/people/person”, “artists” and “makers” depending on the context of the discussion and their own applications of those words. I view all these titles as interchangeable in many circumstances since it can be seen that they are often the result of subjective assessments and particular histories that have their bases in various notions of aesthetics, class and “culture” in all its forms (Alberro 2003; Dormer 1994, 1997; Freeland 2001; Kingwell 2003; Newdigate 1994).

Printmaker Ruth Davey provided a telling example of these constantly changing ascriptions. Because printmakers may run off a series of prints from one plate, they were perceived in the art world as producing copies and thus not “art”. As Ruth explained, this is not so, as each individual run through of the press will result in subtle differences on the paper. No two prints will ever be entirely identical. Similarly, a ceramicist who makes a set of bowls on the wheel may produce a set of bowls which may be similar but are unlikely to be exactly identical. At the same time, the Stafford tradesmen often alluded to some examples of the engineering work they did as being like “works of art”.

- Artisan

The term artisan is normally used in circumstances where the craftsperson/artist is working in an environment such as a workshop where the maker has a particular talent or area of expertise and goods are made to order, i.e., a small area of niche production; but again the word has shifting value (Hobsbawm 1984).

***- man*ufacture**

I have used this variation of the word manufacture to indicate the more hands-on-materials nature of the process of making objects in the context of an artisanal setting. This applies to work in both the engineering workshop studied, and the workshops of the various artists/makers. I created this variation of the word from its Latin parts and as such italicise the beginning as the derivation of the Latin *manus* – the hand. However, it is still a somewhat arbitrary division as there will always be some human manual input into even the most highly mechanised or computerised forms of production whether this is in the actual processes carried out or in the need for someone to make and maintain the machines themselves. It is simply further removed from the place where machine transforms material and as such requires a different range of techniques and knowledge. I describe this as “manufacture”, i.e., without italicising “man”.

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The Structure of the Thesis

While identifying the field and scope of the research in this introduction I have also indicated a number of the wider discussions which will follow. In providing a brief background of the related historical and political contexts, I wish to draw attention to the importance of an awareness of history, both individual and general, as a part of learning and of understanding better the circumstances of the present. I have also described aspects of my experience at the engineering company, along with some reflections on the processes of the research undertaken and on some of the sometimes troublesome words involved in the descriptions used.

The following chapter provides an overview of historical and current discussions relating to apprenticeship, skill and education. Chapters three to six introduce firstly the artist/makers, secondly, Stafford Engineering and the work that is done there, and thirdly, those who work there. At various points I also restate my arguments that innate talent, disposition and the biographies of learners are important elements of later success; that experiential learning provides a strong foundation for other forms of learning; and, that learning cannot always be neatly packaged into easily assessable “standards” and “units”.

My use of “innate” in this context arises as a response to the way many of the participants would describe another as being “a natural”, as “always having known how to do it”, or, as having “something in the veins”. Thus, it stands as a proxy for what we may consider birth talent. Birth talent can also be regarded as a complex combination of genetic factors and familial and wider social contexts and systems for recognising talent. It is also a cultural process.

Evident in these chapters is the articulation of all the above elements in the personal histories of the participants, the stories of both formal and informal learning, and the learning that takes place in the various workplaces. These demonstrate the complex mix that provides for successful apprenticeship and learning in these environments.

In chapter seven I provide more detailed ethnographic discussion of various aspects of learning on the shop floor. Chapter eight continues this discussion to include some of the less tangible aspects of the process; various aspects of the shop floor culture which underpins both production and learning; along with discussion of the data in relation to aspects of the institutional requirements of apprenticeship.

In chapter nine I return to the discussion of education, skill and apprenticeship in light of the findings from the ethnography, to provide some conclusions which demonstrate the contributions that the thesis can make.

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Chapter Two

Apprenticeship, Skill and Education

In this chapter I provide a brief history and background to the discussions of apprenticeship, skill and education. These three topics are inextricably intertwined in any consideration of learning in the areas of trades and technical work and in the *man*ufacturing of objects.

While apprenticeship is often depicted as a tradition-bound and invariable form of learning, the history demonstrates a different reality; that apprenticeship is frequently moulded by the context in which it is practised. In this section I consider briefly some of the history of the practices of apprenticeship, along with discussion of its wider applicability in relation to the development of human skill.

Frequently, apprenticeship is thought of in its simplest sense as a form of “learning by doing” or, as applicable to the “manual” and craft trades, and traditionally learned through time spent in a workshop and under the guidance of a master or an “expert” (Guile and Young 2001:59). There is an impression that the learning is somehow fixed and context bound and lacks a theory of instruction, or is, as Guile and Young note, “a natural process”, and one that is more concerned with the “implicit rather than the explicit dimensions of learning”.[29]

[29] Ainley and Rainbird (1999:3) describe the two basic interpretations of apprenticeships: “…one, that they were wasteful exercises in timeserving, oppressing youth labour and excluding others from employment … through union rules and restrictive practices in collusion with management … Alternatively, they are seen as a valuable legacy of the past in nurturing knowledge and skills”.

But such a definition ignores that in a broader sense many occupations such as law and medicine also entail a period of apprenticeship, a period of learning by doing, or, “practising”, and often entailing many of the same elements that have been found historically in the trade apprentice experience (e.g. Haas 1989). This demonstrates the widely differing contexts and spaces in which apprenticeship occurs, along with the many different forms of knowledge which may be involved. It also appears that many historical accounts attribute little sense of agency to apprentices themselves (e.g. Kaplan 2007:23-25; Reith 2007:179).

The idea that apprenticeship in the past was some sort monolithic institution which changed only through a linear, evolutionary process as production moved from the domestic sphere to the guild system and artisanal workshops of medieval Europe, and subsequently to the factories of mass production in the eighteenth and nineteenth centuries, does not do justice to the varieties and forms of apprenticeship that existed during these times.

Bert De Munck, Steven Kaplan and Hugo Soly (eds. 2007:4) demonstrate a much more malleable concept of apprenticeship than has been previously acknowledged. The broad range of sites of “shop floor” learning which are described by the various authors show that there was no one fixed structure of apprenticeship; rather, the form it took depended on many variables. The various chapters in this volume attest to the way apprenticeship varied not only geographically (Nagata 2007) but also within a single workshop. Apprenticeships could be of different durations due to different fee structures arranged with the individual apprentices and their families).[30] A study of apprentice contracts provided a number of the

[30] Families may still be involved today. At Stafford when apprentices are being considered for the company they often visit the workshop along with their parents. Also, a number of the apprentices continued to live at home during their apprenticeship training.

authors with insights not formerly recognised in studies of apprenticeship (Kaplan 2007:208).

Oral arrangements also operated in some circumstances and, noting Karel David (guild control in the Netherlands) and Johnathan Reinarz (nineteenth century brewers in England) in the same volume, Kaplan points out that in some areas contracts reflected a “precocious responsiveness to market forces and the political environment”. Neil Kamil (2005) describes a similar reality in his extensive history of French Huguenot craftsmen. “Flexibility” is not a new word in the history of work.

Increasing knowledge of historical apprenticeship allows for useful reflections on apprenticeship as it presents today. Of the field of apprenticeship and workplace learning as a whole, as will be shown in the history of apprenticeship in New Zealand below, little has changed in many respects. As the authors of the above volumes demonstrate, apprenticeship has always been moulded by the society (and even at times, the household) in which it is embedded and, as they also demonstrate, has the potential to change that society in numerous ways.[31] That apprenticeship is moulded to suit socio-economic ends is equally evident in the following brief history of engineering apprenticeship in New Zealand. Perhaps “Modern” apprenticeship is not so modern after all.

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[31] In New Zealand during the late 1950s, early ‘60s, programmes to bring young Maori men to the cities to train as trades apprentices is at least partly responsible for the first large-scale migration of rural Maori to the cities.

A Brief History of Engineering Apprenticeship in New Zealand.

The following summary of the history of apprenticeship in New Zealand is provided here as a background in which to locate the stories of both the Stafford men and the artist participants. For that reason, while noting the early beginnings of apprenticeship in engineering in this country, I have focussed in particular on the period from mid-twentieth century onwards, as it is within this time-frame that most of the Stafford tradesmen undertook their apprenticeships.

Jane Higgins (1993) and Nicola Murray (2001, 2002, 2004) have provided comprehensive histories of apprenticeship in New Zealand as it relates to industry training and I have drawn on these in parts of the following. However, while considering notions of skill and a number of issues relating to education, their work falls largely within a socio-economic framework where apprenticeship and education are considered from a more instrumental perspective. Their focus is on the history in relation to labour relations and constitutional and policy initiatives around apprenticeship and vocational training. By comparison, I wish to pay greater attention to the phenomenological aspects of skilled practice and to aspects of the qualitative dimensions of apprenticeship, education and work.

To extend the knowledge of this history as it relates to my thesis, parts of the following recognise in particular, the interrelationship of education and apprenticeship as it developed during the mid-century period. The era of educational reform which occurred during that time under the guidance of Director of Education, Clarence Beeby included fundamental changes to the apprenticeship system. Effectively, Beeby was the architect of the primary and secondary education systems throughout that time, and oversaw the implementation of the formal components of apprenticeship from the late 1940’s onwards. His underlying philosophy, influenced by educational theorists such as John Dewey, along with the prevailing ethos of egalitarianism of the time, underpinned the frameworks of child and youth education long after he left the Education Ministry in 1960.

It can be argued that despite many challenges to his philosophy, his influence has lived on in the New Zealand education system, if not as policy, then in the embodied practices and beliefs of the many teachers who gained their own education within that era.[32]

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New Zealand's history of metal manufacturing and associated apprenticeship began towards the second half of the nineteenth century. Increasing settlement and immigration (predominantly from Britain) occurred from the 1840's onwards. Olssen (2008:3, 4), points out that the new immigrants wished to leave behind the "corrosive aspects of the industrial cities" and to create a new, less stratified society.[33] Gilbert Pearce (1982) provides a picture of flourishing artisanal production in these early years. New Zealand's distance from centres of production in Europe and North America meant that the new immigrants had to produce many goods locally.

[32] McWilliam and Haukka (2008:660) have also noted the long term effects of the history of humanist based educational philosophy that is continued in the practices of many teachers to this day.

[33] While attempts may have been made to achieve this society, it appears that many aspects of class stratification (along with racial attitudes) were simply replicated in the new setting (Eldred-Grigg 1980; Olssen 2008; Olssen and Hickey 2005). As will be described below, artisanal practices provided one of the few areas for social mobility at the time. The closest the country has come to being in any way a more fully egalitarian society was in the post-WWII years of strong labour policies, almost full employment and a strong export economy (Keep 2007, notes a similar situation in Britain at the time). In addition, a sound system of "social security" which had been introduced by the first Labour Government in 1935 supported those who had retired or were too ill to work, and those with young families.

Pearce (1982) also describes the early recognition of the importance of education for working “men” in New Zealand. The first Mechanics’ Institute (1841) was built in Auckland to serve the needs of “working men wishing to study scientific subjects but financially unable to attend university” (227). The institute followed the model begun in Scotland by Professor John Anderson in 1790 and expanded by Dr. George Birkbeck in early nineteenth century England.

As a society to serve the working classes in New Zealand, *The Working Men’s Association* was also formed at the same time “for the purpose of acquiring and diffusing useful knowledge by means of a library, discourses, lectures, etc” (Pearce 1982:277). Similar institutes were founded in other main centres throughout the country.

> In all of them the formation of a library received priority and for many years almost the only libraries in New Zealand were those of the Mechanics’ Institutes (Pearce 1982:277).

The institutes could be seen as the precursor to the later *Workers’ Education Association* (WEA) and also as providing the first adult education centres for the country. There is an irony in this history, with its emphasis on reading, since reading will be shown as among the least favourite pastimes of many of today’s engineering apprentices. It also contradicts the notion that such work was simply “work of the hands” and of “uneducated” men.

The establishment of the Engineers’ Union in 1863 and the passing of the *Master and Apprentice Act 1865* demonstrate that many of the social habits of England at that time still remained strong in the new setting (Murray 2001:39). The Act, in seeking to train those less fortunate in “service” or in the “manual trades” and occupations is an early example of thinking that continues to this day, that training for such occupations is a useful way of ameliorating social disadvantage. The assumption underlying this thinking appears to have been that it is easier for such people to "do" rather than to "think" or, that assigning them to "manual" work avoided having to provide other forms of education which may have been viewed as unsuitable for their "class".

Industrialisation increased from the 1880's onwards as secondary industry increased. Murray (2004:61,62) notes a number of abuses of apprentices during this period, with boys and women being used as cheap labour while at the same time there was no compulsion on the employers to actually teach them. Also, if they did become proficient, various tactics were used by some employers to avoid paying fair remuneration, or, to avoid keeping the person on when they did become skilled.

While Murray (2004) paints a bleak picture of many aspects of apprenticeship and employment in the industrial scene in late nineteenth century New Zealand, Olssen (2008:3) argues that it was within this activity that the ethos of an egalitarian society was built. He attributes the prevalence of egalitarian ideology in New Zealand to

> …the numerical and cultural dominance of the autonomous artisan and craftsman, first serving his apprenticeship, then working as a journeyman, owning his own tools and controlling how he tackled any job and how long it would take him. In many trades a high proportion went on to become masters or even employers. Class position became, in brief, a function of age and desire.

The reality of the time possibly lies somewhere in between the two representations. However, the hierarchical nature of crafts learning that allowed an individual to explore and develop his or her talents and skills, to some extent within their own control, did provide fertile ground for such a reality and has continued to do so in some areas of production and the trades.

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Early 20th Century

While state regulation through compulsory arbitration gave workers some protection and was largely supported by the craft unions, it also restricted the activities of union movements. Worker unrest, in particular by miners throughout the early years of the new century, led to the formation of an independent labour movement and subsequently to the formation of the New Zealand Labour Party in 1916 (Davies 1997; Lee 1963; Murray 2004:63-65).

Murray (2001:66-70) also describes the ensuing years until the end of WWII demonstrates the way that apprenticeship and the available work in which to undertake it are driven by prevailing economic conditions. The depression years of the 1930’s and the shortfall in the domestic male population during WWII led to changes to remuneration, to the length of apprenticeships, and to the amount of formal education required.

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Post World War II – 1974

The end of the war saw a refocusing on education in which vocational training was emphasised. This signalled a new era in education and training which was built, during the succeeding years, through the visionary goals which had been developed by the Prime Minister, Peter Fraser and the professional leadership of the Director of Education, Clarence Beeby (Renwick 1998:338). Both believed that it was imperative that industry and education collaborate, with the result that there was strengthened administration of the apprenticeship system (Alcorn 1999:50; Beeby 1956; 1974; 1992:182-188).

Beeby's background was in "…industrial psychology and vocational guidance … [along with] experience in juvenile unemployment during the Depression" (Beeby 1992:183). This experience had convinced him that "the skilled trades were having a raw deal in New Zealand". Also, he believed that many employers were using apprenticeship as "a source of cheap labour and that unionists saw it as a means of limiting entrance to their trades and enhancing their own scarcity value" (Beeby 1992:184). Beeby had recognised the "merits and failures" of human resources planning in education where there had for a long time been a focus mostly on the three Rs. He believed that

> …a strong apprenticeship system was vital not only to the industrial future of the country but also to the development of a curriculum in the post-primary schools that would have new meaning for a wide range of students (Beeby 1992:184).[34]

[34] In 1939 Beeby drafted a statement for Peter Fraser, the Minister of Education of the time, which summed up the philosophy behind the first New Zealand Labour Government's education policy and as well, their broader social goals. This philosophy and the policy on which it was based would shape and drive the country's education for the next twenty years and affect the education of its children for many more decades. "The combination of Fraser's political vision and Beeby's professional leadership was unique in New Zealand's educational history" (Renwick 1998:338). As Beeby later remarked, and wrote of his minister, "the words were mine, but the policy was his" (Beeby 1992: xvi):

The *Apprentices Act 1948* was enacted to ensure that apprentices received the necessary amount of theoretical education for their respective trades, and also to raise the status of the trades by improving the remuneration for such work. Measures were put in place to set proportional wages as they applied to apprentices and journeymen. A result of these interacting forces, including the prevailing buoyant post-war economy, was that industry in New Zealand was consolidated and expanded and the country saw the "beginning of a lengthy period of sustained growth" which was further fuelled by the Korean War in the 1950's and the resulting rise in wool prices (Murray 2004:70).

The mid 1960's onward however, saw the end of full employment and brought the realisation that apprenticeship could be adversely affected by the state of the economy. In addition, changes in technology led to a belief that the form of apprenticeship would have to change to be more responsive to changing skill needs. More off-the-job education was seen as the way to provide this. An irony that echoes today is noted by Murray of the time: "Accompanying this debate was the paradox of shortages of skilled workers at the same time as unemployment was beginning to increase" (Murray 2004:75-77).[35]

More importantly, it was effectively, the beginning of the long story that would continually largely blame the quality of the country's workers (including their deficient educational and skill and productivity levels, and the institutions in which they were taught) as a contributing factor to the many ills that would continue to affect industry and the "economy"; or, that

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The Governments objective … is that every person, whatever his level of academic ability, whether he be rich or poor, whether he live in town or country, has the right, as a citizen, to a free education of the kind for which he is best fitted and to the fullest extent of his powers. So far is this from being a pious platitude that the full acceptance of the principle will involve the reorientation of the whole education system.

[35] In hindsight, arguments at the time about the effectiveness of the existing system of engineering apprenticeship can likely be seen as related to who should have control over that apprenticeship. It was instead cast as one over the content and structure of apprenticeship, in particular that of "time-serving" as the criteria for completion.

if corrected, could solve these (and many other) problems. The oil shocks of the mid-1970's, along with Britain's entry to the European Common Market, saw New Zealand enter another time of political and economic turmoil. Cast adrift from its major source of income, the country struggled to regain a foothold in an unfamiliar and swiftly globalising world.

The response to this problem was what Higgins (1993) and Murray (2001, 2004) describe as years of incremental change and tinkering with the system at government level, culminating in the *Apprenticeship Act 1983* which shifted more responsibility to improve apprenticeship to industry, including moves to replace time-served apprenticeship with a competency based form of assessment.[36] While the act provided for a small incentive for employers to take on apprentices, industry was being called upon to do this at a time of recession and high unemployment and the decimation of manufacturing in New Zealand as a result of the globalising world market.[37]

A number of the senior Stafford tradesmen completed their apprenticeship during the 1970s-1980s era. From their descriptions of their experiences, it does not appear that apprenticeship as it operated on the shop floor has greatly changed since that time. However, opportunities to practise their trade were to become fewer and fewer.

1984 saw the election of the 4th Labour Government which, as Murray notes, reviewed education "to within an inch of its life" (2004:79). This government however, was soon to be hijacked by a minority who believed

[36] While it was argued that this would broaden the training and reduce the length of apprenticeships through more "off-the-job" training, it also had the potential to weaken union influence on those apprentices. Also, a discussion of the pros and cons of competency (and component) based learning forms a part of my theoretical analysis.
[37] Murray (2004:78, 79) reports that although the act was designed to streamline the system, it was seen as cumbersome, underfunded, and unnecessary by those in industry who were expected to take more responsibility for the scheme.

that the only way to save the country from its economic plight was to embark on a plan of neo-liberal based economic reform (Kelsey 1993, 1997).[38] This ensued and was continued with even greater enthusiasm by National Governments from 1990 until 1999. In this strengthened new paradigm, the "market" was seen as the best mechanism through which to determine need and on which to base policy.

The manufacturing industry was a case in point. Manufacturing was at a low; with high unemployment following the stock market crash of 1987, from the rapid deregulation that was a part of the neo-liberal programme, and from increasing overseas competition. Manufacturing businesses were struggling to stay afloat let alone take on apprentices, and as well, deal with a new and complex system of qualification for those apprentices. (As noted in chapter four, the current owner of Stafford Engineering purchased the company in 1986 in the midst of this challenging economic period.)

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This story demonstrates clearly that fluctuations in apprenticeship numbers and arguments about its suitability as a way of learning, relate directly to the state of wider socio-economic conditions and ideologies rather than to inadequacies of the system itself. Arguments over the quality of workers and education and training systems followed a similar pattern to those of the past and would be repeated in the present.[39] The

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[38] Murray notes of this period: "By the late 1980's, the incremental and often piecemeal reforms of the apprenticeship system were overtaken by the harsh economic realities and the consolidation of emerging neo-liberal ideology. Similar themes were mentioned in report after report: the need for a highly skilled workforce and flexible, life-long learning practices; demands for increasing productivity and responsiveness to the global market place; and the superiority of the market in determining the best mix of skills" (Murray 2004:80).

[39] Claims that it was the lack of a sufficiently skilled workforce that was holding back the country and contributing to unemployment were also found by Higgins (1993, 1994) to be fallacious and

passing of the *Education Amendment Act 1990*, *Employment Contracts Act 1991* and *Industry Training Act 1992* came at the end of years of labour market reform. Together, these three acts saw the end of the formal apprenticeship system as it had been known for over fifty years. The face of apprenticeship was changed to one of "training" for the next ten years.

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From Apprenticeship to "Training" and Back Again

The *Education Amendment Act 1990* established the *New Zealand Qualifications Authority* (NZQA), an institution which was formed to "develop and administer … the national qualifications framework" (Murray 2004:89). The authority's website defines their role in the education sector as the following:

> …to ensure that New Zealand qualifications are regarded as credible and robust, nationally and internationally, in order to help learners succeed in their chosen endeavours and to contribute to New Zealand society (New Zealand Qualifications Authority 2012).

As such, it oversees all areas of educational assessment within the country; including setting the individual units of learning for primary and secondary schools, tertiary providers, and for work based learning and training.[40]

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that the true deficit was the *lack* of employment. Similar claims are made today in relation to what is argued to be low productivity.

[40] The basis of all current training qualifications is 'Unit Standards' by which teachers or assessors may judge the learner's competence in discrete areas of knowledge or practice. An example of some of the engineering unit standards is provided in appendix iii. The underlying reasoning for the changes was to create what the then Minister of Education, Lockwood Smith, claimed would be a "seamless" system of education (Strathdee 2011:303). The change in emphasis led to a huge expansion of tertiary education.

The Industry Training Act 1992 resulted from work on an *Industry Skills Training Strategy* (New Zealand Education and Training Support Agency 1991), (subsequently rebranded *Skill New Zealand*) which was set in place by the government to restructure and provide advice on the new way of delivering industry training. The new strategy called for each industry to take the initiative for the training of their workers and meant that this training would be designed, managed and delivered by the separate Industry Training Organisations (ITOs) set up for their respective industries (Murray 2004:90).

The main roles of the ITOs as set out in the 1992 Act were to set skill standards for their respective industries and to develop and make arrangements for the delivery and monitoring of that industry's training (but not to be the actual provider of the training). Further, ITOs were to "provide leadership within the industry on matters relating to skill and training needs" [and] "develop arrangements for the collective representation of employees in the governance of the organisation".[41] The overarching supervision and funding of the scheme is now vested in the *Tertiary Education Commission* (TEC).

The National Government of the day envisaged that funding for apprenticeship training would be "transferred gradually to industry control on a contestable basis" (Murray 2004:90). However, as Murray notes,

> There was no direct mechanism within the Act for the ITOs to collect levies from firms within the industry at that time and, by 1995, ninety percent of ITOs' income was still from government funding (92, 93).

Alongside the new form of training, *The Employment Contracts Act 1991* changed labour relations in New Zealand (Law 1991; New Zealand

[41] *Industry Training Act 1992* S. 2 (a-f) (New Zealand Government 1992).

Government 1991; Rudman 1991). The Act made union membership optional and replaced collective bargaining largely with individual contracts which left workers in a weakened negotiating position. The outcome for the institution of apprenticeship was hugely destructive: "…the triumvirate of union, employer and state that had protected and supported the apprenticeship system was broken" (Murray 2004:91).

The word apprenticeship was largely replaced with the word "training", with apprenticeship cast as an outdated, inefficient and inadequate system of learning. The traditional pathway from school to an apprenticeship appeared to be broken and trades training competed with the emerging emphasis on information technology (computer studies), on sports and tourism careers, and on gaining *academic* qualifications.

Numbers entering trades training dropped dramatically during the 1990s. The manufacturing industry, as noted above, was in poor shape economically and those who did become involved with training, found the new system complex, expensive, and difficult to administer (Moses and Strathdee 2007). While the qualifications initiative was successful in increasing numbers training in some areas of the labour market, shortages still existed in others. In yet other areas, many were paying for training and accruing student loans for occupations in which there were only a limited number of jobs.

Integrated more fully into the national education and training qualifications framework and operating under a more fragmented, component and competency based form of assessment, it appeared to many that apprenticeship had "gone". Murray's (2004) work also highlights the difficulty for industry of negotiating the new system during that time. The stories of a number of those at Stafford, along with that of the apprentice coordinator, include mention of their frustrations with the system during this decade. Most notable though was the lack of recognition of the value and importance of trades training.[42] However, while the overarching system may have changed, the stories of those at Stafford demonstrate that "apprenticeship" as it was practised at the level of the shop floor, appeared, once again, to continue as and where it could, in what became throughout the 1990's, increasingly difficult times for manufacturing.

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In 1999 the Labour Party was returned to power (minus the more extreme manifestations of its errant neoliberal element of the 1980s), along with the rhetoric surrounding notions of a high-skill, high-waged, creative "knowledge economy/society" that would gain the country a competitive edge,[43] and a renewed focus on apprenticeship. The party was supported by the unions which had lost much of their bargaining power as a result of the *Employment Contracts Act 1991*, and nine years of neo-liberal reform and increasing unemployment. The unions' focus, in the manufacturing field at least, had shifted from their original focus on wages and working conditions to one with an emphasis on "education and training", "up-skilling" and "flexibility" (Higgins 1993; Murray 2004:103; Piercy 1999; 2002) effectively, an adaptation to the prevailing socio-economic and political climate.

In 2000, the *Employment Contracts Act 1991* was repealed and replaced by the *Employment Relations Act* 2000, in an effort to mitigate the most damaging effects of the ECA on workers. However, this did not reinstate

[42] In engineering at least, there was a perception that careers advisors knew little about the industry. Many schools had closed their "workshop" departments and were investing in computers instead.

[43] This same message however, was being promoted in many other OECD countries, largely diminishing the possibility that any one of these countries would command a premium in terms of their new levels of "knowledge" or, stocks of qualifications. At the same time, in emerging economies such as India, similar efforts in education added further competition globally, from large numbers of graduates (Brown and Tannock 2009; Keep 2009).

compulsory unionism and nor did it change the status quo in regards to individual contracts.[44] Instead, it could be seen as the type of compromise that resulted from the new “third way” politics, or, as Keep (2009:27) puts it “neo-liberalism with a smiley face”, which lay behind the new government’s agenda (Chatterjee 1999; Dalziel 2002; Kelsey 2002; Roberts 2008; Thrupp 2009; Thrupp and Irwin (eds.) 2010).

Meanwhile, the new knowledge economy and society would be achieved by an even greater emphasis on, and investment in, training and lifelong learning. A particular target area for training though, has always been unemployed youth and, more specifically, young men. The promise to recognise again the ethos and status of apprenticeship saw the introduction of the Modern Apprenticeship scheme in 2002, following similar introductions in Britain (1994) and Australia (1998 – as the *New Apprenticeships Scheme*).[45] This revamped scheme was seen as a way of re-engaging this portion of the population and as well, of responding to the cry of businesses who were struggling to find skilled tradesmen.

The main difference in Modern Apprenticeship (MA) from the previous system was the introduction of a new layer in the management of apprentices and a new key person in the equation – the *Modern Apprentice Co-ordinator*, generally employed by apprentice companies who contract to employers. While those in industry may still choose to manage their own apprentices and carry out their own assessment and the marking off of the unit standards, they may also purchase this service from an intermediary company. In this case the apprentice company may employ the apprentice and second them to the business which is the case

[44] Since 2000, the *Employment Relations Act 2000* has been amended several times. This has continued with the change of government in 2008, back to one with a centrist/right agenda. Changes were made to the act in 2010, and it has since been amended to introduce an extension of their controversial ninety day trial period for new employees, to all areas of the labour market.

[45] *The Modern Apprenticeship Training Act 2000* came into force in 2001. Its stated aim was “to encourage and help people (especially those aged 16 years or older, but less than 22 years) to take up and complete apprenticeship training” (*The Modern Apprenticeship Training Act 2000, S. 3)* (New Zealand Government 2000a).

for the Stafford apprentices. As John, the apprentice co-ordinator for Stafford explained, there are a variety of contractual arrangements within the system.

The *Tertiary Education Commission* (TEC) describes the role of the MA co-ordinators: [They]

- facilitate young people accessing apprenticeships
- encourage employers to take on young people as Modern Apprentices, and
- provide ongoing mentoring and support to both parties throughout the apprenticeship (Tertiary Education Commission 2011).

Murray (2004:110) and Piercy and Murray (2003), while noting that the return of apprenticeship training had been welcomed with enthusiasm by many, also identified a number of problems with the system. Among these Murray notes divisiveness among providers, differences in employer commitment, over-reliance on market forces and questions over its sustainability during periods of recession.[46] Issues of equity were identified by (McGregor and Grey 2003).

With the opening of the training market to private providers[47] the training industry grew exponentially in the period from the early 1990s through the

[46] Murray also found that service sector industries "with less history of structured training and a more transient workforce, [tended] to have lower completion rates" (2004:111), while some in industries which did have a history of apprenticeship were resentful of the fact that they "…were never *paid* to do it [administer apprentices], now someone else is getting paid to do what we were doing anyway" (Medium sized business employer cited in Murray 2004:109 (respondent's emphasis)).
A background paper from the National Equal Opportunities Network (2006) demonstrated the gender disparity among apprenticeship numbers and also reported that the scheme cost $6.73million dollars in 2001/2 and had increased to $40.29 million by 2006.
The paper by McGregor and Gray (2003) for the Human Rights Commission identified the problem of low numbers of women, Maori and Pacific Islanders participating in the scheme.
[47] Keep (2009b:27) notes that the benefit to neo-liberal style government is that "contestability and marketisation, despite their supposed efficiency gains, also afford central policy makers the same opportunities offered to any colonial administrator by classic 'divide and rule' tactics".

early 2000s, as training and then apprenticeship training as well was extended to many areas of work which had no history of such systems and in many cases were simply accrediting existing learning (James 2010; Moses and Strathdee 2007). Industries which had formerly borne the cost of training their employees were now subsidised by the state.

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Throughout the last fifty years many initiatives around youth unemployment have come and gone. These have included work schemes, upskilling schemes (Higgins 1993, 1994), pre-employment schemes to address "basic" skills, and schemes to promote access to the working world for school leavers, among many others. They all focus largely on the supply of workers to business but, as has been noted by a number of authors (Keep 2007; Keep, Mayhew and Payne 2006; Keep, Lloyd and Payne 2008; Keep and Mayhew 2010a,b,c) the mechanisms that surround and affect this process are much more complex than issues of supply alone.[48] Meanwhile, the quest for a magic (economic) bullet continues to focus mainly on education and training for work and the power of "the market".

A more recent response, expanding on the long-running "skills" debate and first suggested during the late 1990's, was the idea of exploring the notion of human capability (Barker et al. 2009; Bryson and O'Neil 2009a, 2009b; Deakin 2009;[49] Department of Labour 1999; Sen 1999). This approach was seen as providing for the possibility of a broader approach

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[48] While these authors argue that it is also necessary to pay attention to issues of demand, Keep Lloyd and Payne (2008), point out that the policy focus on training as a transformative mechanism takes the spotlight away from other aspects of policy, such as industrial relations, which may also be contributing to poor economic performance.

[49] Deakin argues that "Amartya Sen's capability approach has the potential to counter neoliberal critiques of social welfare systems by overcoming the false opposition between security and flexibility. In particular, it can be used to promote the idea of social rights as the foundation of active participation by individuals in the labour market" (Deakin 2009:7).

to the issues around training and productivity, rather than focussing on simply trying to create larger and larger stocks of human capital. Jane Bryson and Paul O'Neil (eds. 2009b) explored these ideas further, having carried out research as to their possible efficacy in a number of occupations, and identified a number of useful elements.[50]

The argument is that there needs to be greater emphasis on the ability of those with capability to be able to make use of it and gain from it in both economic and human well-being terms. To do so it is necessary to have greater focus on the effects of institutional and organisational practices and how these may better use the capability that workers bring to them.[51] Thus, the notion of human capability appears to be promoted as a yet another means by which to identify ways to improve training, increase productivity, improve the economy, and mitigate social deficits via the world of work. While the work provides valuable insights, there is still a danger that the more qualitative aspects identified by a number of the authors in Bryson (ed. 2010), will be ignored in the more instrumentalist paradigm that currently holds sway.[52]

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As is apparent within the above, apprenticeship as a form of vocational learning is enjoying a renaissance in workplace learning discourses and practices and in the policy related to these areas, in a number of countries.

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[50] In particular, chapters by Peter Boxall and Keith Macky (2010), Paul Dalziel (2010) and Leda Blackwood (2010), focus attention on the workers themselves.

[51] As Sennett (2008:276) describes it, capability is "activated or repressed by culture".

[52] Wackerhausen (1997:196) notes, "Every paradigm or tradition has an inherent tendency to protect or recreate itself. The more one is socialised into a particular paradigm, the more likely it is that one's "new" ideas, intentional or not, are just subtle reproductions of or variations upon the basic assumptions and concepts of the paradigm".

However, it is largely concerned with the notion of apprenticeship in its instrumental form and less focus on individual agency, or, even individuality, and greater focus on how apprenticeship may serve the needs of industry, and on its utility for workplace learning in general.

The extent to which the notion of apprenticeship can also be seen to have been undermined in some cases is pointed out by a number of authors. Taylor (2010) describes the tensions that arise when apprenticeship is moved to the high school classroom, separated from the place of the actual use of what is to be learned (and likely devoid of many of the social aspects of apprenticeship on the shop floor). Competing interests also argue over the appropriate academic/vocational balance in both educational institutions and "on the job" programmes.

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As this brief history has shown, it is not only the acquisition of theoretical and skill knowledge that is important in the equation that represents the nexus of education, training and work in society but also the availability of the places and spaces where that knowledge may be utilised in a productive and rewarding manner. The candidates to fill these places are brought up in the wider society in which the various institutions and workplaces that provide training exist. There is a growing awareness as shown in the "capability project" of the need to consider more fully, the wider community and societal issues. Most recently, the literature is reflecting the need to look even more carefully at the workplace and to improve both the conditions of work and the nature and quality of, and remuneration for, the work itself, so that there are no "bad" jobs (Baker 2009; Buchanan 2006; Ezzy 2001; Juravich 2009; Keep 2010b; Warhurst 2011; Warhurst, Eikhof and Haunschild 2008).

It appears that these issues, along with fundamental issues in the areas of education and childhood, require more attention if there is to be equality of opportunity and an equitable, productive, knowledgeable, talented, vibrant and creative society as imagined by Peter Fraser and Clarence Beeby in the 1940s. Through the stories and biographies included in this thesis I want to demonstrate the importance of these areas of concern and the way they contribute to who does which work and where, how well they do it, and, on whether and how they find it fulfilling.

In addition, and critically for my discussion, I wish to give voice to those who go unrecognised in policy, and in much of the literature, and who are a critical element in knowledge production and reproduction in this field – the men (and women, however few they are) who work on the "shop floors" of the engineering industry. The story of apprenticeship in New Zealand is just one thread of our history. It does, however (noting Olssen 2008) have the ability to enrich the understanding of how parts of New Zealanders' culture and identity were created. It also shows that the mistakes of the past are often forgotten, only to be repeated in later years.

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Skill, Skill, Skill

I began this research at a time (2007/2008) when talk about "skills'" (and the lack of skilled workers) was evident almost every week in New Zealand public discourse. Whether it was manufacturers bemoaning the fact that they could not get qualified staff and that this was holding back their ability to gain contracts, or whether it was politicians and policy makers trying to fix the problems of the education system or of "today's youth", "skill" remained a taken for granted concept. The word skill had become ubiquitous and could be seen in all sorts of contexts including training programmes, employment agencies, company names and advertising.

Publications from bodies such as the Department of Labour (DOL) and the Industry Training Federation (ITF)[53] discussed skill as one or a number of either generic or specific abilities. e.g. *NZ Skills Strategy 2008* (New Zealand Government 2008)[54] and (ITF 2008) a briefing to the incoming Government. This latter publication highlighted "the skills and production challenges facing the country". Another document from the ITF website made this rather broad claim:

> Our poor level of labour productivity, and even more the slow rate of improvement in our productivity rate, is a key reason why we are no longer one of the richest countries in the world (as we were in the 1960's).
>
> But it is also clear that **having** skills isn't enough. They have to be the right kind of skills, and they have to be **put to good use**. Putting skills to good use means paying attention to a lot of things – motivation, rewards, plans, teams and many other factors (ITF 2008b, bold in original).

And, from another document, and indicative of the prevailing notions of the word they note that "[s]kills may be thought of in a number of ways":

- **foundation skills** – things we need to know, understand and be able to do in order to do other things

[53] The Industry Training Federation (ITF) "is a member based organisation, representing [Industry] Training Organisations (ITOs) to government and working with agencies and sector groups to improve the policy for and delivery of industry skill development and work-place learning" (ITF 2009). Unique to New Zealand, it is the member organisation for the ITOs. The organisation is research-based and co-ordinates and acts as an advocate for ITO input, and promotes training policy. It "receives funding through the Tertiary Education system and the industry contribution comes through a mixture of cash and in-kind support" (ITF 2012).

[54] This document was the result of discussions between "government Ministers and officials, Business NZ, New Zealand Council of Trade Unions (NZCTU), and the Industry Training Federation (ITF)" (New Zealand Government 2008).

- **generic skills** – skills that we can apply in a range of contexts, and often enable use [sic] to make use of other skills
- **technical skills** – skills that are often specialised and required for particular activities (ITF 2009b, bold in original)

This conflating of personal qualities with the various kinds of skills is reflected in the ITF's definition of the word:

"Skills" means a number of things, including:

- people's capabilities and abilities
- people's knowledge and understanding
- people's motivation, willingness and ability to use their capabilities and knowledge (ITF 2009b)

It would seem from some of these statements that the reason for the country's lack of economic success can be laid at the door of workers who either do not have sufficient or appropriate "skills", or, who may be "un-motivated", "un-willing" or "un-able" to make use of whatever skills they do have. There is no acknowledgement here of the wider socio-economic factors which may also account for some of these issues, as well as an unsure grasp of what skill actually is.[55]

While the DOL and ITF attempt to define skill as an entity, their definition is a very broad but shallow one. It appears to cover any and all instances where skill (and qualities) may be found in humans and fails to acknowledge either the deeper dimensions of skilled practice or the complexity involved in the processes of skill acquisition. In addition, the

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[55] In a report prepared for the Department of Labour (Infometrics 2006) and under the heading "Conceptual Considerations" that from an economic point of view:
…skills can perhaps be defined as the quality aspect of human capital. Skills define the way that human effort produces outputs. That is, the skills we possess determine our ability to convert physical and mental effort into productive outputs … they relate to latent abilities that are only observable as an aspect of the residual between outputs and inputs (Infometrics 2006:4).
In this document, "Attitude" is included with the "generic skills" of literacy and numeracy, then later included with the "soft skills" of "presentation, communication etc" (Infometrics 2006:4, 5).

definition includes what I would describe as personal qualities or characteristics, reflecting the notions of individual responsibility, where any such failings in these areas noted above (third point) are attributed to the individual, without regard to the circumstances in which that individual is acting. In this definition of skills, these organisations conflate skills with character assessment, the quantitative with the qualitative and the objective with the subjective.

Grugulis and Vincent (2009) note a number of studies which show that “soft” skills are valued differently in different circumstances. Among the many findings they report: “employers placed very different values on soft skills depending on the workers who exercised them” (598); “When it is an individual’s character that is being judged, evaluations based on gender and race are far more likely” (599); “Conflating personal attributes and skills also individualises responsibility for them and neglects their reciprocal and relational elements” (599). They cite Lafer who points out that:

> Traits such as discipline, loyalty and punctuality are not ‘skills’ that one either possesses or lacks; they are measures of commitment that one chooses to give or withhold based on the conditions of the work offered (cited in Grugulis and Vincent 2009:600).

And as they point out, such commitment is bound to be higher in those in good work that is well paid.[56]

A number of New Zealand training policy publications which were produced around this time cite the 2006 Leitch Report which was

[56] In a case study involving a hospital and a university it was found that managerial virtues were prioritised over professional ones, leading the authors to conclude that “soft skills are employer-defined, locally relevant and political rather than universal and generic” (Grugulis and Vincent 2009:600). Of importance to note in the field of training, they also argue that programmes which focus entirely on the teaching of soft skills may deprive workers of “one of the few opportunities to learn technical skills [thus] trapping them in poorly paid jobs” (Grugulis and Vincent 2009:600).

produced for Britain's "New Labour" government of Tony Blair. The underlying beliefs and the rhetoric of the report can be seen to have their origins in neoliberal ideas of "individualism" and the "sanctity of the market" (Keep 2007). Keep identifies these beliefs and I have summarised his list below:

- Skills and human capital are the keys to corporate and country success.
- Globalisation and its impacts are unstoppable and its effects uncontrollable.
- The role of governments is to ameliorate the most damaging of these by equipping individuals with the skills to change jobs and careers in response to economic change
- Most workers will be knowledge workers and more highly skilled
- Universal employment rights will be the main safeguard for workers and if this isn't working they can change jobs
- Skills are the "key to ensuring social inclusion"
- Policy ignores any notion of collective interest (Keep 2007:3, 4).

As Keep points out, none of these change the underlying inequity or the less than satisfactory job conditions of many workers. "Skill has been chosen, not because it is necessarily all that effective as a lever, but because … it is all that is deemed available" (Keep 2007:17; 2009).[57]

To be fair, in regards to the Industry Training Federation at least, the *raison d'être* of this organisation is to promote workplace training.

[57] Keep (2009), in undertaking his analysis of the "skills" narrative in thirty years of E & T policy in England, describes the process as "the gradual accretion of layer upon layer of policy statements … that is broadly akin to the process through which sedimentary rock is laid down" (2) to the extent that it eventually attains the status of myth. As such (following Boje, Fedor and Rowland), Keep notes that "myths are forged as a means of establishing and maintaining shared meanings and understandings" (15).

However, the same rhetoric permeates most of the general policy statements issued from governments and relating to encouraging the population to improve their skill levels. There is little discussion of how these trainees are being produced and reproduced, or, of the societal factors that may need to be present for such people to emerge. There is also little recognition or discussion of the wider value to society of having skilled, capable and creative citizens who through their skills and talents contribute in a wider sense to a better or more democratic and fair society (Standing 2011, Wilkinson and Pickett 2010). Like the promotion of the idea of a "creative/knowledge economy/society" which has also featured frequently since the late 1990's, the focus is almost entirely on its value in terms of economic gain.

Skill appears to be yet another commodity to be produced, managed, bought and sold, but with little understanding of the processes of its acquisition or production, or, of how it is then maintained and reproduced, or may be transferable. Rather, it appears to be simply a matter of somehow providing suitable courses or training within the education system and/or workplace, and hoping that skilled workers would emerge from the other end.

Nowhere in these documents is there mention of what occurs before the "workers" arrive at the workplace. There is no mention of the families and communities from which these workers are provided. The student, trainee or worker is presented almost as a blank slate upon which the training establishment or the workplace will effect its transformation. It is also of note that within these policy discussions, there is little mention of the largely unrecognised men and women who will be the informal teachers and mentors to those who will learn the skills – in the case of this research - the people on the shop floor. These are two areas of interest on which my thesis will focus.

The biographical and ethnographic data from the engineering company, along with that relating to the artist participants, will provide the basis on which to gain an idea about who and/or what may create a culture that enables growth, learning and the building of skills to take place in those various worksites.

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By the end of 2008 the state of the New Zealand economy had tipped into recession following the world-wide financial crisis, and, it became obvious that there were too many workers for the jobs that were available. This volatile situation continues; making the prediction of future labour needs as problematic as always. This set of circumstances has brought about a shift in emphasis on the rhetoric surrounding skill. A strong skill-base is still seen as important as a means of having a workforce ready "when the economy does improve". In addition, as a re-occurring theme, there is even more emphasis on the needs of industry (Industry Training Federation 2009), or, as a number of authors describe it; "business welfare" (Gleeson and Keep 2004; Keep 2007:15).

The first of these is already evident in policies released. They focus on support for businesses in the form of tax breaks, changed rules around "hiring and firing" and other lower compliance rules (ITF 2009). At the same time, any emphasis on "rewards" for workers (i.e. higher wages) for being skilled, results in heated argument over whether this would or would not be an effective strategy for stimulating the economy, with a frequent argument being that businesses cannot afford to pay higher wages and would be forced to close, thus increasing unemployment, or, that by paying higher wages they will lose their competitive edge internationally.

This situation has continued throughout 2010 and 2011 and, as of 2012, the number of young not in employment, education or training, or, NEETs, has risen, along with unemployment (Macfie 2011)[58]. A record number of New Zealand citizens have left the country to seek better wages and employment prospects in Australia, and there are still calls to address the skill needs of industry and business.

Alongside the everyday and policy discussions of skill, examples of its wide ranging appeal as a topic of interest can be found in the international literature of education and workplace learning. Of particular note among these, are numerous publications from the Economic and Social Research Council (ESRC) based in Oxford and Cardiff Universities and, the related ESRC Centre on Skills Knowledge and Organisational Performance (SKOPE). These articles have provided valuable insights through which to critique the field of workplace learning in New Zealand, even while it is sometimes noted that the organisation of our training through the Industry Training Organisations (ITOs) and Modern Apprenticeship schemes have elements which avoid some of the unsatisfactory outcomes which have emerged since the implementation of the similar schemes in England (Keep 1999, 2007, 2009, 2010a, 2010b; Keep, Lloyd and Payne 2008).

Among other authors, Eraut and Hirsch (2007); Irena Grugulis and Steven Vincent (2009); Keep, Mayhew and Payne (2006); Keep, Lloyd and Payne (2008); Lloyd (2004); Lloyd and Payne (2006) and Unwin (2004a, 2004b), are just a few notable examples of the work of these organisations and related publications.[59] In addition to earlier writing such as that of Hart (1978) a sound basis for thinking through many skill-related issues is provided. The recent work emphasises the limited value of focussing economic and education policy so heavily on one element of the many that might contribute to a more productive workforce, or, even a more creative,

[58] In the main article in this issue of *New Zealand Listener* Joanne Black outlines the difficulties faced by even those *with* qualifications, to find a way into employment (Black 2011).
[59] *Are Skills the Answer?* (Crouch, Finegold and Sako 1999); *The Skills that Matter*, (Warhurst, Grugulis and Keep (eds. 2004) also provide valuable contributions to the discussion.

knowledgeable and equitable society. Hart's work, on the other hand, signals the danger to education that is inherent in the processes of breaking down tasks and knowledge into little pieces.

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While skill may be easily defined as "the ability to do something well, expertise, [or] a particular ability" (Soanes and Stevenson 2003:1658), it is in fact frequently used in many policy documents as noted above, as an all-purpose descriptor, to the extent that it loses all analytic value. In addition, a person's "skills" may also be considered "poor", in which case they should effectively not be referred to as skills at all. One of the Stafford tradesmen spoke of having worked with people who had "…no real skill at all". What the tradesman is likely referring to in this instance is a lack of ability, or the lack of a disposition that suited that particular work.

It is also worth noting that many uses of the notion of skill appear to make the assumption that skill is an inherently good phenomenon; that all skill is good. By contrast, skill is not always good and may in fact contribute to actions which are counterproductive, destructive, or even dangerous or illegal (Westwood 2004). In the remaining sections of this chapter, I consider the articulation of discussions of skill with current discussions of the field of education.

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The Siren Call of "Skillspeak"[60]

In their analysis of mid-career adult learning in the fields of medicine and engineering, Michael Eraut and Wendy Hirsch (2007:6) also note the "muddled terminology used by economists, politicians and many workplaces, where the terms "knowledge" and "skills" are used separately, combined and interchangeably".[61] While their research is based largely in Britain, similar usage is seen and heard, as noted above, in the New Zealand context. Terms such as "Skills Strategy" "basic skills" and "high skills economy",

> …use the word 'skills' as a blanket term which subsumes 'knowledge' and clearly includes a significant portion of codified knowledge. In contrast, we have terms such as the *knowledge industry*, *knowledge management* and *know-how*, all of which claim to subsume various kinds of 'skill' (Eraut and Hirsch 2007:6 their emphasis).

To avoid confusion around the meanings which may be implied or inferred from the use of the words *skills* and *personal knowledge*, they instead use the word *capability* (Eraut and Hirsch 2007:6).

> We argue that *knowledge is a state*, and that *learning is a process*; but since learning is invisible, we can only infer that individual learning has occurred by noticing changes in that person's knowledge.[62] Skills are processes that use varying amounts of both codified and uncodified knowledge; but when we use terms such as *know-how*, we are treating learned skills as a form of knowledge (Eraut and Hirsch 2007:6).

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[60] Goldsmith (2003) invokes the use of "culturespeak" following Hannerz. The device serves a similarly useful purpose here as it provides "a useful cover term for all the ways in which people talk about [skill]" [as such] "it works as a fruitful heuristic device for inspecting the field of … public discourse because it focuses our direct attention on the polysemous ways people talk about the concept" (Goldsmith 2003: 280, 281).

[61] Eraut (1997:553) argued similarly that the discourse of vocational education had adopted a "reductionist approach to practical knowledge. The rhetorical use of terms like 'skill' and 'competence' by academics as well as politicians and civil servants uncritically assumes a simplistic view of practical knowledge".

[62] As will be discussed in chapter eight, in setting out to write about my experience of the shop floor I also soon came to the realisation that I had not been easily able to "see" learning.

Sigaut (1993) on the other hand, claims:

> Theoretically at least, we can analyse skill as we would knowledge.[63] For there is an information content in any skill, which can be 'extracted' … The problem is that, even assuming that the relevant information is extractable to the last bit, what we get in the end is a sum of knowledge, not a skill (Sigaut 1993:107).

However, he goes on to identify the various problems that would be encountered in such extraction and that it is simply not only too difficult but also that it can lead to "an endless accumulation of less and less relevant information" (Sigaut 1993:107). This last comment identifies the problem that is inherent in current forms of assessment, as will become evident in the stories of the Stafford apprentices, a problem that affects them as well. The "problem" centres on what is assessed and how. It is a problem that can be placed within the wider context of the ever expanding culture of audit.

In 1978, W. A. Hart critiqued the notion of skill as it was used in education discourse. In particular, Hart warned of the dangers of separating the idea of skills from the idea of personhood, as though they simply belonged to the surface of our lives, somehow "tacked on" (213).[64]

> There is a tendency … to append 'skill' to all kinds of activities,[65] as a kind of grace note, thereby ensuring euphony and an air of analytic

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[63] In the same paper Sigaut analyses "knowledge", pointing out that "*knowledge* denotes both the fact of knowing … and the things or items known" (1993:107). He then restricts "the use of the term *knowledge* to the fact of knowing something, and to use *information* to designate the thing thus known. Defined that way, *knowledge* means 'to mentally possess some information,' implying the ability to acquire it, to store it in the memory, and to retrieve it reasonably quickly and correctly when needed" (Sigaut 1993:107).

[64] "There are all kinds of things we can 'tack on' to people or that, given a bit of encouragement, they'll tack on to themselves. And that's all that's left of the idea of self development: each of us a little hook on which is hung one skill after another" (Hart 1978:213).

[65] Hart provides a wide selection of examples from various discussions or publications: "…people don't now talk about 'reading' but 'reading skills', not about 'teaching' but 'teaching skills'. Children no longer learn to speak and write; they learn 'language skills', or, 'language arts' even,

> impressiveness which disarms criticism … what I have against the indiscriminate use of the word ‘skill’ in education is that it confuses things which really are skills with things which aren’t. It blurs, and destroys, important distinctions between different kinds of things which we learn and are differently related to ourselves. In so doing it misrepresents what education is and what it means to receive an education. It betokens an impoverished view of human life and of what makes it so distinctive (Hart 1978:205, 206).

Since the 1970s many authors have written on the pros and cons of skills-based education, in particular in relation to vocational training. However, the idea of dividing up the many little parts of various practices or knowledge dates back to the early twentieth century with the introduction of “scientific” systems of business management. A pioneer of the system in the education field, Ellwood Cubberly, wrote in 1916:

> By means of standards and units of the type now being evolved and tested out it is even now possible for a superintendent of schools to make a survey of his school system which will be indicative of its points of strength and weaknesses and to learn from the results better methods and procedures (Cited in McKenzie 1997:1).

Thus, McKenzie (1997:47) argues, that the “first wave of managerialism in education” was born in 1910, along with,

> …the introduction of Taylorism and task analysis into American industry …what task analysis was doing to advance industrial efficiency could also be done for education if scientific principles of administration were introduced into school governance.[66]

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or ‘communication skills’. People still talk about ‘moral education’, and perhaps to a lesser extent about ‘character formation’, but increasingly the field is being taken over by talk about ‘social skills’ and ‘moral skills’. Thinking itself is a skill …”(205). And further: “skill of relevance … skills in sensing continuity and opportunity for continuity (‘metaskills’ these latter) … skills in loving, respecting and caring for oneself and others … skills of working with others in teams … skills to cope with and respond positively to pressures for innovation within schools” etc (205).

[66] De Lissavoy and McLaren (2003:132-135) note similar connections.

As McKenzie points out, around the same time, philosopher and educational theorist John Dewey (1859-1952) argued strongly against such a system of education:

> For Dewey, worthwhile educative experiences in the classroom were not something that could be ordained and controlled from a distant source. Rather, they were born in the classroom, they were absolutely tied to time and place, and they occurred through reciprocal give and take… (McKenzie 1997:51).[67]

McKenzie argues that:

> …much of the history of public school systems in Western countries between 1830 and 1930 is, in fact, a history of teachers, educationalists and concerned citizens trying to ameliorate the miseducative outcomes of the rule-bound method and assessment schemes which administrators, often with the best of intentions, had sought to impose upon the schools from without (McKenzie 1997:51).[68]

James Marshall (1997) was equally critical of the policy responses that resulted as unemployment "rose dramatically in the 1980s" and schools were called upon to provide transition programmes to make students work-ready. He also identifies what was not only a switch in policy direction but also effectively the point at which, rather than young people being encouraged to learn for personal enrichment and fulfilment, or to develop a sense of the role they could play in society, students were framed as individual consumers who would then be able to "sell" their newly acquired skills to the market.

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[67] In advocating an experience based form of education, Dewey recognised the immanent and emergent qualities of the learning process (Dewey 1959 [1938]; Scott Johnston 2011:14). As such, learning was argued to result from interest driven inquiry and from embodied experience. Those in opposition to Dewey's ideas believed that knowledge was transcendental, somewhere "out there" waiting to be taught to or acquired by students in a structured and rule-based manner.

[68] Arguments about the value of "progressive" or "experiential" education, versus "traditional" or "classical" education continue to this day. Dewey's work is revisited in valuable ways in recent issues of *Educational Theory* (2011; 61, 1; 2; 3). In these publications, analyses by James Scott Johnston, James C. Lang, Shane Jesse Ralston and Leonard J. Waks, explore and critique various aspects of Dewey's theories and their ongoing value in today's field of education.

> The emphasis is on adaptability to changes determined elsewhere in the world of work, and not upon acquiring judgement and wisdom and *providing* service in a chosen vocational area to other human beings. That 'old-fashioned' notion of service … has disappeared. Instead, the vocational skills of individual workers are now purchased by an employer who, in turn, sells them to a customer who purchases commodities (for which the term 'service' has been [mis]appropriated (Marshall 1997:305).

Mark Olssen and Kay Morris Matthews (1997:11, 12) argue that the increasing influence of the Treasury on government policy in the 1980s silenced the robust education debate that was occurring at that time. The Treasury's advice to the incoming government of 1987 would see the cementing of the next wave of managerialism in education in New Zealand. During the next nine years, education became more and more about the "standards" and "units" described by Cubberly in 1916, as a means of creating a "seamless education system" which would remove the barriers "between schools and post-school education and training" (Olssen and Matthews 1997:19; Strathdee 2011).[69]

The return to nine years of Labour-led Government from 1999, while seeing the reinstatement of apprenticeship in its new form, as noted above, did not see any major wind-back of policy in the general education field. Since the swing back to the right and return of a National-led Government in 2008 and its subsequent re-election in 2011, it is very obvious that we are firmly within a third, and even more deeply embedded, wave of education managerialism, underpinned and driven by market ideology.

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[69] The concept is embedded in the National Qualifications Framework where all courses of study, now hierarchically structured within eight levels, will lead to national qualifications regardless of the place of study. The institutions that comprise the "seamless system" include universities, technical institutes (which now offer degree courses), the senior sections of secondary schools, private training establishments (PTEs), wananga (Maori based institutions) and colleges of education. Also related to the 'seamless system' are the key units of Skill New Zealand – the Industry Training Organisations (ITOs) with their workplace training, assessment and certification capacity (Olssen and Matthews 1997:19).

A return to an emphasis on narrow, formal and standardised practices in education, in particular for younger students, goes against much of the literature about the processes of learning (Alexander 2010; Beeby 1992; Biesta 2004, 2006, 2007; Dewey 2009 [1922]; Edwards 2010; Kvale 1976, 1996; Makus 2001; Renwick 1986). In fact, its proponents seek to turn the tide on more than a century of efforts to embrace more democratic, less formal, broader, and more "child based" experiential teaching programmes in schools.[70]

In New Zealand, the argument that education can act to reduce social inequality was one of the underlying beliefs of the Fraser government of 1939. However, as Beeby who was the main author of the educational vision of the time later admitted, "shouldn't we have realised the stringent limits the economic and social structure would put on the realisation of our dreams" (1992: xviii).[71]

Such insights are still not heeded, and expectations of the transformative power of education and training alone are still heaped on schools and "training for work" type programmes.

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[70] Henderson (1998) relates the difficulties faced by Beeby (and Gordon Tovey who became the first supervisor of art and craft for the Department of Education) in convincing parents and even some teachers, that "creative" and practical learning experiences were not only as important for learning as "the basics"; but were in fact essential as a means of enabling the learning of the basics and in developing the whole person. At the time, among parents who had been brought up in an education system based firmly on the three "R"s, some programmes were viewed as somewhat frivolous.

[71] In reflections on his career, Beeby admitted to having been unaware of the extent of the problems involved in meeting the needs of the twenty percent of western world children who continually failed in the school system: "…I had only a layman's idea of the socio-economic barriers that prevented some students from taking advantage of the opportunities we were offering them. …it was not until 1959 that the sociologists began to develop the skills that made it possible to look at the Fraser principle from the point of view of large blocks of children for whom the phrase 'equality of opportunity' could ring hollow" (Beeby 1992:198).

The "Awful Idea of Accountability" and the "Audit Explosion"[72]

I am measured and counted, therefore I am.

Charles Harvey (2010)[73]

> …the system is too qualification focussed. I mean I'm not asking teachers to do any more, I think they're doing plenty but they spend all their time measuring – it's all about qualification. It's just not relevant … assessment, more assessment, when do they get to learn?

Roger Evans, Stafford CEO[74]

The recent introduction of National Standards at primary school level is indicative of the rise in external audit in education. While schools already have well-tried and robust systems to check students' progress, the new system is argued to be unnecessary and potentially damaging to teaching and learning (Campbell 2009; De Lissavoy and McLaren 2003:131; Edwards 2010; Gainsford 2010; Kvale 1976, 1996; Makus 2001; Thrupp 2008, 2009; Wylie, Hodgson and Darr 2009).

An increasing number of authors has outlined the pernicious effects of the increasing emphasis on measurement and accountability in education or as Kvale 1976:111) describes it, "…learning reduced to the assembly of chains of responses"; or, "pipeline education" (Lave 2011); or, in Greg

[72] These quotes are from Strathern 1997:308, 309. Hoskin (1996) noted the first mention of the "awful idea of accountability" emerging in Britain in the 1800's and "audit explosion" is attributed to Power (1994).

[73] "Through the early inscription of measurements upon its body and mind, the person is made who and what he or she is ... no one is measured without to some degree internalising the measurement; no one is compared to others without feeling doubtful about who he or she is or is not. I am measured and counted, therefore I am … in the penumbra of my measured identity are always all the things I am not, all that I should be but have not yet become and perhaps never shall. There is no grading, perhaps, that is not also de-grading" (Harvey 2010:191).

[74] Interview with Roger Evans (September 2009).

Downey's words "a filing cabinet model" of learning (Downey 2007:222). Michael Herzfeld (2007:91) also identifies the problem of "simplification" or, "standardisation" which he regards as "analogous to the deskilling of the artisan". The work of these authors, like that of Erica McWilliam and Sandra Haukka (2008) and others noted later, demonstrates the way that such measures are contradictory to aims of creating "highly skilled" or "creative" citizens or "knowledge societies".

The call for "standards-based" education frames the argument as one where this is the only choice, with the implication being that without such assessment there would be a lack of "standards". However, the standards themselves are, as Hart above noted of "skills", simply "many little parts" or "competencies" somehow "tacked on", possibly only temporarily for the sake of an assessment; with the assessed child or youth simply becoming the sum of the parts rather than being recognised as a unique person with his or her own unique talents and dispositions. The depersonalised nature of this form of assessment will be shown to be identified as problematic for the apprentices at Stafford.

It is important throughout the remaining chapters to always keep in mind the warning sounded by Hart in 1978:

> …if everything is regarded as a skill indiscriminately then nothing is left to the self. It becomes a mere mathematical point, an abstraction (Hart 1978:213).

Many words about skill have been written and spoken in the years since Hart wrote these words. Other theorists are coming to realise the important truth which he identified at that time; that in focussing on simple basic units of learning or knowledge without a sense of the person who is the learner, and of the importance of that person's lived experience or of what he or she may become as a person, we lose sight of what an education may be, or, as artist Susan Flight neatly describes it: "...the end of real education".

At the same time this speaks to the heart of the problem with an education which is conceived of in terms of "units" and "standards"; little pieces that are attached to, or acquired, by human beings and by which that person may then be judged, assessed, measured and recorded as "competent". This assessment may simply have measured that person's ability to carry out a particular procedure at one point in time. It is a basic measure as it does not account for the embedding of skill that comes only with longer term practice. If I require a mechanic to fix my car, an electrician to rewire my house or, if I ever required brain surgery, I would not want a merely competent practitioner, as measured by such an assessment; I would wish for an expert.

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The above discussion has focussed on the "dangers" of fragmenting knowledge and skills and the way in which this fragmentation has arisen in the fields of general and vocational education. While this discussion is of importance in providing a part of the context in which the participants of my study are located, it can be seen that the dangers emanate not from skill itself but rather, from the uses to which it is put. I turn now to the task of illuminating the "pleasures" of knowledge and skill, any hint of which is missing in the above discussion.

In the following section I provide a brief overview of a number of texts which have provided more holistic and deep, or, "thick" (Geertz 1973; Shankman 1984) descriptions of skilled practice and knowledge building or, “manufacture” (Barley and Orr 1997; Knorr-Cetina 1981; Marchand 2010b; Sawchuk 2003; Vallas 1998). This literature has provided many insights and avenues for the analysis of my own fieldwork, where I encountered many instances of the deep satisfaction and a sense of being or personhood that the participants gained from their various skilled and expert practices.

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The Pleasures of Skill

> In truth, skills liberate thought. The spirit is dumb without them.
>
> Simon Brett 2002

During my discussions with participants during my Master’s research I asked about ideas of skill, creativity, and the impact of technology as they were experienced by this particular group of “makers”. While Peter Dormer (1994:8) has noted the many prejudices about “craft” knowledge, he argues instead for the re-recognition and valuing of manual skill and knowledge. He focuses in particular on “tacit” knowledge (following Polanyi 1967). Not easily described in empirical terms, tacit knowledge is the particular type of knowledge that results from an “interaction between practical knowledge and theoretical knowledge” (Dormer 1994:10). It is acquired through “doing” and “making” and is not always easily translatable through language.

Such knowledge could perhaps be best described as the micro steps of action and thought that need to come together to carry out an action such as those experienced when first engaging with a new form of technology.

Dormer argues that such skill is not always a “quick learning” process that one picks up when one chooses, but rather is built slowly in the processes of making and doing. He describes the way the deeper dimensions of knowledge and skill, or intuition, in such diverse activities as nursing and piano playing, are built up over many years of practice, and involve elements that are often difficult to quantify.

> Tacit knowledge may be impossible to articulate precisely, but it may certainly be demonstrated: the virtuoso knows how in a way the amateur does not (Dormer 1994:17).

While many of the quiltmakers I interviewed for my Master’s thesis talked of growing up in families where many types of hand work were practised, a number had learned the necessary skills more recently. Some talked of their skill being “instinctive” or “natural”, reflecting received ideas about the innateness of needle skills in women – part of an ideology that dates back to the eighteenth century and the “construction of femininity” (Parker 1983; Wanigasekera 2006). It also provides an example of the way that skill may be embedded within social practice to the extent that it becomes a taken for granted reality. Similar comments will be seen among the men who work at Stafford.

Like Dormer, Trevor Marchand has also identified the difficulty of *describing* the many elements of skill acquisition and argues that skill comprises a different domain of knowledge to that of language and to attempt to describe a performative skill *through* language would provide only an impoverished account (Marchand 2003:46). The person demonstrating a skill in the performative sense must then rely on their skill in language if they wish to describe what they have done; in effect using one set of skills to describe another. Marchand is describing the way that a skill may be learned simply by an apprentice “watching and then doing” and claims that there are aspects of this process that are *not* describable in words.

Marchand's work in this instance resulted from ethnographic research carried out at a number of stonemason sites in Yemen and Mali. In his description of the Yemeni stonemasons Marchand asked, “Why is it that those who perform (often) cannot explain what they know?” (Marchand 2003:44). While it can be seen that there are parts of skilled practice which are more effectively taught through demonstration, the contexts described by Marchand show that the lack of verbal instruction had as much to do with the underlying social structures at those sites.

Power over, and control of, knowledge along with ideas of hierarchy, status and tradition shaped the master/apprentice relationship. Marchand found that the master gave little verbal direction and questions were not encouraged (2003:32). The “masters” appeared to deliberately resist both questioning about the work and any manner of codification of the techniques. The “difficulty” was thus as much a function of the power relations and traditions that existed in that particular craftworld as it was of the practices themselves.

Marchand's ethnographic work at that site does demonstrate that some of the knowledge may be expressed in words even if, as he notes, it is comparatively “impoverished” description. In his later study as a fine furniture apprentice (Marchand 2007, 2010b, 2010c) he developed a method of describing the bodily techniques used in the processes of making furniture. Marchand demonstrates that the phenomenon of parsing, as understood in speech analysis, can be usefully applied to the processes of observing the physical processes of tool use.

This further research also allowed him to develop an expanded explanation of why a verbal description of embodied practices may be less than adequate. As in many other areas of expertise, not every tiny component of the knowledge required for performance in that domain can be *easily* transformed into a verbal description.

> Verbal instructions are necessarily impoverished because linguistic propositions can only convey information about one salient action at a time. Other simultaneous and possibly crucial actions to the movement are either eliminated from the instruction altogether or (re)arranged to follow one after the other. Propositional representations flatten three-dimensional practice into the sequential order imposed by language, thereby rendering simultaneity time-linear. Vision on the other hand, has the capacity to construct multi-dimensional representations (Marchand 2010c:S112).

Because of this simultaneity and complexity of movement, a demonstration of a technique and even the physical guiding of another's hand or body position, or force of movement or of pressure, are often the most effective means of enabling learning for others, and of modelling appropriate behaviour in the process of doing the work (Downey 2007; 2010; Marchand 2010c). However, while Marchand and Downey focus on embodied performance as sites for analysis of the learning of skilled practices, it is important to remember that speech itself, and even thinking and looking, are "embodied" acts, and also, skilled practices (Goldsmith 1989:60, 1993; Grasseni 2007; Hanks 1991:22; Stout 2002:694).

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Sigaut (1993) lists a number of theorists dating back to Augustus Lane-Fox Pitt-Rivers (1874), through to Maurice Bloch (1991) and Pierre Mounoud (1991) who have all recognised the complexity of trying to describe the various forms of knowledge and the difficulties that arise in trying to explain skilled knowledge. While describing the processes of acquiring “practical” skills can be seen to have its challenges, Sigaut asks us (following Salthouse 1984) to consider how we can explain expert practice: “After a century of study, it is still something of a mystery how typists can type as fast as they do” (Sigaut 2002:438). A similar question can be asked of the playing of musical instruments (Sudnow 1978).

Sigaut also warns against adhering to an evolutionary concept of technology or of the skills involved in using it. Sigaut argues that such a concept is often assumed in the way societies are defined by their techniques; the use of categories like hunter-gatherer, agriculturalist and pastoralist, by way of definition is, he argues, a risky hypothesis:

> …in the case of a category like hunter-gatherer, the hypothesis is all the more indefensible in that the real criterion of classification is not positive but negative, not the presence of hunting and gathering techniques but the absence of farming (Sigaut 2002:442).

The warning is as relevant to the consideration of “techniques” used in industrial society and to the value and importance that we may attach to different forms of practice and to what faculties we think they may involve.

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Despite the challenges of describing the acquisition of skilled practical knowledge and of the deeper dimensions of skilled knowledge in action, a number of authors have provided valuable examples. John Sloboda (2001) has usefully described five characteristic elements of skilled practice, listing them as fluency, rapidity, automaticity, simultaneity and knowledge, and illustrates these with a number of examples. Social anthropologist Jean Lave’s (1977, 1988) seminal works on apprenticeship and maths learning, followed by Lave and Wenger (1991) and Chaiklin and Lave (1996), led to the widespread appreciation of the value of apprenticeship learning and “situated learning” (learning in context, learning by doing, everyday learning).[75]

A number of ethnographers who had undertaken apprenticeships are noted in chapter one. Relating more to mechanical forms of technology, Stephen Barley (1996) (technicians) and Barley and Julian Orr (eds.1997) (various forms of scientific and craft work); Orr (1996) (photocopier technicians); Gary Chick and John Roberts (1987) (lathe craft); Matthew Crawford (2008) (philosopher and motorbike mechanic); Douglas Harper (1987) (a car mechanic’s workshop); and Ed Hutchins (1996) (marine navigation); have provided ethnographic descriptions of practice which have allowed me a greater understanding of what I have been observing.

The artist participants of my study work closely with their materials in the creation of their works and the work demands good knowledge of those materials. Their practice is also technical. Precision engineering on the other hand, is a hands-on occupation to a certain extent; but it is equally a practice that involves scientific knowledge; of the chemical and physical properties of the materials used and of increasingly complex technology.

The strategy suggested by my chief supervisor of using my background in crafting practice to further investigate forms of art and object making, as a counterpoint to the study with the precision engineers, has been a fruitful one. It has led me to consider more fully the skilled practices of both groups. Lissa Roberts, Simon Schaffer and Peter Dear (2007), and Pamela Smith (2004) provide historical overviews of the importance of artisanal and embodied knowledge in the development of scientific knowledge and invention. Their descriptions of embodied practice allow for

[75] Lave was strongly influenced by earlier thinkers such as Dewey, Vygotsky and Piaget.

a reconsideration of what we frequently regard as “knowledge of the mind”. Richard Sennett (2008) takes an holistic view of the notion of “craft” and argues that good crafting in all its forms, is at the heart of the way we could improve the way we work, and our lives and societies in general.

Also, importantly, I recognise the work of Maxine Sheets-Johnstone (2000), who argues that all the skills and processes for apprenticeship learning are developed from birth onwards. Her work, like that of a number of educational and developmental researchers, alerts us to the importance of taking into consideration our early years of life in any discussion of knowledge, learning and skilled practice. And, to refocus attention on “the work of the hand”, that part of us that connects us most intimately and frequently with objects and others, I will refer to the work of neurologist Frank Wilson (1998) who describes the importance of the hand in human cognitive development and practice. While a consideration of all five senses is crucial to any explanation of skilled practice, recognition of the importance of the hand in the development of language and cognition has implications for discussions of all forms of learning and ways of being and practising, and, of education itself.

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The introduction and this chapter have provided an outline of the background in which the research is located, an overview of apprenticeship and education and of some of the literature and writing that relates to the development of skill and of skilled practice. I have also considered the political landscape as it relates to education and training, as it is within the nexus of these fields that the participants of this study have undertaken their various forms of learning and in which they will continue to practice or work. In continuing, I will introduce the artist/maker participants, and their work. I will then move on to the chapters which describe the engineering factory and the backgrounds of those who work there.

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Chapter Three

Craft Technicians, Artists and Makers

> Creation, whether it is in art or science, is a long journey. Some believe that youth is a prerequisite of creativity. This is not necessarily the case. We obviously all admire Mozart's precocity, but equally admirable is the expression of a maturer mind, one whose critical faculties have been nurtured over time and through experience.
>
> Frederico Mayor[76]

Artists and Makers

In this chapter I introduce the craftsperson/artist participants: a printmaker, a ceramicist, a fine furniture maker and two luthiers - a father and son. I also include an engineering designer who would be best described as engineer, craftsman and bricoleur since his work involves the use of all three forms of knowledge.[77] These makers comprise a comparatively small sample in comparison to my fieldwork participants at the engineering factory and the number of engineer interviewees, but they do nevertheless provide a useful counterpoint to the family and learning histories and everyday practices of the engineers. As a different group of workers from the engineers, their stories also enrich the understanding of what it means to be a maker of things.

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[76] Preface to Eliane Strosberg *Art and Science* (2001).

[77] Claude Lévi-Strauss (1966:16-21) however, compared the bricoleur to the engineer. The bricoleur worked only with what was available so that bricolage was a response to whatever possibilities presented themselves. By comparison, the engineer assembled whatever tools and materials were needed for a task.

My 2006 Master's thesis drew on fieldwork conducted among a number of New Zealand quiltmakers who worked at different levels of the craft from hobbyist through to exhibiting artist. The study was a cross-disciplinary one which located the ethnographic work within the context of wider art and object making worlds. I wanted to understand the way different makers attach different meanings and values to the work they produce and the way prevailing ideologies within the art world act to form hierarchies of value in relation to different forms of production and market exchange. These hierarchies include unstable and shifting values that are applied to (in no particular order) ethnic art, craft, fine art, applied art, artefacts, conceptual art, collectibles and antiques (Wanigasekera 2006).

These hierarchies have parallels and perhaps some of their origins in ancient Greece and the writings of Plato and Aristotle and the separation of the "work of the body" from the "work of the mind". In ancient Greece:

> Activities such as tragedy (drama), sculpture, painting, pottery and architecture were discussed as forms of *technē* or skilled craft and as such were considered to involve a 'lower' form of knowledge (Freeland 2001:31).

Historian and social scientist Pamela Smith (2004) notes in her study of the role of the artisan in the development of scientific knowledge:

> A particularly persistent feature of Western culture has been a division between those who work with their minds – scholars – and those who work with their hands – artisans. Throughout most of Western history, these two groups have been separated by a social and intellectual chasm. The Greek distain for manual work as deforming to mind and body was carried on in Western culture up into the seventeenth century and beyond (Smith 2004:7).[78]

[78] In his recent book *Shop Class as Soulcraft*, Matthew Crawford (2009) also provides a valuable contribution to this discussion. As a political philosopher who became disenchanted with his high level, government "think tank" executive job and traded it in to open a motorcycle repair shop, his

During my earlier research I found that within a history that is deeply entangled in ideas of aesthetics, gender and class, the concepts of "craft" and "art" became separated to provide a means of maintaining particular power relations and ideas of status. These dynamics are well described by authors such as Dormer (1994, 1997); Newdigate (1992); Parker (1983); Parker and Pollock (1981); Summers (2003). This hierarchy, which was reinforced during the Renaissance, has seen a number of areas of art and object production (in particular those made by hand and in the domestic realm) classed as "craft" activities and as such, seen as more prescriptive, or, rule-based, and less "conceptual" than art which is about ideas or "meaning". Again, such judgements reflect the mind/body dualism.[79]

In addition to Smith (2004) authors such as Eliane Strosberg (1999) and Siân Ede (2000) have also explored the long entwined histories of the arts and sciences. While Strosberg and Ede acknowledge the two-way flows of recognition and insight, Smith (2004) demonstrates the way much of the scientific knowledge in early modern Europe drew on the embodied knowledge of the various artisans and craftsmen of the time. Her research is based on the close examination of the works of artisans and the texts of philosophers and scholars.

Through careful analysis of these artefacts and of archival sources, she provides a picture of a rich field of knowledge production by the artisans and argues persuasively for recognition of the importance of the body in knowledge generation. Of value to the emerging field of scientific study at the time, was artisanal knowledge of the natural elements, substances and

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analysis of the phenomenological dimensions of working "with the hands" has added useful insights for my discussion of the work done by all of those who are the focus of my research. Crawford rails against the separation of the mental and the manual and seeks to give "due credit to the cognitive richness of manual work" (21).

[79] In my Master's thesis (2006) I explored these ideas more fully and showed how such judgements may result from the claims of various actors at different times and in different circumstances. For my discussion of these phenomena I drew largely on the work of the late anthropologist Alfred Gell (1992, 1996, 1998), and his theory of agency, by way of comparison to institutional explanations of what may constitute "art".

materials and the ways they could be manipulated. Drawing on the writings of Paracelsus[80] who "took the methods of the artisan to be the ideal mode of acquiring all knowledge" Smith describes the unwritten techniques of artisanal knowledge reproduction as a kind of "artisanal literacy … such literacy had the goal of making knowledge productive. We might regard this as a non-textual, even a non-verbal literacy" (Smith 2004:8).

Bert de Munck (2010), who has made valuable contributions to knowledge of the history of artisanal apprenticeship, has also identified the way the competing ideologies of artisans and artists (*artes mechanicae vs. artes liberales*) played out one or two centuries later, re-enacting the mind/body division of ancient Greece. He demonstrates the way that during the seventeenth and eighteenth centuries "views on the value of skills and knowledge were changing" (334). He also describes the interactions between artists and medical practitioners at that time (333).[81] Re-enforcing Smith's thesis, he also argues that "…handicraft and artistic milieus were indispensible for the transformations associated with the scientific revolution" (de Munck 2010:332).[82]

De Munck's account is useful in the way he has described and analysed the competition and tensions that existed between the various actors in this history. In the engineering factory they can be seen to exist in the many comments that I recorded of the tension that exists between the designers and the makers of the various components and mechanisms

[80] Paracelsus (1493-1541), born in Einsiedeln, Switzerland and first named Theophastus Bombast von Hohenheim, was a philosopher and military surgeon. He travelled widely and developed theories of illness and healing and gained knowledge through the study of metals and alchemy. "The art of the craftsman 'reformed' nature by creating noble objects from the dross of fallen nature. The work of artisans, like the practices of agriculture and medicine, worked to redeem the body and life of humans after the Fall" (Smith 2004: 82, 83, 84).
[81] At this time (c.1600's) surgeons appear to have been considered artisans, since they worked with their hands. As such, they initially served a time of apprenticeship as a basis to practice.
[82] De Munck bases this paper on his research of documents and literature relating to assessment procedures of a number of forms of apprenticeship (including those of surgeons and artists) of the early modern period.

that are manufactured there. The comments are usually well-meaning, a search for the "best" way to achieve the intended result. But they also in a sense, again, represent a discussion of the relative values of practical and theoretical knowledge.

The five artists interviewed for the current research are all late career practitioners of their various forms of making. David Fowler is the exception to this in that his fine furniture making is a relatively new occupation for him. However, he does draw on a long history of involvement in arts theory, practices and teaching. A sixth participant, Danny Ryan, is also included in this chapter as his story includes both artistic and engineering elements and as well, he contributes to the discussions of apprenticeship.

There are also many examples within the data of crossovers and connections between art and object making, and engineering. Luthier[83] Noel Sweetman grew up tinkering, making and fixing, and gained an apprenticeship in electronics. He then learned a second trade while working as a precision engineer in the aviation industry. He drew on all this history, along with skills in building and carpentry when he began making stringed instruments and when constructing a new workshop and many of the tools he uses within it. His father also has some engineering experience in his past work of making and maintaining scientific apparatus. Printmaker Ruth Davey noted the value in working in a printmaking workshop which was next door to an engineering one and the way the printmakers were able to make use of the engineering equipment and thus broaden their range of skills and add to their printmaking equipment, including building their own printing presses.[84]

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[83] A maker of stringed musical instruments.
[84] Currently known as the Quayside School of the Arts, the centre originally provided for a range of training including engineering (Quayside School 2012). Steve Carson, who currently manages facilities at the school, reported that the engineering workshops closed in 2007 and that all trades

Craftsmanship in engineering and the arts involves art, science and skill in techniques, as well as the knowledge of materials. Sculptor Susan Flight pointed this out as she worked on her current piece, "… handling clay is very technical, just as textiles are, very technical. I like that combination of technique and technique used creatively, not as an end in itself". Her comment also hints at that shifting and subjective boundary where some may argue that the crafted object becomes "art".

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Ruth Davey – Printmaker

> …one of the important things for people to remember is that the work itself gives you the encouragement to go on – the delight of it … there are all sorts of things that can happen. And some of them, you're surprised; you can use some of them to your advantage. It's often as you work that you get the ideas – the work itself tells you, if you put your mind on it and if you let it happen. If you're too definitive before you start – you're bound to go wrong.

After growing up in a family where art was always encouraged, Ruth Davey set off to Wellington (c. late 1940's) where her father had got a job for her in a section of the public service. With this job came an opportunity that was otherwise not affordable for her family. Her job allowed for time off each week to attend university and over the next few years she gained a Bachelor of Arts degree. Working in Wellington in the years just after World War II Ruth also found the city a dynamic environment.

> …it was a pretty good place to live in Wellington. There were a lot of new things, a lot of things happening, a lot of people coming back from the war

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training had been transferred to Palmerston North. However, the school still employs a technician to maintain the workshop (pers. comm. March 2010).

> wanting to do things. A lot of immigrants were coming…. They certainly transformed a lot of people's ideas…

Wishing to work in a job that would use her drawing skills she joined the town and country planning branch of the Ministry of Works which at that time she remarked was "full of the ideals of the time".

> They were re-planning our towns and there was a tremendous lot going on in Europe as you could imagine, rebuilding after the war … It was pretty exciting.[85]

In addition to her university study Ruth also frequented libraries and at nights and weekends attended courses run by the Workers' Education Association (WEA)[86] where, as she noted "you could learn painting, drawing, all sorts of things". Having never attended formal art-school training Ruth credits many of her skills to those night classes, and weekend and summer schools. Tutors of these classes were often school teachers and Ruth took every opportunity she could to attend.[87]

> …they were always there, those night schools, and I've done most of my training in printmaking … that way. And working in studios, seeing what other people do and picking it up from them – they're usually very generous.

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[85] Ruth noted that she worked with and learned from architects such as Helmut Eichhorn and Austrian architect Ernst Plischke (1903-1992). Plischke came to New Zealand as a refugee from Nazi Germany. A contemporary of Walter Gropius, Mies van der Rohe and Le Corbusier he was "a key figure in the introduction of modernism into Wellington architecture" (Te Ara 2008). His designs and influence can be found throughout the country, e.g. Richardson (2010).

[86] The WEA currently has seven branches throughout New Zealand (although not in the Waikato) which offer courses, forums and seminars covering a wide range of topics and media.

[87] Ruth says of the night – school classes: "I think at the time that education was getting a tremendous leap forward too with the new Education Act at that time. The director of education [Beeby] was a very far thinking person. It makes what we are doing now [the cutting of these classes] – impossible to believe really". Rob Strathdee (2009) has also critiqued the massive reduction in this form of education, arguing that neo-conservative strategies have recently been used to frame areas of tertiary education as "abnormal, or aberrations to the normal functioning of markets" resulting in a "state of emergency", as a way of justifying intervention which has usually resulted in the withdrawal of funding or, increased surveillance of the institutions concerned, by the State.

Feeling the need to gain further qualifications in town planning that were not available for her in New Zealand at that time, Ruth then set off to England where she spent five years. Working for the London County Council also allowed her the opportunity to attend the University College of London, “they were pretty generous in the LCC ... to people who wanted to learn”.

On Ruth’s return to New Zealand in the 1960s she found that the environment was to change as town planning became more privatised and under the control of local bodies, with design largely in the hands of private developers. By this time Ruth had married and had a small son. She made use of this time away from paid work to connect with local artists. What had been, as she described a “kind of parallel life, my drawing life”, was to form the basis of her future lifelong engagement with art and the discovery of printmaking. Thinking a good way to “find things out” would be to teach Ruth spent a period of time teaching in high schools but found that while she enjoyed the students, she “just didn’t really enjoy the system somehow”.

Ruth continued as a teacher in community education while also expanding her own knowledge through Master classes and summer schools88. Again, among her teachers were some who had been refugees of the war in Europe and who had made their home in New Zealand. [89]

While Ruth noted that for much of the time the necessary equipment and materials were not always available but she now has an imported printing press in her studio (Plate 1).

[88] Ruth noted that the art studio at Whanganui was next to the engineering part of the school which had been closed. However, all the equipment, along with “one or two technicians”, remained. She related the way they made use of the facilities to build their own presses: “… [we] came out with not only a great skill of printmaking as an art but had the press and [we] knew how to build it – how to fix it if it went wrong”.

[89] Among these was Kees Hos, a Dutch artist. “He had a most interesting history, story to tell. He was busy underground engraving passports for poor souls trying to get out of Holland” (Ruth).

Plate 1: Ruth at her printing press.

Ruth described some of the history and the many different processes and techniques involved in the different forms of printmaking.[90] While she had in the past worked in bigger formats her smaller current studio space meant working to a smaller scale.

> …I have done most of the printmaking modes but etching – intaglio is the proper word – on metal – that's what I've been doing mostly in the last few years … we use either zinc or aluminium, or copper - is the queen of the metals … copperplate would refer to the very early type of print of intaglio I suppose. I think they used it originally for armour – and for decorating their shields and things like that (Plate 2).

[90] Printmaking involves the use of a template or matrix which may be marked and treated in a number of ways. This base is then inked and then used to make prints. Further marking and treating may be used to add detail and depth to the image.

Plate 2: An etched metal plate.

She provided a quote from a fellow printmaker:

> The printmaker combines the democratic nature of a printed image with the uniqueness of a piece of paper…. [Concerning etching] we are metalworkers, balancing the four elements, ink, paper, metal, acid, with the idea as the central pivot (Rodney Fumpston).

Ruth observed that while some printmakers may produce only single images, it is more usual for them to create "editions" from a single plate. While this allows more people to purchase such a piece of art she emphasised that each piece of an edition is still regarded as an original.

> They're all original – they're not reproductions. Each time you have to ink it up again and start from the beginning. It's a circular process because you come back to the paper and you lift it up and there it is and then you go back to what you did on the plate - so it's mixing those four elements together. (Plates 3 and 4)

Plate 3: Ruth checking the newly printed image.

Plate 4: Close up.

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Susan Flight - Ceramicist

Susan Flight has a long history of involvement in the arts as both a teacher and practitioner. She has, as she noted, "…always lived by my art". Her current residence and studio are in a large converted shearing shed set in hill country near Raglan on the West Coast of the North Island. Susan, along with the help of friends, carried out much of this conversion herself and it now provides an inspiring home and ceramics studio where she also runs workshops and summer schools (Plate 5).

Plate 5: Susan's "woolshed" home and studio.

About to leave school, and having told her parents she would like to be either an artist or an actress, she was told, "Oh … I think your sister's got the talent dear. I think you'd make a nice little teacher". Consequently, having worked her way through two-thirds of a university degree, she "rebelled … and went off and did something else". However, some years later and with four children to support Susan did become a teacher, seeing this as the most pragmatic decision for her circumstances.

> So I learnt a hell of a lot through teaching and to keep reading very, very widely, doing that preparation thing that we were talking about, learning to teach, learning eventually about art, I had been doing a bit, and teaching to a syllabus ironically, meant that I had to learn certain stuff and know it really well ... So that's how I began doing serious art – was because I had to earn a living.

I asked her if the energy she put into teaching took away from her creative energy for her art and she said that the teaching was her "creative event".

> I was a very creative teacher because I was teaching secondary school and it was in Mana College[91] which was allegedly a very tough school and I found it fierce and exciting and passionate and wonderful.

> [S]ome of my students from that time are now New Zealand's leading artists … it was a really good time of life. I used to get up at five in the morning and do my art work because at the same time I was doing a class in etching with John Drawbridge[92] in Wellington at Polytech and I would go into that one night a week, get up at five in the morning to do the artwork … So I always used the best part of the day for the art work. And I learnt very fast … I have really followed that line all my life, of needing a teacher and finding the one I needed.

> And I belonged to arts societies and did life drawing things and etching things, started exhibiting early on and also doing exhibitions with my students first. We had the most wonderful art shows. I've still got the photographs because they were just really good because the kids were so keen. They were also you see, not so much an academic school, they were just full of rebellious kids at that school and they were good artists, very good artists.

Susan continued to teach at secondary school level and went on to tertiary level, teaching at both polytechnic and community arts groups. She finally completed her degree when she was fifty-five. Much of her work around

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[91] Mana College is in Porirua, a suburb of Wellington. It is an area with a large lower socio-economic population. New Zealand schools are currently given a "decile" rating with 10 being the most socio-economically advantaged. Lower deciles gain some additional funding to attempt to ameliorate the deficit. Mana school is currently rated decile 2.

[92] John Drawbridge (1930-2005) was one of New Zealand's leading artists. Working in a variety of media he not only left a large body of mainly abstract works but also worked as an arts advisor for schools in his region (Drawbridge, Macdonald and Skinner 2008).

this time was in dyeing and textile media. As the recipient of a number of Arts Council study grants she was able to travel to South East Asia and Japan where she had learned the arts of batik, *shibori,* and indigo dyeing.[93] A number of very successful exhibitions and workshops resulted from these visits.

In the following years Susan spent fourteen years in Queensland where, amongst other things, she embarked on a three year diploma in ceramics. Her strong belief in the need for freedom in learning was highlighted once again when she recounted how at the end of her course there the nature of this school changed.

> It was an old-fashioned course with real artists teaching – very exciting. Good interchange and just very excitingly creative and then of course everything got tidied up – the year after I left and they got in far more rigid courses and far more rigid tutors.

With her long and varied teaching experience Susan had strong opinions about the current trend in education policy in New Zealand. I mentioned the proposed (at the time of the interview) implementation of national standards testing in schools.

> It just doesn't work. They're trying to systematise something that is basically irrational.[94]

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[93] Batik is a form of resist dyeing where wax is used to form the pattern or image before dyeing. Shibori is again a form of resist dyeing where the main techniques are those of folding, or, stitching and gathering the fabric into myriad patterns before dyeing. Indigo, in Japan in particular, is frequently used in this production. Similar techniques and dyes are used throughout Africa.

[94] Additional excerpts from our conversation are included in chapter nine in the discussion of learning.

Susan sells most of her work and at the time of our interview was preparing work for another solo exhibition. Completed pieces stood at various points around her living area and studio (Plates 6, 7, 8).

Plate 6: Interior living space with completed pieces.

Plate 7: In the downstairs studio – Susan working on the finishing touches to an exhibition piece.

Plate 8: The artist, the work, the tools.

She was also well ahead with the planning of what would be an “intensive” four day summer school which involved a number of other tutors as well.

> …adults are terrific fun to teach because of course each one has got a life and they bring that life to what they do and they don’t need information pasted over their lives, like a little skin of wall-paper that’s going to change them - on the surface – they don’t need that at all. They just need a sharing, and an empathy, and the right words at the right time.

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David Fowler – Fine Furniture Maker

I say I am self-taught but this is never true.

For David Fowler, the wish to become a fine furniture maker was set aside until his retirement in 2000 after a long career in teaching, initially as a primary school teacher and advisor then subsequently as a lecturer at the University of Waikato, Faculty of Education. As a young man he was fortunate to have attended Dunedin Teacher's College at a dynamic time in the history of New Zealand education. As noted earlier, Clarence Beeby had become Director of Education and had set about reforming the education system. Part of his strategy for improving the system was to broaden the curriculum and he began this process by working on the arts, science and sport. This involved additional training to provide specialist teachers in these areas.

David had a strong interest in both art and science and of these he noted, "…they're supposed to be poles apart but I don't see them as that". However, he decided finally to specialise in arts and crafts and was admitted to the new specialist arts and crafts course designed by Gordon Tovey.[95] Within this innovative programme, David became what he described as an "itinerant organiser" for the arts in Waikato schools. Tovey's underlying belief was that the expression of creative imagination "held the key to both children and society fulfilling their potential".

David's work as an advisor eventually led to a position in 1972, as a lecturer in arts education at Hamilton Teachers' College.[96]

> … you got a lot of freedom in teachers' colleges in those days, designing your own courses and following your own enthusiasms and took the students with you – doing all that sort of stuff ... all of those media areas that I worked in and taught in – you just continue to learn … everything

[95] Gordon Tovey was appointed by Beeby as his first Supervisor of Art and Craft for the Education Department (Henderson 1998). Together, they established the "intellectual respectability" of what were seen as the "frills" of education (Beeby 1974). Tovey saw art as a way of enabling a child to locate him or herself in the social, physical and emotional environments that surrounded them – in other words - as a way for children to find and claim their place in the world; or, as Richard Sharell (1949:42) observed at the time, to become, through such work "complete human beings".
[96] Now the University of Waikato, Faculty of Education

> that we did had to be somehow related to what you could do with children in the classroom...

It was not until his retirement in 2000 that he was able to fully indulge his long-time interest in working with wood and become a maker of fine furniture. I could see from his history that for this he drew on his long experience of making and his knowledge of materials, design and aesthetics.

> … as for what I am doing now – furniture has just been a love of mine – the way people make things you know – I've always been curious – especially things where you can work with your hands and your head together. I've always been curious and 'what would it feel like to make a pot out of a bit of clay' – had to know, had to do it, had to find out – had to get up to a point where I could say, yep, I can do that. I didn't necessarily continue but – prove to myself something I suppose (Plates 9 and 10).

Plate 9: David at a workbench.

Plate 10: David in his workshop.

Much of David's information about woodworking has been gleaned from books and from internet sites which often include filmed demonstrations of techniques.

> …in terms of technical development, books would be the most useful to me. So sometimes it's good to read, especially when you're getting on a bit. Sometimes you don't remember something you did two or three years ago. Some of the processes I do I have only done once so … it's not like I've done forty years at a workbench … So the hours that I would've wasted compared to somebody doing an apprenticeship under a master because the master would have just shown them – you do this. This is the best way of going about it.

However, he was also fortunate in meeting Englishman Vic Mathews who at the time was teaching woodwork and physed at a local high school. Vic had been trained at Loughborough College in Britain by Edward Barnsley whose work drew on that of William Morris and the English Arts and Crafts movement. "…a lot of this furniture I make is influenced by all those guys" (Plates 11 and 12).

Plate 11: Beech dining suite.

(Plates 11 & 12 provided by David Fowler. Used with permission).

Plate 12: Sideboard: American Cherry. (Photo: David Fowler).

David called on Vic when he realised he needed some one-to-one tuition for a piece of furniture he was making.

> I said what I want to be able to do is learn how to do the dovetails in all the drawers so I went to over to him ... I spent four days working in his workshop and sleeping there at night and I came home with four drawers with beautiful hand-cut dovetails.

David's valuing of this mentoring was for more than simply the learning of new skills:

> Well, the emotional facet of what I've just described with this one to one – with a Master, of the art of the early fine furniture making – that of course is huge. You don't get that out of books.

David described the way the design of work could change during the time of making because of the nature of the wood, even when it had been carefully selected.

> Certainly you have to respect your timber. You can't fight it …you've got to develop a philosophy…. Otherwise you end up fighting it and you have to sit back and say, 'Okay, this is not quite working – the grain's getting pulled out or something when I am working on a machine so what can I do'? You just think it through quietly and then attempt to get to grips with it.[97]

When I asked him about the processes of gaining knowledge and which aspects felt instinctive as opposed to having had to learn them he explained:

> Aesthetics obviously, you learn about aesthetics, proportion and things like that, instinctively or gradually by symbiosis really. You don't realise that you're picking up all these things but if you go around as I have – for forty, fifty years of my life – every opportunity going to see an exhibition of art, craft, whatever, and you're looking at things, handling things, you're picking it up.

> You don't really know that you're learning but I am sure it impinges forever that when you decide why do you do it this way, why do you put it there rather than there, why do you do a curve there rather than a straight line – what is it that brings you when you're designing something to do that – well, it's just so much to do with living a life where you are consciously taking on these examples where other people have made similar decisions about the aesthetics of the object or the art that they're making. I don't think I have really sat down and made a conscious effort to study these things. But in a way I suppose you could say now it's instinctive, many times.

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Ian Sweetman - Luthier

> I told one reporter that kept asking me [where I had learned my skills] and I told her, 'I went to school and I learned to read. Most of what I learned, I learned from books'.

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[97] "The timber was far from being prey, a helpless victim, to a machine. Rather it would lend its own special virtues to the man who knew how to humour it" (George Sturt, cited in Crawford (2009:41)

Brought up in the depression years of the early twentieth century, Ian Sweetman's violin making career began when he had to repair his second violin. He had been brought up in a family where education was valued and where his family made many things by hand.[98] His love of and interest in the instrument though, began while he was still at school.

> So when my turn came around to get music tuition and mum could only afford one at a time – when my older brother packed it in and went off to the farm, I got the lessons and I chose the violin because that's the one I had got fascinated with.

Ian left school at fifteen having gained the University Entrance exam. His first job was as a clerk in the Agriculture Department in Wellington. Spare time was spent at the public library learning as much as he could about violin making. Materials and tools were scarce but he was able to make his first instrument "in a draughty old coal shed at the back of the boarding house".

> I took it on a visit to Auckland to Bob Hewitt who had a shop in Victoria Street and he had a look at it and said, 'Is this your first violin son?', and I said 'Yep'. He said, 'Well, not a bad effort but - take your label out'. So that was my first assay but it whetted the appetite.

> From there on I got all the literature I could and of course you have to look at as many good violins as you can and the only good violins, the old Italians and that, that were available, came in with visiting artists so I used to haunt the Green Room[99] for all the visiting quartets and soloists and I found them very agreeable, so long as you had something to show them, that proved that you were serious about it, then they would hand you their Strad or their Guarneri so I got an association with them.

[98] Ian related how the family often sat around the fire making hooked rugs together, "Always busy hands".
[99] A colloquial term for the artists' backstage room wherever they are performing.

Ian’s commitment to his crafts of both playing and making soon led to recognition not only in Wellington from those in the National Orchestra[100] but also from visiting artists. A suggestion by members of the Juilliard Quartet that he travel to the United States to gain further experience in making led to a travel fellowship from the Arts Council of the time (1968) which enabled him to spend six months in an atelier in New York.[101] Ian credits his time working as a supernumerary in the workshop of René Morel[102] in New York, as one of his most valuable learning experiences.

Because instruments were brought to the workshop for repairs, they were often opened, thus allowing their internal structure to be viewed.

> So you can look at the internal work and all repair work and of course with a supernumerary, as I was – and they always had room for one supernumerary that didn’t get paid - but you were there for what you could learn - so it was a sort of contest – me trying to extract as much information from them and the instruments as I could and they trying to get as much work out of me as they could.

> …really valuable instruments used to come through there – Stradivarius and Guarneri – the great celli and all the rest of it – and the people who played them of course. So that was an education.…

Ian has since visited Mirecourt, along with the schools at Mittenwald in Bavaria and Cremona in Italy. He had asked a Master while in Cremona, how long he thought it should take to make a violin. “He took a deep breath and said, ‘Well I can’t make a *good* violin in under two hundred and fifty hours’”.

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[100] Now the New Zealand Symphony Orchestra.

[101] Ian also noted that this was the first time the first time the Arts Council had sponsored a craftsman. Grants were generally given to visual or performing artists and “they didn’t know what to do about an audition for a craftsman”.

[102] René Morel was from a family of French instrument makers and spent his early years as a violin repairer in Mirecourt, a well known centre of violin making. He opened a workshop at Jacques Français, Rare Violins Inc. in New York in 1964.

While there are many processes and techniques involved in stringed instrument making, the first critical decision is in the selection of the wood to be used. In his early days of making Ian had been fortunate to inherit twenty sets of “very, very good timber” from a Swiss violin maker whom he had known in Wellington.

> Yes, one of the vital things in violin making is to have suitable wood, acoustically, not just to look at and in fact Stradivari who is sort of the pinnacle of violin makers – he sometimes used wood that was strikingly beautiful and at other times completely plain but he was guided by its acoustic properties so you have to study wood before you can really proceed because you have to identify what works. Experience teaches you up to a point but also if you’ve got a certain type of wood then you’ve got to treat it differently from another type. (Plates 13 and 14).

Plate 13: A replica Guarneri violin made by Ian.

Plate 14: Replicas of Guarneri violins made by Ian. The effects of the figured wood can be seen on the violin backs.

After leaving Wellington, Ian had returned to Hamilton and was employed at the Ruakura Research campus as a technical officer. His main work there was in making and maintaining the technical equipment used by the scientists. In his work as a luthier it can be seen that he often calls on his varied skills of making (including some engineering) and knowledge of materials, to improvise where necessary. The specialised tools and equipment are still often expensive to import. Ian draws on this DIY form of knowledge to supplement his range of tools (Plate 15).

Plate 15: Handmade deer horn and metal file thumb planes. The bottom one is upside-down and shows the cutting edge while that on the right is manufactured from metal.

Ian emphasised the importance of hearing for both maker and player. He spoke of the time his grandson worked alongside him:

> I'd be working on one bench and he was working on the other … I would have my ears cocked for the sounds he was making because I could tell from the sound of the cut whether he was doing it the right way or not. When you are working the wood – it sort of 'talks to you' – you listen to it. So you've got to learn how to treat the wood – how to work it to get the best out of it. That's one of the trickiest parts of the whole thing and a lot of this comes from experience, trial and error, and also talking. You've got to keep in touch with the professionals, the people whose living depends on playing the things. But there's a factor that – when people talk about the tone of a violin – well a violin doesn't have an intrinsic tone at all. It's what the player can get out of it that counts and what suits one, doesn't suit another.

> …they acquire personalities and often they take on the personality of the person who plays them. Kreisler's violin, [a Guarneri] his favourite violin was one of these and it always still sounds Kreisler. I've heard it played. It can have a big effect. Also … the bow is so important to the violin. As Isaac Stern says, 'I can play a Guarneri with six different bows and it can sound like six different violins', so once you get a good violin you've got to find a bow that suits it and the player.

It's like three instruments isn't it?

Yes, they really need a matchmaker.

Ian still works with a number of violinists, carrying out small repairs and adjustments for them in his workshop (Plate 16).

Plate 16: Ian at his workbench.

Ian speaks with pride not only of his own work and the artists who own his instruments, but also of his son and grandson, both of whom have learned many of their skills from him.

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Noel Sweetman – Luthier

> …you have taken a whole lot of dead materials - and assembling them in a different form and bringing them to life and every single piece of a violin was a living thing at one point. Every single bit of it. And I think back in the beginning of instrument making and you go right back to the fourteenth, fifteenth centuries, there's no electricity, no distractions, nothing – they just took everything in the environment and created an instrument – something that would make a noise – sound.

Although Noel Sweetman grew up surrounded by and sometimes involved in, his father's violin making activity, he did not himself set out to become a luthier. He explained that while he learned music from his father, his first interest as a child was in magnets and electricity:

> So … electricity which went into electronics; a bit of sport; having a motor bike and car and all that sort of thing. Fixing it yourself amongst your mates as you do and by the time I had left school I had built my parents a TV and several radios – transmitters, a guitar amplifier.

> So I went straight from school into electronics, finished my trade exam in two years but I had to sit another two years for my apprenticeship and I was servicing televisions and radios and electrical appliances and that sort of stuff.

However, one of his friends worked as a pattern and toolmaker in the local airport engineering workshops, and, having seen Noel's mechanical skills at work, he encouraged Noel to join him.

> So I was there for eight years and I developed skills there and they quickly realised that I was really good at doing all the fine stuff, the detail – very fine detail – so I specialised into that but learnt a lot through the engineering shop. I actually got a second trade there.

After some years, the restriction of having to always work indoors and a wish to be self-employed led him to look for other options. A lack of some of the less tangible rewards of work saw him gradually make his move to what would become for him, a much more rewarding career - following in his father's footsteps as a craftsman of fine musical instruments.

Despite the lack of intrinsic reward from the engineering work, it has nevertheless been useful in his new vocation. Noel built his own pantographic router (copy router) using this knowledge (Plate 17).

Plate 17: The router is used to automatically carve down the first stages of some of the instruments.

Of the engineering work he pointed out:

> …all this fine detail and everything just went out the door. I never heard from it again, never saw it and while you get paid for all your effort, there's no other reward, just the money in your pocket. There's never that, 'what a great job – I made that – that's good'.

> I think you can put more of yourself into something if you have direct contact with the end user and the music thing was fantastic because you actually ultimately make an instrument and then sit in the audience and

hear it … there's something very tangible about an instrument and it's the medium and what people do with them and it becomes a part of their life and it takes them places as well.

So you can follow where they go.

I do. I do. I've made over a hundred instruments and I can tell you where a lot of them are (Plates 18 and 19).

Plate 18: Using a small thumb plane for the early carving down stage (inside) for a replica Sanctus Seraphin violin (origin Venice 1746).

Plate 19: The outside. Also visible is the wooden mould within which the body of the instrument is secured during the carving down.

Having started with learning through repairing and restoring, both of which he continues to do, Noel made his first violin in 1991 and has worked steadily at the craft ever since.

Plate 20: Noel restoring a Mougenot violin (origin Rouen 1789) – the polishing process.

He now “makes everything except double basses”, and noted that he had “pretty much only ever made to order, virtually never got in front of a waiting list”. His work has taken him to many countries as he has travelled both to purchase materials and as well to deliver instruments to their new overseas owners. He describes this “other side of the workshop door” part of his work as “almost like creating a family”.

This awareness of not only creating a fine instrument but also tailoring it for an individual player appears to be another skill that Noel has developed to a high degree. Both Noel and his father have worked with students in music department of the arts faculty at the University of Waikato. For Noel this is a weekly appointment during term time and many of the students are owners of Sweetman instruments. These visits are another important aspect of “the other side of the door”. Much of

Noel's work there involves doing the "set-up" for the students and performers.

Noel's son Mark has joined him and is effectively an "unofficial" apprentice working alongside his father – "bench to bench". His preference is for working on the larger instruments and he is building a reputation as a restorer of the double bass. Therefore, at the present time, three generations of this family are now involved as makers of stringed instruments.

The importance of the less tangible rewards of making and of the close relationship with the user of what is made could be seen as a strong theme throughout the conversations I had with Noel. He returned many times to this aspect of his work as a maker.

> …being able to do what I want, when I want and how I want – and where – it's probably being a bit more in control of my life and where I wanted to go with it work-wise – particularly work-wise. Because when you add up how many hours of work you do through your life – for a lot of people – they're just happy with their pay packet every Thursday because it allows them to buy their groceries and make their payments and what; but for me that's *nowhere* near it. There's got to be some other kind of reward – apart from a pay-day … there's been no better reward than being in concerts or having your instruments win competitions. To me that gives me a bigger buzz than some cheque through the mail.

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Danny Ryan - CEO Cheese Solutions International (CSI) – Engineer, Entrepreneur and Bricoleur

Driving into the "World Headquarters" of CSI there is a distinct feeling of being in a place of creativity. Set in farmland on the edge of Hamilton city, the property which is also the owner's home, has been landscaped in a unique manner. A large variety of machines and metal parts sit between trees and palms and in the undergrowth. One, the size of a small high barn, is the engine from a ferry which used to cross Auckland Harbour. Inside, between various mechanisms, hangs a hammock. This is a place for relaxation and contemplation (Plate 21).

Plate 21: The recycled ferry engine.

Further along a pathway outside is a glass topped picnic table, again, constructed using recycled machine parts (Plate 22). A nineteenth century traction engine has come to a stop at the top of the driveway.

Plate 22: The picnic area with a gathering of machinery.

On this property is the headquarters of Danny Ryan's company, *Cheese Solutions International.*[103] The office building houses some of the owner's classic cars, with a number in the process of being rebuilt and restored. The design office hub also shows a strong presence of classic car related memorabilia; early twentieth century technology next to twenty-first century technology in the process of being designed (Plate 24).

[103] I first met Danny Ryan when he was at Stafford one day to oversee the fitting up of one of his new cheese packing machines. Since his business is now design only, the actual manufacturing of his machines is done off-site at companies such as Stafford. Having begun his working life as an apprentice, Danny started his own engineering company which, at the time he sold it, employed about fifty staff.

Plate 23: A designer at work.

Danny Ryan previously owned Ryan Manufacturing Limited which he had started “in 1981 as a one-man-band”. As a precision engineering company producing a variety of products they had built up the business until they were employing fifty staff and had a sales branch in Melbourne. When they decided to sell and move on to something new they chose to keep the cheese-cutting machines part as a separate business. Two of the men who work in this new business have worked with Danny before – Neil as his first apprentice, “a fitter and turner – awesome skills in machining ideas, design and stuff”. Chris, with a similar background, he has known for ten years. Both had worked elsewhere in the interim but became interested when they knew that Danny had started a new venture. A third designer has been with the company for four years.

Also at work at his computer was David who is a student from Waikato University, currently working as an intern.[104] David had been selected from fifteen applicants for the position:

> …we selected him and two others. They came and chatted to us. He got the job because he had been actively involved in that car that they built at the university. So if you work with this organisation you either have to have motor vehicles as a passion, motor cycles as a passion – otherwise there's not a chance.

Danny explained the way the office works, and effectively his belief in creating a workplace where ideas can emerge in an organic manner:

> [W]hat I've got here is a really powerful group of guys and you can see the culture that we've got here, just being in this environment and how easy it is – as in – you end up with everyone contributing to everyone else's little issues. You can pounce on it instantly. Now this morning – there's no programmed review time or anything – I quite enjoy typically what happened with Thomas this morning. "What's happening here", and you draw up a chair and you have a chat and an hour and a half later we have actually dreamed up a better concept than what we had started with - because, because, because, because – …we might all sit around and we end up then creating a machine that hasn't evolved through building, reviewing, building, reviewing; we actually end up not building the Mark 1 but the Mark 5.

> [I]n this environment like out of my old company, there were twelve designers and so I am fully familiar with the skills and designers and I have to say that the crew that are here are the most powerful guys that I have ever had the privilege to work with. So what this is all about is taking the risks out of prototypes and therefore then the risk to the company financially if you have to modify, change or whatever.

I met Danny one morning at Stafford when his company was using the factory space to trial and finish a new laser cutting machine. I was particularly interested to talk more with him as he had some innovative

[104] Danny explained that the company is subsidised for 450 hours of work for David by Technology New Zealand, as part of a work experience initiative.

ideas about apprenticeship and about children learning about technology and making things.[105] Danny himself had done an apprenticeship in fitting and turning but from the beginning always had a wider interest in the field:

> I also enjoyed creating machinery, designs, improving designs, improving ways to manufacture things because the whole machine tool scene changed because of computer aided systems so therefore you needed to design componentry and stuff to suit the most modern way to manufacture.

With this background, it is evident that his career in design is one that has grown organically - from the bottom up. His ideas have emerged directly from his knowledge and history of engagement with, and experience of, making – a very practical hands-on experience of how things are made, what materials feel like and what can be done with them. His deep knowledge of how mechanisms may work, along with an urge to find new ways of improving the design process, provides a powerful combination.

Like Stafford CEO Roger Evans, Danny also had a keen interest in the continued supply of a talented pool of possible employees to work in his earlier company, and along with Roger helped set up an organisation to improve the supply of tradesmen and apprentices.

> Well, all businesses are scrambling over the same labour pool.... The people that are out of work in our industry probably ain't the brightest spark so therefore then you end up with a pool of people that just literally roam around businesses – to a degree. So in my view, grabbing a bloke off the street to operate machinery and systems and stuff is hard work so the only way to do it is pump the young guys in and overdo it with that so … along the way several of them are going to fall by the wayside, and at the end of their time they'll move on to something completely opposite

[105] Danny was adamant that a lack of strong role models of people making and fixing, or of carrying out other forms of work, needed to be addressed. He proposed a well thought out system where "out of school" groups of experienced adults could share their skills and talents with children. Danny's own father had worked for the railways and was a "tinkerer" and lover of classic cars.

> but what I had was, I think, a system within the business that was like quite a pressure cooker system, and so an accountable system. There was no, no time for any slacking in our regime so therefore then if you took it on the chin and gave it hell, I reckon you're going to pop out as a person who is going to command a higher wage…

An apprenticeship at Ryan Manufacturing Ltd obviously meant signing on for a very focussed learning experience.

While WECA (Waikato Engineering Careers Association) was set up to address the "skills supply" by improving links between the manufacturing industry, training institutions and schools, Danny was unsure if it was still working effectively. After a recent visit of St Paul's Collegiate (high school level) students and their careers advisor, he found that the careers person had been unaware of the extent of opportunities in this area of design and production.

For himself, Danny had decided to lessen his direct involvement with the company:

> Well I'm in my mid fifties and I realise that I'm not going to live forever. And so why … I would have the ability to rush around like a madman and set the world alight but I have had four years of actually the opposite and it's because I don't think that you can keep the tempo up forever - and what a bloody shame to die prematurely of ill-health. You don't get a second chance, do you?

I remarked that I had read an article only the day before which was pretty much about that very thing. Although many say businesses should grow bigger and do this or that, this commentator was saying it's not always just about that. People want quality of life and health and the other things as well (Dodd 2009).

Plate 24: One of Danny's projects - a classic car under restoration.

> I've got an ideal world here as it is. Here we are. We've got a vibrant business … One of the guys is off racing motorcycles this afternoon and for the next few days – because he can – in this environment. I can work on my old cars and hobbies, garden and stuff, and we do really well (Plate 24). So then I say 'Yeah, I can create a whole lot of razzmatazz throughout the world - do I want that? Nah'. So I think that once this new system is built; I don't know how we'll manage this company because it will be a real injection into the company to go to the next phase. We're not so much forced to but I suppose we ought to, take it to the next phase and offer the system to other people, in Europe and other places.

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The makers featured in this chapter, while all highly skilled in their respective areas of production, have brought to their work long histories of involvement in object-making practices, many of which date back to their childhoods. Like the histories and family backgrounds that the engineers describe in the next three chapters, they demonstrate and may lay claim to the availability of a wealth of social and cultural capital, even while they may not have always had access to large amounts of economic capital.

Their careers and interests changed over time with the later ones being built on those of the past. All followed strategies of seeking information and teachers and mentors who could add to their development; they actively sought the teaching and learning experiences they needed to progress in their chosen fields. A number also reported making frequent use of books and the internet as sources of information, instruction and inspiration. This factor was more evident than in the stories of the engineers. However, as will be seen of the engineers, there is also a great deal of “self-teaching” in their histories.

Four of the artist/makers speak of their history of public service employment and the ways in which it enabled them to develop talents and interests alongside their work. Their interests were self-driven but found fertile ground in the many programmes which were available to those who wished to learn. Time, and their perceptions of its availability for these activities, is also a recurring theme in their stories. It is somewhat of an irony that while a field of academic study has grown in recent years so that we “know” more about leisure many people, in particular those in the working population, feel they have less leisure time than before. Those who do not have paid employment and thus could be argued to have plenty of such time are unable to afford many leisure activities.

From these stories, along with those of the engineers, it could be argued that talent and innovation can flourish given various combinations of elements but rather than being mandated or organised in some prescriptive way, these must have the opportunity to grow in their own time according to the needs of the individual and to what is available in his or her environment. Neither of the company owners, whose businesses were started independently and within four years of each other, attributes their success to any specific or direct national or regional government initiatives. However, it is evident that they themselves have benefited and continue to benefit from the wider culture and institutions in which those who work for them have been raised and educated.

The worker/maker biographies/histories above identify the importance of the availability of opportunities for individuals to follow, explore and build on their strengths. In the discussions of knowledge, skill and education that follow it will be useful to keep in mind the above stories of opportunity and work and of long term enriched knowledge-building.

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Chapter Four

Stafford Engineering

Roger Evans CEO

Roger Evans and his brother Don purchased Stafford Engineering in 1986. At the time Roger intended to be only a silent partner in the company, which had been in receivership at the time, but as it continued to falter under the old management Roger left his job at Trigon Plastics[106] to take over its running. He came with a number of skills, having begun his engineering cadetship at Trigon and worked his way very quickly into a supervisory role. At the time he left to take over the running of Stafford, he had also spent three years in plastics processing plants in South Africa, and on his return to Trigon had helped set up a separate machine building company within the group, Trigon Engineering. During the next year the share market worldwide crashed, creating a risky environment for many businesses.

However, drawing on his knowledge, skills and contacts, he set out to create a successful company. Some of the early work also came from his previous workplace:

> …we were doing a lot of work for Trigon – that sort of came with me. Yes, we had some start and my brother in Auckland sent us some business for a while to pay for the first few months and keep things ticking over. We even made money in the first year, but I mean not 'real money', but the books showed a profit …Two of the staff left pretty soon … pretty bloody

[106] Trigon Plastics is a highly successful Hamilton production company which grew very quickly during the 1970's and 1980's under the ownership and management of Bill Foreman. Foreman grew the business, creating an international reputation and branches in a number of other countries. From Evans' interview it can be seen that Foreman was an inspiration to him as both a teacher and manager.

> hopeless anyway and we were left with one good guy – Tony [who] stayed with us until he retired. He actually retired three times. He left when he was about seventy. He was a Yugoslav, old school, dead capable, committed, hardworking; very good at his job.

The two brothers continued building the business until they decided to part ways and each follow their preferred areas of engineering; Don, in high volume/low margin work which was his background, and Roger, in the fabrication and sheet metal field. Averaging sales growth of seventeen to eighteen percent per year since then, the company now employs approximately thirty-five staff.

I remarked that this was a huge achievement.

> … I think the greatest satisfaction I have now after twenty three years of graft is that we've got a great business, a really great business and I think with what has happened right now with the last eighteen months, two years, and now the realisation that the business model that we did have is sustainable in the long term. We might have missed the boat in terms of all those boom years, of the last ten years probably, but, we have got a model that is recession-proof … that would be the one achievement that I have put in, my ethos and my upbringing put in place, is that this business is recession-proof. I mean a hell of a lot of people would fall over before we fell over.

With the company being located at the centre of the rich Waikato dairy farming region, much of the work that goes through the shop floor derives from this and its associated industries, mainly in the field of food processing and packaging equipment. In addition, the company has built a reputation in this field which has resulted in work not only for local clients, but also for a growing number overseas. The work is often of a "one-off" nature and ranges from small components through to fully operating assemblies and machines. Some of the designs for this work are provided by the design team within the company, while others are customer provided.[107] Roger provides a description of the work of the company as it stands today:

> We have become a custom manufacturer of low volume, highly complex customised components and equipment destined for food processing, packaging and healthcare and aviation industry sectors globally. In some respects we are unique in the local market specialising in design and project management, precision engineering, fabrication, including laser cutting and assembly and commissioning for global clients (cited in Blake 2011).

The company has been recognised by the local business community, winning the 2005 *Westpac/Waikato Chamber of Commerce Manufacturing Excellence Award* and since becoming the sponsor of this award. In 2003 Roger, along with Ryan Manufacturing CEO Danny Ryan and others, also started WECA, a group involving fifty Waikato engineering organisations "who signed up their support to collectively address the skills shortage that they were experiencing".[108]

I had selected Stafford Engineering as a possible research site after reading an article about the company in a 2006 *Waikato Times* supplement subtitled *"Where have all the Workers Gone?*" (Pepperell 2006). I was particularly interested in Roger's comments about apprenticeship and his belief that industry itself had some responsibility (and much to gain) by being involved in training issues and in ensuring that there was a continued supply of skilled workers for the industry.

Roger had great admiration for his own early role model, Bill Foreman, who employed him to train as a cadet in his plastics company. By the time Roger left there to take over Stafford Engineering, he had been managing

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[107] A short film of some of the work done at Stafford can be viewed on the Stafford website (Stafford Engineering 2012).

[108] Waikato Engineering Careers Association (2011)

about thirty cadets across the company, which by then employed between two and three hundred people.

Roger's former employer was once asked about the success of his business and what had set it apart. The reply was: "It was all those young people we trained up that understood our culture and could take it to the world". Roger continued:

> You become a part of that. You talk to any of us that completed a Trigon apprenticeship or cadetship – we were all part of a family really – for most of us, I would say ninety five percent of us - it was a hugely rewarding experience.

His commitment to his own learning has continued. To increase his managerial skills, Roger attended an intensive training course within the Icehouse Programme.[109] His commitment to training others has also continued as, since handing over some of the day-to-day running of the business, he has freed more time to focus on ways of working with other groups to foster a wider interest in engineering as a career. He is an annual participant in the *Principal for a Day* programme, where business and other civic leaders spend a day at a local school; and is a trustee of *Smart Waikato*.[110] He is keen to increase linkages between business and education and the company frequently hosts school groups who visit the different areas of the business.

[109] The Icehouse is a collaborative partnership begun in 2001 between Auckland University Business School and a number of large businesses. It was set up to provide support for the start up and improvement of SME's (small and medium enterprises) in New Zealand. Roger commented that he found the Owner Manager Programme he attended there invaluable to his business practice and believed that more businesses should take advantage of the opportunity to participate in this type of programme.

[110] Smart Waikato is an independent charitable trust which acts as an 'employment and education resource' for the Waikato. Its goal is to 'forge meaningful connections between Waikato schools and Waikato workplaces' (Smart Waikato 2011).

A Day on the Shop Floor

There is probably no typical day at the company, as a wide variety of components and assemblies are manufactured in the workshop. Sometimes flows of familiar work go through the workshop, sometimes not. Much of the work is in the nature of single or small numbers of components or machines and these are worked on predominantly by one person at a time. Thus, most of this work is of an individual nature with the tradesmen and apprentices each working at their machine or workstation. There may also be works in progress such as large one-off projects that involve a number of tradesmen working together in their assembly. The components of these assemblies and machines may have passed through a number of hands as they have required successive operations.

Any one day may also see a variety of visitors or associated support staff at the company. Technical support staff may come in to carry out diagnostic and maintenance work on existing plant or to assist with the settling in period of new machines. Occasionally, technicians from related industries may be working on the shop floor adding such things as electronic mechanisms to a particular processing machine. High-school age students who are considering a career in engineering also come in for a day each week over a period of weeks to experience time on the shop floor. The parents of prospective apprentices are also invited to look around the workplace. Others related to the training field visit from time to time. Prospective clients are often shown around the business and in the inward goods and despatch areas there are constant comings and goings.

The working day begins very early with the first tradesmen arriving around 6 a.m. The working day is calculated from the time they clock on until they finish work. The building is open between 6am and 6pm and employees are generally expected to be at work between the hours of 7.30am and

4.00pm, although some of the early starters will have left by 3.30. I asked Kaleb, the workshop manager, about the early start time and whether this was the norm for engineering companies:

> It depends on a few things. We would be one of the earlier ones around … When you're busy you need to get in and get that early start. Generally speaking, that's when you get the most done, in that first period in the morning.

I mentioned that I had come in earlier than usual one morning and that the whole feel in the workshop was different. There seemed to be a more intense sense of urgency and focus. There appeared to be little of the usual informal interaction between the men (FND 9.6.09).

> The thing with getting in early, 6 o'clock or whatever; we don't break for smoko till nine-thirty; that three and a half hour window, that's the longest stint of the day so you've got your biggest concerted effort there and you're also fresh. You come in and generally, I'd say probably ninety percent of the guys, will have had a bit of a think about their day ahead before they get here; overnight they've had a think about what's going on, what's in front of them and they'll come in, in the morning and, yep, let's crack into that (Kaleb).

The workshop is divided into a series of bays, largely according to the work that is carried out in each (Fig. i, and Plate 25).

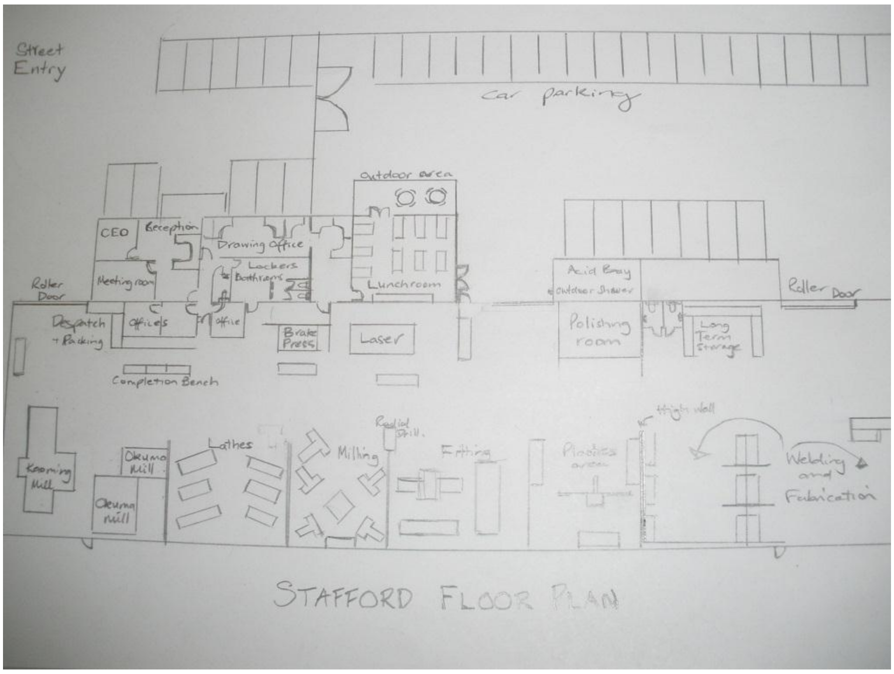

Figure i: A floor plan of Stafford Engineering.

Plate 25: The Stafford shop floor.

The largest milling machine, the Kaoming, sits at one end of the workshop (Plate 26).

Plate 26: The large Kaoming mill. Phil, the tradesman who operates this, can be seen at the computer control panel at the right hand side.

Operated mostly by Phil, who has been with the company for eighteen years, this machine was relatively new when I first went there. The machine is the size of a shipping container and with its large “bed” and powerful five face milling head allows for very large items to be milled. It is CNC (computer numerically controlled) with the programming being done by the tradesman or otherwise, supplied by the customer. Two other NC mills, two Okumas – a 5VA and a 4VA, are located next to the Kaoming. Again, these are operated by experienced tradesmen (Plate 27).

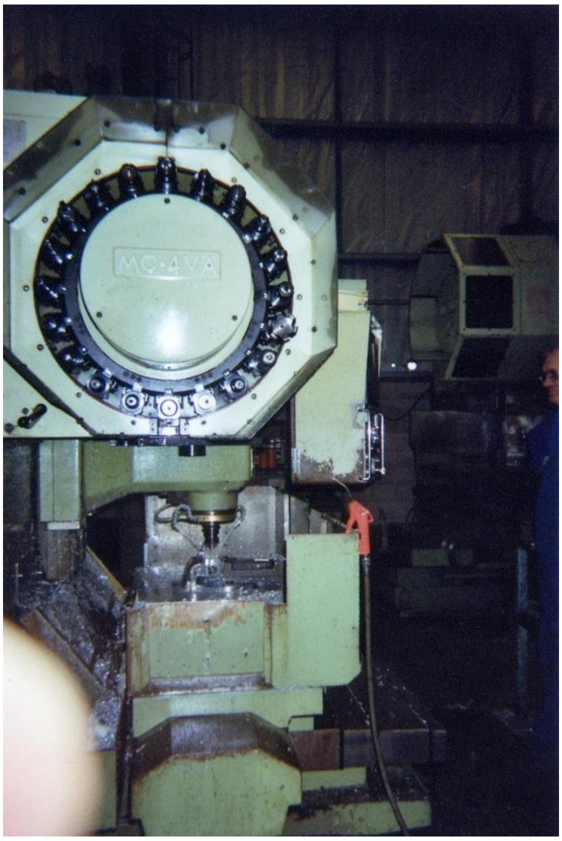

Plate 27: The OKUMA 4VA mill. The “wheel” contains
all the different milling tools that can be automatically selected.

I have not seen the apprentices working on these machines, but in the rest of the workshop apprentices and experienced tradesmen work close to each other. This allows for free and open exchange between the two to take place. The tradesmen are fairly readily available should the apprentices have a query. The arrangement also allows for observation in both directions – for the apprentices, an opportunity to learn, and for the tradesmen, an opportunity to oversee and guide as necessary when help may be required.

The next bay contains a number of lathes of varying ages and sizes. As will be noted by most of the workshop staff, each of the machines throughout the workshop has its own little quirks and discrepancies and the tradesmen and apprentices who operate them must come to grips with their different “personalities”. Malcolm is a constant in this area as he is the main operator of the large Alpha lathe (Plate 28).

Plate 28: The Alpha lathe with a mixing dasher held between the chuck and the tailgate.

Like a number of the men, Malcolm is originally from England and, as Roger noted at one point, he had taken the operation of this lathe “to another level”, highlighting the value in having dedicated, knowledgeable and skilled tradesmen. At the end of 2009 a new Alpha lathe was added to this area and has become Malcolm’s new workstation (Plate 29).

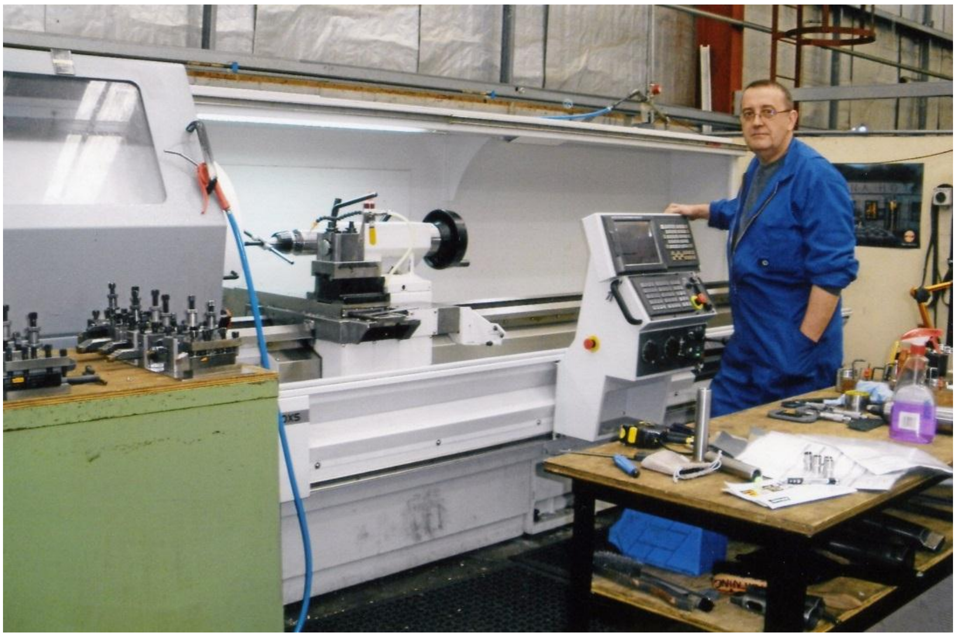

Plate 29: Malcolm at the new Alpha lathe.

The next bay contains a number of milling machines, each operated by a tradesman or apprentice (Plate 30).

Plate 30: Greg, at one of the smaller mills. The stainless steel component is firmly clamped so that it does not fly out while being milled.

Together, these groups constitute the *machining* part of the factory; an experienced tradesman ("leading hand") manages and oversees the work in this area.

A second leading hand does the same for the *fabrication* area which comprises the bays for cutting, folding, welding, fabricating and fitting. Working from the other end of the factory are the fabricators and welders, each working in a screened-off area because of the need to use eye protection against the welding arcs. A high partial wall also separates this area, as eye damage can result even from reflected welding light (Plate 31).

Plate 31: TIG Welding. [111]

[111] One of the fabricators explained that in MIG (metal inert gas) welding the welding rod feeds through the head of the welding tool which can be held in one hand. In TIG (tungsten inert gas) welding the rod and flame are held separately, requiring two hands. They are used for different purposes and some tradesmen have a preference for one or the other.

On the opposite wall further along are two large machines; one a brake press (or press brake), the other, a laser-cutting machine. Like the turners and millers, the men at these machines produce a wide variety of components. Both machines are computer controlled. On the laser machine, once programmed, the laser beam automatically cuts as many components as are required from sheets of the specified thickness of stainless steel. The cut components drop through to a collection tray underneath and from here the operator can scoop the still hot pieces clear of the machine (Plates 32, 33).

Plate 32: The laser cutter.

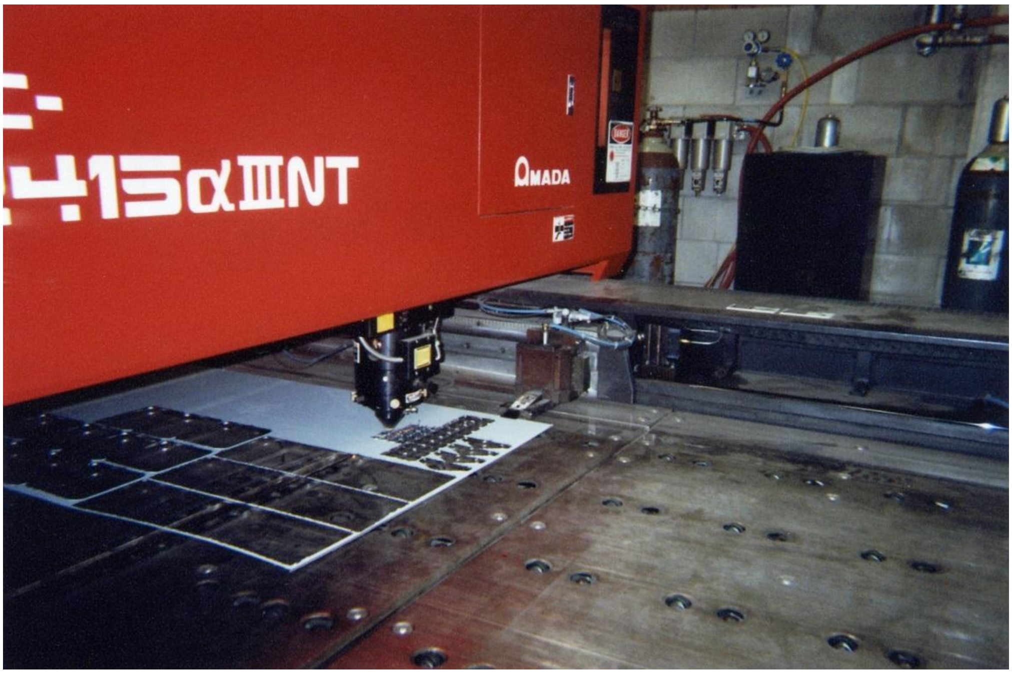

Plate 33: Close up, showing a sheet of stainless steel being cut for components.

I observed a number of different tradesmen using this machine at different times throughout my fieldwork, and came to realise that different operators achieved different results from it. The job entailed more than just the ability to calculate and key in the necessary numbers on the computer, press the button to activate the cutting head, and then flick the parts from the collecting tray as they were cut. Rather, like a number of machines in the workshop, it involved a hard earned understanding of how the machine worked to get the best out of it.

The brake press machine is used to fold metal and, again, requires a skilled and knowledgeable operator to calculate the necessary pressure and fold rate for the varying thicknesses of metal used and angles required. In addition, some pieces must be folded in sequence to prevent an earlier fold making later ones impossible (Plate 34).

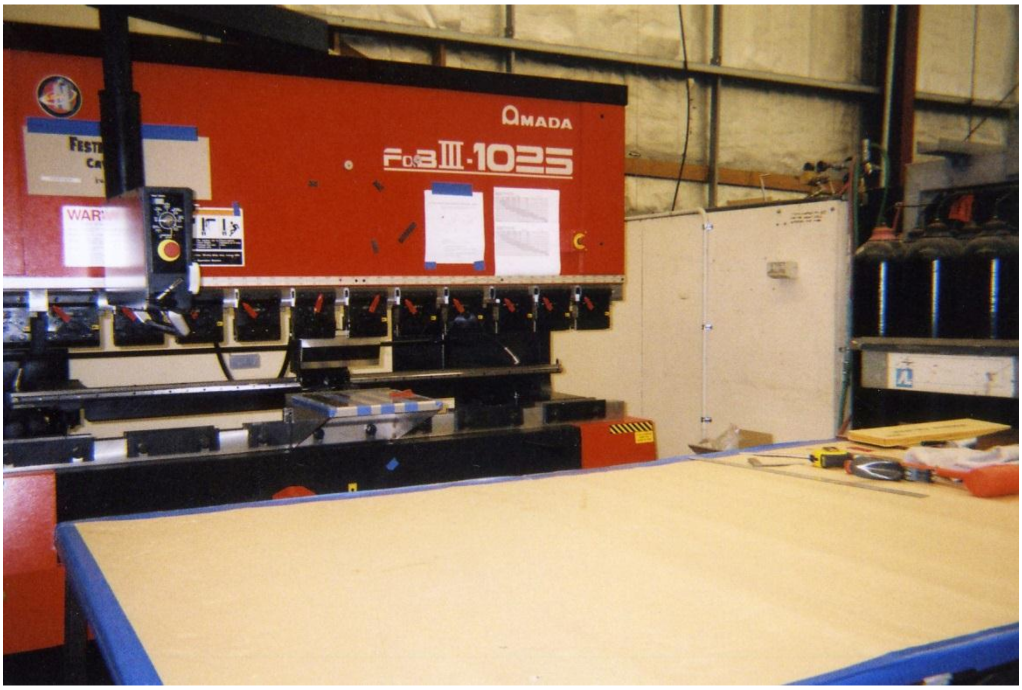

Plate 34: The brake press machine, used for folding sheet metal.

Work put through a lathe, mill, laser machine or press requires careful and thorough set-up in keeping with the machine's operation. On the lathes and mills, items must be firmly clamped to ensure correct processing and safety procedures. This setting up process is essential and often occupies a large percentage of the time used to make a component.

The most commonly worked material in the factory is stainless steel. A variety of plastics are also used for many components and it will be seen that many of the men have definite preferences for the type of material that they like to machine. Also, as will be seen from discussions and the interviews with the men, while a number are happy to work across the shop floor in milling, turning, fitting or fabrication and polishing and like variety in their work, *most* show a strong preference for one area in particular.

New machinery is also frequently added to the shop floor and I witnessed the introduction of a number of these new items. Most notable for its long period of “settling in” was a new Victor Four Axis multifunctional machine which was introduced during 2009. With the ability to carry out a variety of different processes in one sequence, and handle large production runs with less human input, many queried its suitability for the company and the type of work carried out there.

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The fitting of the manufactured components is carried out in a bay that sits fairly centrally to all the other areas. Here, assembly of the various components, mechanisms and machines which are made at the company takes place. Some of this work may also involve the fitting of electronic, computerised or robotic components and control panels (Plate 35).

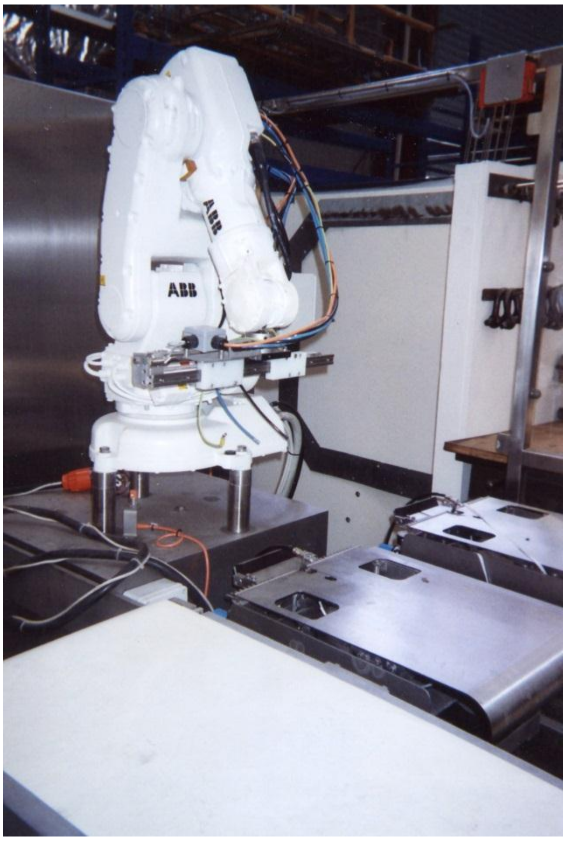

Plate 35: A robot attached to a packing machine.

Apprentices who are specialising in this area of engineering also spend time here. Michael, who finished his apprenticeship around the time I started the research, has gravitated to this area. Ryan, who completed a cadetship which involves both shop-floor and design experience, giving him a broader range of skills, also works mainly in this area and has most recently, constructed the large tea filling machine below (Plate 36).

Plate 36: The tea filler - for filling packets of leaf tea. As can also be seen, this machine includes components of both plastic and stainless steel.

The fine finish of the work produced in the workshop is a result of the work done by the polishers. They operate from a separate room on the office side of the shop floor with access to a second outdoor area which is used for acid etching and washing down. The specially designed indoor room that they work in is screened by a large, heavy plastic flap curtain to contain the metal dust that results from the polishing. Within the room are two air extraction systems, with one forming the base of a perforated work-bench so that the air and particles are drawn down and away from the tradesman as he works (Plate 37).

Plate 37: The extractor bench in the polishing room and various polishing wheels and pieces of equipment.

Polishing in this context is not simply a case of rubbing a cloth over a component as Jeff, one of the polishers, remarked. Rather, it involves a good knowledge of materials and a great deal of patience. Because some pieces may require different processes at different stages, such components often require polishing after each stage. Some return to the workshop with earlier polishing partly spoiled because it has required clamping or some other process and is thus unavoidable. Careless handling can also cause damage to a polished surface. However, this final stage in the manufacturing process can be critical for a variety of reasons as well as aesthetics. Any form of pitting or scratching could allow ingredients in a processing situation to accumulate and degrade and therefore contaminate the product being processed. In the case of medical equipment, it could become a source of infection (Plate 38 and 39).

Plate 38: Jeff polishing the mixing mechanism for a pharmaceutical blending machine. In this instance, the part was being polished in the main workshop because of it was too large to fit in the polishing room.

Plate 39: A variety of smaller polished components.

For much of his time at Stafford, Jeff has worked alone as his colleague has been there for only the last few years. Jeff feels it is important for the apprentices to have at least some training in polishing, as there are times when a lack of awareness of this area causes difficulties as noted above. Hamish, just out of his apprenticeship, had spent three months of his time working with Jeff.

> …now when he fabricates he'll know, if a weld is going to be removed [through the polishing process], he'll know if it's a good enough weld. If it's not, he'll run over it again. Whereas other guys who have never polished before will send something in and as soon as I see it is under-cut and you'll have to take the top off the weld, so you've got to take it back to them to fill it up. It has actually made Hamish a really good fabricator. He can weld something once and you hardly have to take anything back to him. It makes a hell of a difference. Grant's the other one because he's been doing it that long and he can polish as well.

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Along the length of the factory an overhead gantry crane allows for goods to be transported easily from end to end and side to side. It is operated by a switch which dangles from the machine. Facing the shop floor are several glass windowed offices: one containing a computer which is used for writing programmes for a number of the machines, and the others workstations for those who work closely with the tradesmen. Their occupants are Kaleb, the workshop manager; the leading hands (for most of my time there Julian and Grant); and staff such as Luke (human resources, health and safety) and Sean (procurement).

Facing the car park and entrance to the building are the reception area, the CEO's office, a conference room, and the design and drawing offices. Here the designers work at computers, creating the drawings for work done in-house and the fine-tuning and re-drawing of client-provided work which requires alteration. While the designers work in close contact with management and to some extent with the senior tradesmen, there is sometimes tension between those who create the working drawings and those who then have to manufacture the drawn components or assemblies. This appears to result from the fact that the designers do not generally have shop-floor experience and from time to time design items that are difficult or impossible to manufacture, as designed, and for which the tradesmen have very definite ideas for improvement. As the apprentice coordinator noted, "Oh yes, that is an old issue; an old chestnut". It is however, an aspect where the company is constantly seeking to make improvements.

Completing the facilities are the locker rooms and bathrooms and a large well-appointed lunch room. The responsibility for managing the lunch room falls on the store-man who, among his many other duties, sets up the room for morning and afternoon smoko and lunch, keeps the room tidy, and fills and empties the dishwasher after these breaks (Plate 40).

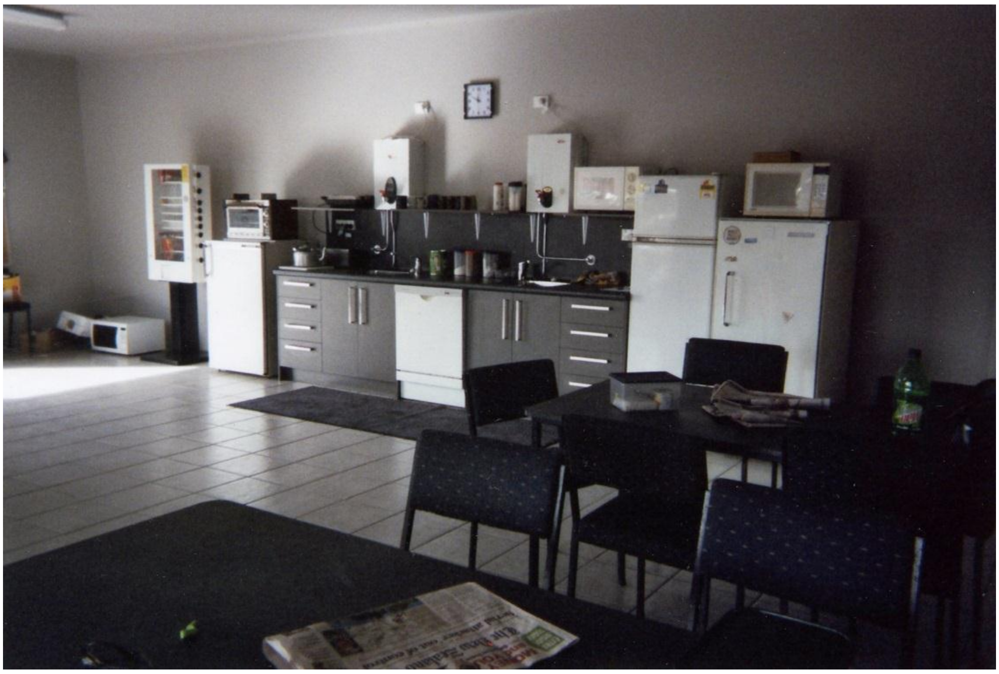

Plate 40: Part of the lunch room.

Outside, under cover of a veranda, are some large wooden tables and seats, providing a place for the men who are smokers or who wish to sit outdoors. This is also a favourite place for after-work beers, and some of the men are often seen here at the end of the day, as they finish their work, having a few beers and a chat before heading away home (Plate 41).

Plate 41: Part of the outdoor seating area.

As noted above, the first tea break is at 9.30am when a bell rings on the shop floor and ends when it rings again fifteen minutes later. Lunch break is from 12.00 mid-day until 12.30pm, and the afternoon break from 2.30pm until 2.45pm. In the lunchroom most of the men choose to sit at the same particular tables for each break. Some sit and read newspapers or one of the many magazines, which are usually about engineering or automobiles. There is a certain amount of conversation but the time is generally fairly quiet. A number of men will take time to make toast or heat food which they have brought in. Some commercially prepared lunches and snacks are also ordered by the men from a nearby bakery and delivered daily.

Between the break times the men will have settled into their various jobs and carried on with their work. Jobs are allocated according to the various skills and knowledge bases of the tradesmen and apprentices. There will have been discussions between the workshop manager, the leading hands and the HR manager as to which staff member will be most suitable for each job. Once allocated, the job and design sheets are placed in the individually named work-slots near the locker-room (Plate 42).

Plate 42: The tradesmen’s and apprentices’ job slots.

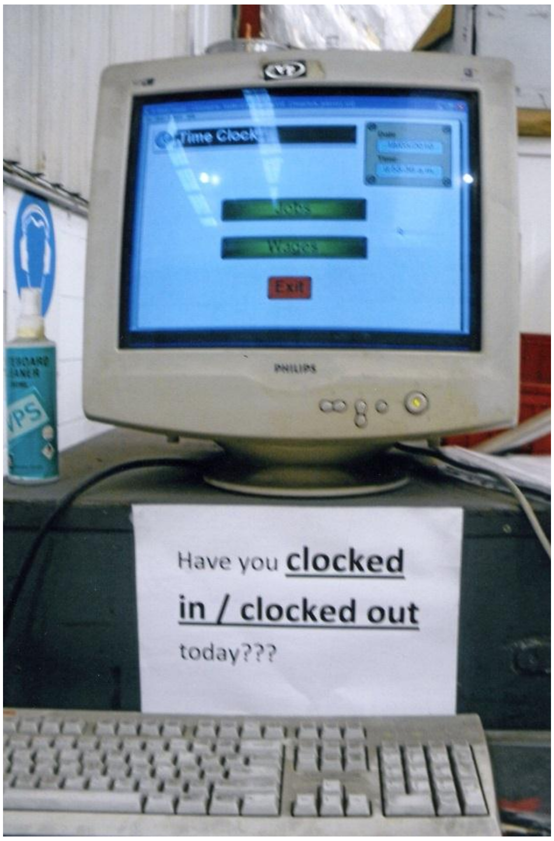

Plate 43: The “time” clock.

Here also is the computer where the men clock the times for the jobs as they complete them (Plate 43). This provides information for those who prepare quotes and invoices, and a record of how long the different jobs are taking. On larger projects, many individually made components must be available in a particular order as the work moves through the different areas of the workshop for the required processes to be carried out. At this computer the men also clock into and out of work. By the end of the week they will have worked upwards of a forty hour week, with many clocking up fifty hours or longer, either by choice or with overtime during busy times.

While times are allocated for jobs, these are mostly, a fairly arbitrary indication based on a history of similar pieces, as a number of factors may affect the progress of the work. As Roger noted, allocating a given time for any job is not straight-forward. When he discussed the pricing of jobs, it can be seen that the manufacturing time is not the only factor to consider when it comes to making a profit (or not) from the work done. He had been discussing a job that had had to be re-done and the issues involved in pricing:

> …it's not all because the workshop haven't done a good job; there's a whole raft of things. Prices undercooked because we didn't start with the right price to start with at the beginning, because at the beginning it's just a guess! And even when you look at those after-job costs you say to yourself, 'Well, why in the hell did they spend six hours fabricating?' Our guess is it should have been three hours but when we did our costing it could have been - you know, four hours. 'Well how long will that take – oh, four hours, or two hours' and yet the reality is, you know, three hours – like it's just a guess.

While the men may take many of the job-sheets away and carry on, confident in what they are doing, they may also sometimes consult with one or other of the leading hands or a colleague. They may seek clarification or a few suggestions of ways to approach a job, or for different tools, or if they feel there is something amiss with the drawing. Some jobs are repeat work and will have been through the workshop previously, so that whoever has done them at that time can often supply helpful information and will sometimes know if special tools have been made to do that or a similar job.

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The drawings for components and assemblies, as they are picked up on the shop floor; do not come with instructions of how to set about making them. That working out, whether relatively simple and straight forward, or complex and challenging, is done on the shop floor, mostly by the tradesmen and apprentices.

For large jobs such as when a whole machine is to be created, a great deal of planning has to take place at management level, especially if it is a one-off or something that has not been done before. This planning stage may also involve some of the senior tradesmen, as the progression of the work through the workshop can be critical in terms of having the right materials and components available at the right time. As well, any one component may have to be made in a series of operations.

Some parts have to be made in a particular sequence as anything to be milled or turned must be held in mill or lathe respectively. If material is removed before an operation requiring its presence is carried out, the part may not be able to be finished, or, it may require material to be welded on temporarily to create a “handle”. This results in frustration and unnecessary time delays. Some components are also more efficiently made “back-to-back” then “parted off” (made from either end of one piece of material then separated by cutting through the middle). These are only a few of the considerations that will form a part of the tradesmen’s discussion.

An important feature of all the work is that this is a *precision* facility, and as such the work demands constant measuring of the dimensions of the parts being worked on. Tolerances (the degree to which the piece must be accurately machined or fabricated) vary, but the figure is usually a part of the information supplied. The men personally purchase and own much of the required measuring equipment and many other hand tools. Their collections are gradually built up during their apprenticeships and careers, kept in their individual tool boxes at their work stations, and carefully cared for (Plate 44). Stafford provides a monthly tools allowance which staff may put towards this purpose.

Plate 44: Phil’s toolboxes and workbench – the old and the new.

As individual or job lots of components are completed, they receive a final check by the maker and are then placed, along with the job sheet, on the completion shelves or table to be checked for quality control. This is generally done by Luke. Some, when completed, will be shipped to the customer, while others will be sent to the next section of the workshop where further operations may be required until the mechanism or assembly is complete.

Assembling obviously cannot be carried out until the necessary components have been manufactured so the planning of the sequence of manufacture for the whole process is critical. In addition, in creating a plan for the work and a time frame for the completion and delivery to the customer, time must also be allocated for checking and testing, and time and space for delivery of the goods booked. This last item may entail negotiations with local courier companies or, in the case of overseas clients, the booking of cargo space and the necessary documentation for export goods. Transit times for such cargo are unpredictable:

> Nothing is guaranteed in the freight business, nothing. It's all over the place. Sometimes it takes what took twenty four hours in real time – just over a week…. sometimes it might just get bumped from a flight. Pre-book it and it's going to New York, and it gets to Los Angeles and the plane isn't big enough or the box is too big or something, and it sits there for a couple of days waiting for the next plane to take it (Roger).

Components and plant to be freighted are carefully prepared for the journey. This sometimes necessitates the construction of a custom-made wooden packing crate, or at least plenty of corrugated cardboard and/or bubble wrap to protect the parts. This work is mostly done by the store-man, although Luke, the HR manager, is also often seen in this area checking off and preparing goods and documentation. Once neatly wrapped, the individual parcels are sealed with a Stafford label, a part of the drive to create a brand for the company (Plate 45).

Plate 45: Luke and the store-man checking goods for freighting.

Some of the tradesmen who start very early, finish work from about 3.30pm onwards. By 4.30pm most have gone. Occasionally, someone will stay to finish a particular job. Outside the lunchroom, a number may stay on to have a few beers. A social club operates where each worker puts in 2 per week and this goes towards the purchase of the beer and towards some of the company's social outings. Beers "shouted" for various reasons go into this pool. Fridges in the lunchroom accommodate the supply which is accounted for by a system where each person marks a sheet as they take a bottle. A number of the men remarked on how well this system worked; and *trust* was a quality often mentioned when I asked the tradesmen what they valued in their workmates.

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Chapter Five

The Stafford Men

In this chapter I will describe the family backgrounds and work and learning histories of the men who work at Stafford. In the context of this research, this information is critical for my later critique of the idea that the path to increasing prosperity is simply a matter of investing in more and better education and training. While there has been a greater emphasis on the value of workplace training over the last ten or so years, and an exponential growth in the training industry (and in the accompanying literature), little attention appears to be paid to the life histories of those who enter the institutions and schemes where such training is provided, or, of those already in many areas of the workforce. For this reason, and as I have done with the artist/maker group and will do with the apprentices' stories in chapter six, I have paid particular attention to the biographies and backgrounds of all the men interviewed.

While Stafford Engineering recruits experienced staff, the owner, as noted earlier, has a strong commitment to training the precision engineers (and his workforce) of the future. This ethos can be seen to be equally important to many on the shop floor. While not every tradesman is a willing teacher, the majority are, and, in fact, appear proud to be considered as mentors to others. From my observations of this process in action, I would describe the interactions as ranging from family/community/village relationships through to master/apprentice relationships. There are experienced, wise and highly respected elders, father figures, one or two grumpy "uncles" or neighbours, occasionally loud and over-confident youth, and, as well, those who need more encouragement and nurturing than others.[112] The shop floor or "field" comprises a wide range of personalities and experience, skills and knowledge.

*****

Luke – Human Resource Manager (also Quality Assessment, Logistics, Health and Safety)

Luke Li was employed by Roger after making an impression on the CEO when he carried out a study at the company as a requirement for a university course. Luke came to New Zealand from China to study management communication and resource management, but arrived at Stafford with no knowledge of engineering and a newly acquired skill in the English language that was still a work in progress. This skill was put to the test in an environment that was very different from his first experience of New Zealand culture as a student at Waikato University. In this first job as a graduate he had to learn not only the language of engineering but also the language and culture of the shop floor. His story of learning English in his first few years in New Zealand reflects his personal beliefs about work, learning, and life in general, in the way he draws on what his environment has to offer. It is one of discipline and focussed determination to succeed.

> …when I first came I couldn't speak English at all … Basically every time I was hungry or thirsty I had to draw a picture... In my home-stay family it was very hard for me. Even the first year, two years, I was hanging out with Chinese because I wasn't able to communicate … So I started just learning new things from basic vocabularies and grammar and all that and everywhere I go if I see a word I don't understand I just put it down in my notebook and go home and get a dictionary and find out what it means. I started reading a lot of newspapers and children's books because I was baby-sitting as well sometimes. That was a good experience.

[112] A number of the descriptions are the men's rather than my own. In all my time at the company I only ever experienced courtesy and friendliness in my interactions with the men.

Babysitting was only one of many full and part time jobs which Luke worked at during his time at university. Apart from the many general jobs such as pizza delivery, bar work at a casino, and harvesting and quality control at a mushroom farm; these also included working as a course tutor and research assistant within the Management School. He attributes much of his language acquisition to this wide practical experience and described how he had built up his own dictionary of eleven thick notebooks and "thousands and thousands of words".

Luke had been in New Zealand for six years and with the company for eighteen months when I first met him at Stafford. His learning there was also very much "on the job".

> I don't have a stable routine like everyone else. They always put me in different places and I didn't get any training for anything so it's really a self-learning thing, ever since I started.

Since those early days, fellow countryman Sean has joined the company and Luke has trained him to take over much of the purchasing and procurement part of his work, which involves ensuring that the necessary raw materials and outsourced components are available, as required, for the tradesmen. Sean did have some experience of engineering, having done an engineering related degree in China.

Luke's role in the company appears quite open-ended. He may be involved in interviewing job applicants, showing visitors around the factory, checking finished work, helping apprentices with their paperwork, ensuring goods are properly packaged and documented for transportation, attending company meetings and to health and safety issues, to name just some of the activities I observed him working in. Luke has some links back to the University and as well to some of the programmes that link high schools to workplaces. In the time he has been at Stafford he has also bought a house and, with his partner, has a new baby son. With his broad knowledge of the company, and his experience of having to earn his place in a completely new field, he has been a valuable informant in my research.

*****

Kaleb – Shop Floor Manager

Kaleb could be described as a graduate of Stafford in the sense that he worked his apprenticeship at the company after starting in 1994. Kaleb had begun work straight from Fraser High School where he had been fortunate to take part in an engineering pilot programme managed by his technology teacher.

> Alan Wilson – he was a good old-fashioned English guy and he really got me involved and put my name forward to come down here when the opportunity arose.

In the interim, Kaleb had been placed for a short time at each of two other engineering shops; one a mild steel workshop which was “just too dirty”, and the other specialising in fabrication which he had not been keen on. “I wanted things to be just so, so it had to have that precision element to it so it was more about the machinery to do that”.

In addition to his apprenticeship, he also studied for his NZCE[113] which has enabled him to progress to his present position as shop floor manager.

> What that allowed me to do during my apprenticeship was take on a few different jobs that probably wouldn't have been available to me if I hadn't looked for that higher education. There were some design and build type projects that I got involved in very early on. Yeah, it probably helped me to progress quicker I suppose. It helped my learning progress pretty quick.

Kaleb has also had a couple of years out from the company to travel and work overseas. He described his current job:

> It is a lot of organisation really. The biggest part of it is lining up things so that other people's jobs go as smoothly as possible.
>
> *In terms of materials and things?*
>
> Yes, materials and making sure the customer gets what they want on time. That we've gone about it in the right manner so we make some money on it. That we've batched it together say with like jobs so there're not so many set-ups through the workshop, so that like materials are run together and like set-ups are run together on the different machines. I guess I more enjoy the project aspect of it, pulling together the bigger projects as opposed to just the single component manufactured stuff that we do a bit of ... also, the project-orientated stuff is a lot more challenging.[114]

[113] New Zealand Certificate of Engineering. This qualification is similar to the current Diploma in Engineering. Effectively, this qualification provides a broader knowledge base than a straight apprenticeship in that students are taught a wider range of theoretical knowledge, with additional focus on design and project management.

[114] Kaleb described a current "big project": "Its two big filling machines and a whole heap of conveyors and line equipment that's going into China at the end of the year. That's somewhere in the range of eight hundred thousand dollars worth of work so that is a bigger project".

At the time of Kaleb's interview, Julian, the leading hand for machining, had just left and Kaleb had taken on those extra duties until a replacement was found.

> Yeah, that has just put me back into the day to day running of the workshop. It has put me back in touch with the guys on the floor a bit more closely which is not a bad thing. I am quite enjoying it being back into it but it means that you're constantly getting pulled left and right just trying to get things resolved and carry on.

> …it's a very highly organised sort of role and I mean I like that, it's good. You get everything lined up and you can pretty much leave the guys to it. Bit of a chit-chat here and there and say this is what I've got ahead of you or, this is what we need now, do this one next, and just make sure things aren't falling stationary and things keep moving from one process to the next. And at the end of the day when due date comes around, hopefully you're finished.

Unlike many at Stafford, Kaleb does not come from an engineering type background. His father, a clinical psychologist, and mother, a special needs teacher aide, were both involved "in the mental health business". His sister also has a psychology degree. However, the family lived in the country and Kaleb had an early interest in machines, having spent a lot of time "stuffing around with motor bikes, go carts, all those sorts of things. We were always making those when we were growing up". In addition, his parents had converted an old woolshed into a home over a number of years. This project involved many building and engineering processes.

> Yes, it was a big push to convert this woolshed and it was right through everything from laying the septic tank to getting the water. We had an old pump. There was a beautiful clear mountain stream at the bottom of the property so there was a pump and we had to pump the water up from there. And in the fullness of time we ended up with a water tank and all that usual sort of stuff. There was a lot of mechanical stuff around me as I was growing up...

When I asked him if there were any other areas he wanted to branch into, he commented:

> I think you're always learning, really. You've just got to keep walking around with your eyes open – take on board as much as you can as you go through the day and your life – doing what you can - for who you can. That doesn't stop.

*****

Julian – Leading Hand and Production Manager - Machining[115]

Julian completed his fitter/turner apprenticeship around 1990 and, like Kaleb, also set off overseas. In between travel back and forth, Julian also returned to study to complete his NZCE. I asked if he had worked in engineering while travelling.

> I didn't at first but when I did my NZCE I worked at Stafford's and when I went back I worked in a design office in London for nine months or so. Then I went and did construction work on buildings, construction sites all around England and Ireland - but still relevant; all mainly around engineering type things - just not engineering as such. I did the same in America for a while as well.

Building, engineering, and making things had been a large part of Julian's childhood.

> My grandfather was an engineer. That's on my mother's side. On my father's side, I think they're all carpentry … Not so much my dad and my uncle but certainly my grandfather and great-grandfather. They did a lot of carpentry. Not necessarily for a living either. Just for a hobby and things

[115] As noted above, during the time of the research Julian left Stafford to run his own business in the tyre industry. At that time he had worked at Stafford for nine years with one earlier period of employment there as well. By the time I was completing the research he had returned to the company with a new role as a sales engineer.

like that. Certainly for my grandfather it was more of a hobby. But my dad is pretty handy with the tools.

So when you were growing up you used to make things and potter around in their sheds?

Well, my dad makes model aeroplanes even to this day. He's still doing that. I was chopping up bits of balsa wood since I was about three.

Cabinet making had, in fact, been Julian's first choice of career but he explained that when he wanted to do that in the late 1980's there seemed "not much call for it or there were no jobs". So he had instead applied for an engineering apprenticeship, which seems to have suited him well.

I think you take the good with the bad. I was always fairly good at doing long batches of things. I have never really got bored. I would just get in there and get it done and then you'd move on to the next thing and … I think if you were doing that constantly it would bore anyone to tears but I guess once you get the skill level and the confidence of your employer then you're going to tend to get more of the complex jobs.

The second time I was hired back [at Stafford] ... I just took small projects away, parts of a bigger thing and I would do the whole thing. I would weld it and mill it and turn it, finish it. Because sometimes we get some quite complex things that tend to be slow to go through the workshop, so it can be backwards and forwards to the mill or turning and it would take weeks so I would take a few drawings and in a week I was back with it done. So that was pretty good because you just be your own … do everything under your own steam.

I asked him what he enjoyed most about his present job.

Because I am doing a lot of organising and planning I do enjoy it when it all sort of comes to fruition. We're in the middle of these big blender jobs that we're doing at the moment. They're not due for another six weeks because they've had a lot of planning involved with them going in …I'm constantly moving bits around here, there and everywhere with the ultimate goal of it being finished at a certain time so I look forward to that coming to fruition. I would say that is the single most thing that I enjoy

> about the current job here. Seeing something happen and knowing that it was probably mostly your decisions that made this happen.

However, there were indications that he was thinking seriously about his options for the future.

> *So would you like to go on to more managing or… or go back to making things yourself?*

> I'd rather go back than forward. That's kind of why I don't do design. Got there and didn't really like it.

> *You actually like making stuff.*

> Yeah. And you can still use those [design] skills in making things. It's why I do what I do here. People will go, 'I don't know how to make that'. Well I do. I have never made it before but I can still figure out how to make it.

*****

Grant – Leading Hand – Fabrication (more recently – Production Manager - Fabrication)

Grant had been at the company since 2002 – six years - at the time of his interview. He commented that it was the longest he had spent in any of his jobs. Most recently, before Stafford, he had been at a company where the work consisted mainly of building silos for the dairy industry. When I asked him about what sorts of things he liked making he replied:

> I can tell you what I hate making – cabinets! I just can't stand making cabinets… and silos. I've had enough of those because silos are just around and around and around. The only good part of making silos is where you do the fitting up … the last final pieces where you've got to make cones … the trickier stuff is the good work … where you've got to actually think about what you're doing and think about what you're going to do now, how it's gonna affect the next part; is it gonna make it easier or should you just change what you're doing here to make the next bit as easy as you can.

The elements of challenge and complexity in the work seem to be a common source of job satisfaction and what the men regard as meaningful or "good" work. For Grant, this seems to have been an important reason why he has stayed longer in this job than any other. In addition, he has responsibility for managing the fabrication part of the factory and more recently has become even more involved in the management and decision making processes.

As a school leaver Grant spent two years working for the Railways[116] but found it was not what he enjoyed. He was offered an apprenticeship with an engineering company, where he first worked as a labourer and as a trade assistant so he "jumped at it, jumped at the chance". While Grant also has skills in machining, his specialist area of expertise is welding and fabrication. During the time I spent at Stafford I could see that he had to deal with tradesmen of varying degrees of skill in this work. Precision welding is a skilled art and if practised inadequately the result is wasted time and wasted materials, along with the increasing frustration of management and supervisors and other tradesmen who have to deal with the consequences.

[116] For many years New Zealand Rail, along with a number of other government departments, trained many tradesmen. The demise, due to deregulation and the breaking up of these institutional organisations, resulted in the large scale loss of a readymade, trained pool of skilled tradesmen for private industry (Murray 2001).

As the most experienced welder in his section Grant had been juggling his own workload with a supervisory role and as well had been managing the apprentices in his section. He had become increasing frustrated and commented that they really needed another good tradesman there who could be trusted to get on and do the job more independently. He described the difficulty he was having at the time:

> Given the drawing they should be able to work out all their cut lengths, they should be able to just go and make it basically … they should be able to just do the job. I've got a tradesman there that I'm sure he doesn't know how to read drawings. He's just finished putting something all upside-down. We had to cut it all to bits and yeah… and it's not the first time. And you get that. I don't mind training the apprentices because they've got to learn and the other young fellas. When they're tradesmen and they've been in it for quite a few years I don't expect to have to wet-nurse them. It's becoming quite tiring. Especially when you see the mistakes they make.

I noted that a lot of thinking about the jobs had to be done on the shop floor.

> Yeah, some guys just don't seem to be able to work it out.

> *Do you think they have come from a background where their learning has been different or maybe not covered everything?*

> Or they haven't actually had to take charge of a job. They've just sort of been a part of the team and they've just taken orders like, 'You build this part.' and then it all comes together, maybe that's the case, but here they get the job, they have to think about it - maybe they haven't had that skill - some people are just happy to follow orders… They're sort of known as 'truck-and-trailers', one's the truck and [the other] is just sort of following along and doing as he's told sort of thing. There are certainly different levels of skill out there.

Grant, who originally did his apprenticeship under “the old system” (time-served) brings to his job many years of broad experience, and still the ability to continue increasing his skill-base, a theme common amongst the tradesmen who believe that they never stop learning and are all always searching for better ways of doing what they do.

> I actually think it was when I had finished my time and I worked for different firms. I went from firm to firm just learning different things from other tradesmen watching and seeing how other people did it. And then I’ve just sort of picked it up … more that way I guess. You’ll never lose what you were taught … doing your apprenticeship, but you definitely, you keep learning really. Guys come along and they’ve got different ideas and you’ll think, ‘oh yeah that will be a good idea’, and you’ll put it with another idea and you’ll sort of combine it and eventually come up with quite a good system.

Grant’s father was a painter/decorator and later owned a furniture polishing business. Grant had also spent four and a half years working in this trade with his father during a break from engineering. “That’s another trade I’ve got.” Along with his engineering skills, he has put this to good use in renovating his family home. I could see the quality in his workmanship when I visited there. Grant’s brother is a “turbo injection specialist” and with son Josh’s entry to an engineering apprenticeship, the family’s tradition in the trades is continued.

*****

Malcolm – Leading Hand - Machining

Malcolm, from the English Midlands, has worked at Stafford since 2003. While his speciality is lathe work, his original training during the late 1970s and early ‘80s was in all aspects of engineering. He had attended the Mercia Training School, a private organisation set up by ex-engineers there some years earlier. Malcolm commented that if you went for an engineering job interview, a Mercia Apprenticeship at that time "was like a tick in the box straight away".

In Britain he had worked in a number of industries including aerospace, locomotives, and for JCB, a company which made "massive earth moving equipment".[117]

> Yes, I can do milling, turning, most things, well, without bragging, if it's a machine, I've probably worked it. But I do like NC lathes like the one I'm on now, yes, it feels like home to me. It's what I do. But if we'd got no work and I went on the mill … it wouldn't bother me, but I do prefer the work that I'm actually doing at the moment.
>
> *Yes, people do seem to have a preference for that or for the fitting and assembly.*
>
> Well again that, you know my hobby through the years has been taking engines apart and making them go faster so I like doing a bit of fitting as well.

On another occasion Malcolm had told me that he "had always been mechanically nosy". He had been given a train set when he was three years old and within three days had taken it apart.

He recently returned to England for a holiday and to celebrate his fiftieth birthday. With experience that is both broad and deep, he is, informally, one of the main trainers of the apprentices in the machining part of the

[117] Malcolm noted that the abbreviation JCB, named after Joseph Charles Banford who started the company, had earned a place in the Oxford English Dictionary, "so now it's an official word – JCB".
JCB also has a training institution where students may learn business and engineering skills from the age of fourteen (JCB Academy 2011).

company. As explained earlier, Stafford does not have a dedicated trainer but instead uses an apprentice company to manage its apprentices. However, it will be seen that the major part of their learning results from the relationships they form on the shop floor, the work that they do there, and the willingness and quality of the mentoring which more experienced tradesmen are prepared to provide.

For most of the research period Malcolm was the only constant in the turning area. Other tradesmen would spend varying amounts of time there, as would the apprentices as they rotated around the shop floor. As noted above, Malcolm took over operating a new Alpha lathe and has subsequently also been promoted to leading hand, machining.

*****

Phil – Milling

Phil is the longest serving member of the Stafford staff, being the first new tradesman Roger employed after taking over the company. Phil has worked only at this company since that time and is regarded by the CEO as “a very clever guy”. Phil had done his apprenticeship at a company in Auckland.

> The majority of the work that we did there was reconditioning parts for big earth moving equipment – front end loaders and bulldozers and graders – all the workings of those things. They wear out and we’d get to recondition them because it costs so much money to get these parts in from the States … Big as things,[118] big rollers and housings and things maybe up to about a metre in diameter and some of the stuff, big frames, pins, bushes. Grinding, not surface grinding as such, cylindrical grinding, with pins and bushes and turning work. Not a lot of milling work but there was

[118] “Big as”, like “sweet as”, is a slang term frequently heard in New Zealand.

> some major milling jobs that I ultimately ended up doing – for some reason I was the only one around who seemed to like doing milling work. But the majority was lathe-work, I would say.

> *People tend to have preference for one or the other don't they?*

> Yeah, well I spent probably about ten years doing a majority of lathe work and the next twenty years or so was milling – or some derivatry [sic] of milling anyway…

One of Phil's brothers is an accountant, the other a computer programmer. When I asked if engineering was something he had always wanted to do, Phil said he knew he would always be going to do "something with his hands". After losing a year of woodwork theory at school due to a teacher shortage, he decided to follow engineering for School Certificate. "I scored one of the top marks in the country for engineering or metalwork and ended up getting an apprenticeship in fitting and turning after that".

Phil's job in the workshop is a somewhat isolated one in comparison with others in the machining section. While the other mills and lathes are grouped in bays where the men can see and easily communicate with each other, Phil's main responsibility is the large Kaoming mill which stands at one end of the machining section, with the control console and access for set-up on the end-wall side, thus cutting him off visually from the rest of the workshop.

Phil's early experience of working with large components is very useful as this mill is used for large projects which cannot be manufactured on the smaller mills. The Kaoming has a wide and long bed and a powerful computer-controlled milling head. While he is often able to set up the machine and leave it for periods of time, it still requires frequent attention for most projects. Phil commented that he didn't like standing still for too long and that he actually enjoyed the programming side of the job.

> I don't like designing as such… the advanced bits in programming more so - for the computer controlled machinery. I'd rather be doing that than actually out on the machine all the time. I'd rather do programming ultimately… more so than on the machine – because I'm getting old – aches and pains.

> …you're standing on the spot, you try standing on one spot for a long length of time ... you'll find where all the pain comes from … I'm on steel grates and rubber mats on top of that as well but I still get sore feet. It's really about varying it a bit really … a bit of this and a bit of that. If I am moving, mobile, I'm happy. If I can set the machine going and go off somewhere else and do programming or another part of the same job while it's running, and move around doing some other things at the same time, I'm pretty happy doing that. Not just on one spot.

While Phil does most of the programming of the machine, some jobs arrive at the company with the necessary programme. This was the situation with the large stainless steel culvert moulds which he made for a plastics extrusion factory. I watched the progress of their manufacture over a period of weeks. Made from two large slabs of stainless steel (approximately 2000x1500x150 mm) they would form the two sides of a mould for culvert ends. The computer programme, which in this case comprised fifty hours of code, directs the milling head to follow a continual path across the surface of the metal. With each pass another few millimetres of material are cut away until the desired profile is attained. The photographs below show the gradual milling process (Plates 46, 47, 48).

Plate 46: The slab is fixed in place. Milling has just begun on this half of the mould. The large white box-like structure holds the movable milling head.

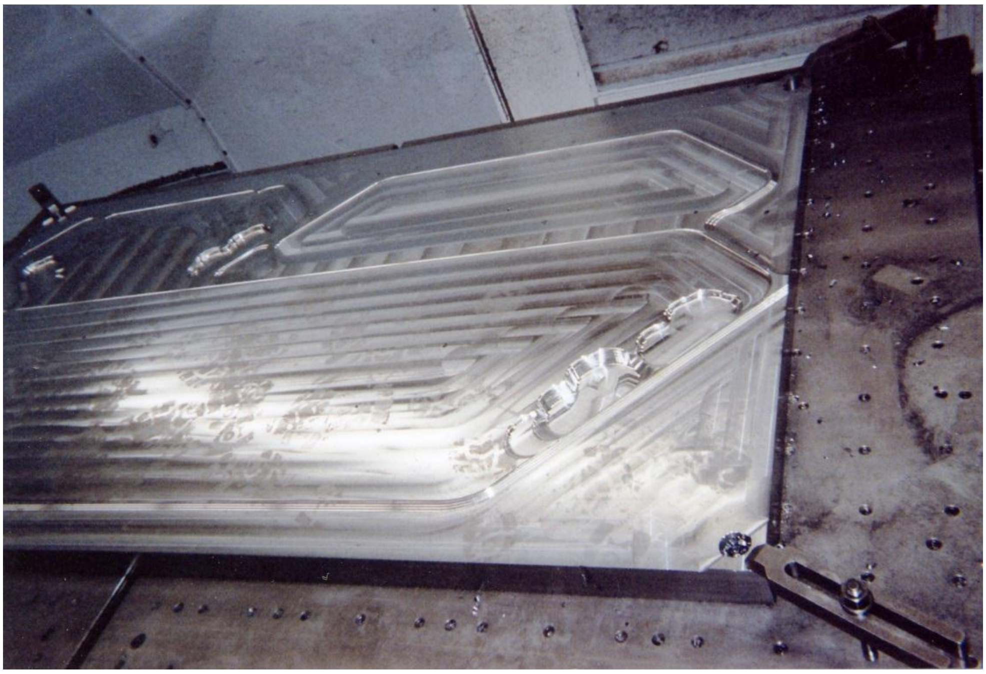

Plate 47: Part way through manufacture with the pattern emerging.

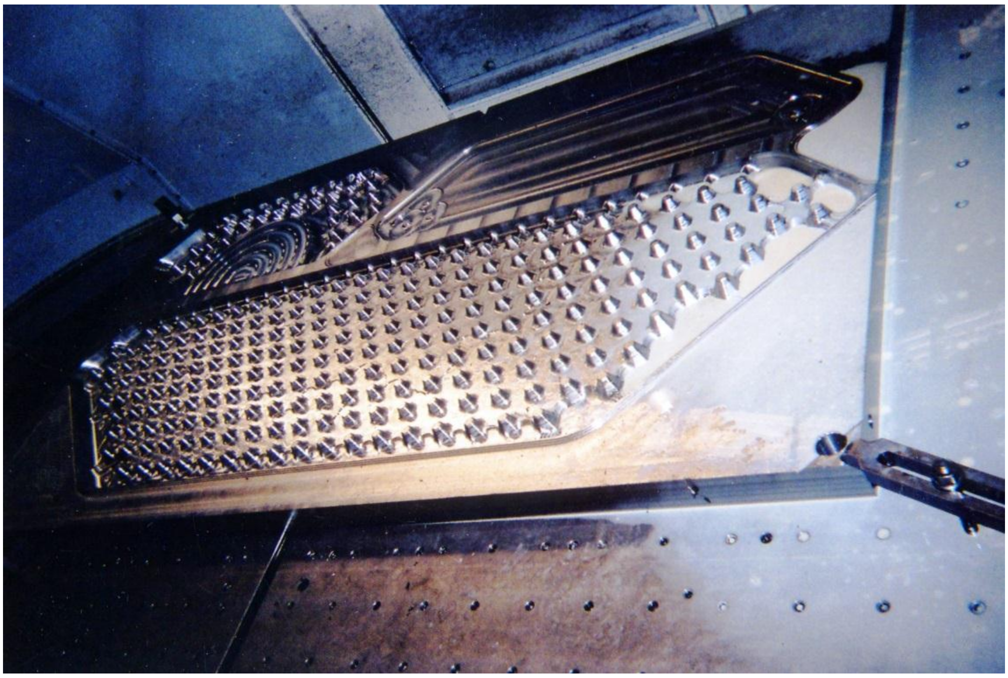

Plate 48: The almost completed side of the mould. The right side is flooded with white cooling fluid from the milling process.

When I watched at different times the milling head was removing a couple of millimetres of material at each pass. The required profile gradually emerged. Towards the end of the process this amount became even smaller until in the last stages Phil was able to leave the large machine running overnight. By this time I had observed how he had watched carefully for many hours to check that the programme was running as it should.

Even though the programme for the work has been supplied by the customer, the tradesman still has to ensure that the required material – in this case two separate large slabs of solid stainless steel - and the machine are properly “set-up”. This entails using sufficient clamping and packing so that the piece will not move during manufacture, and then selecting suitable cutting tools for the job. As the piece is machined and these tools wear down, the tradesman must remain vigilant and be ready to replace them when necessary.

While Phil spends most of his time at this machine he also sometimes uses the two Okuma mills. Over time he has trained a number of tradesmen on all three machines and, with the expected addition of a second smaller Kaoming, will no doubt put his knowledge to use on that as well.

I asked him about the process of working out how to go about a job.

> …you have to work out in your own mind what's going to be the process or the order of the process to make this part; otherwise you're not going to be able to physically make it, if you make it in the wrong order. It's not like a jigsaw puzzle where all the pieces go together wherever you come from. It's like a special puzzle that only goes together one way.

I commented on the amount of analysis required, of thinking through the work.

> You've got to get it right in your head, this is what you do first, this is second, third, fourth … until the job's finished, otherwise you can get into big trouble, having to throw it away and start again.

> *I haven't really seen much of that happen. I suppose it does.*

> Yeah, but it would be more likely to happen to the apprentices anyway because they're a little inexperienced in what they're doing. But they'll come up against it.

With his experience and knowledge of the work Phil had a number of good reasons for staying with the company and summed up what his work meant to him:

> Well I quite like making things. I've always gone to work because I like making things. Money's obviously something that youngsters might say gets them to work but you can only earn so much money and then it becomes a totally different achievement from doing the things that you're doing. I think you've got to like what you're doing. If you don't like what you're doing then you're really in the wrong place.

*****

David – Milling

David (pseudonym) came to work at Stafford during the time I was there. He had completed his apprenticeship overseas and like a number of the other overseas tradesmen had come to New Zealand under the Skilled Migrants Programme.[119] David was among the top three in his apprentice group when he trained and because of this gained access to the best jobs and the best machinery while training. The company he worked for overseas had over eight hundred employees and specialised in earthmoving and construction equipment.

David is the only one in his family to go into engineering. His father, brother and sister work in banking, IT (also in banking), and commerce respectively. Engineering though, is something he always wanted to do. "I know Dad was very unhappy but he just let me do what I did. I was lucky there."

I asked if he had liked making things as a child.

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[119] The Skilled Migrant Programme operates to help fill shortages in areas of skilled employment in New Zealand. Prospective migrants must be able to demonstrate particular skills and qualities to attain a given number of points which then allows them to gain a place. After a time of residence and employment in the country they may apply for citizenship (New Zealand Government 2011). The system appears to be generally considered successful by the majority of employers while migrants themselves experience varying degrees of success in their new lives (Trlin et.al. 2004; Wallis 2006).

> One of the things, the words my sister gave my wife when we got married was: ‘Don’t let him open anything new in the house’. Because when we were small we would get presents and they would work for one week and after that they would stop working because they were in parts.

> *You would take them apart?*

> Yes, me and my brother would take them apart … we would invariably get the same things so there would be less fights and I would take mine apart and if his was still working his would be taken apart.

While he did not inherit his family’s love of accounting, David does attribute his love of technology partly to his father who he says was “very much into electronics”. He recalled a particularly powerful memory of helping his father to repair (the result of a coffee powder spill) a damaged music tape player.

> I was very young and I used to join him [in the evenings] and I remember that particular project – he very dexterously cleaned each and every thing – all the parts. Take them apart, put them down there, clean the coffee off because apparently the powder was still stuck there and then put that back together again. It was really a pleasure, very fulfilling to put that back together … it was really a pleasure to take the whole thing apart, clean everything, put it back together again and make it work. It was great.

The fascination with technology has remained with David. An important consideration in a job for him is to be able to work with good equipment. I asked him whether he enjoyed work that was more complex.

> Yes, you get more pleasure out of it. More often than not you are terribly complacent and that’s when you make errors. It’s like challenging work. When the fourth axis [the new Victor] came up I was only too happy when Kaleb came across and said, ‘You would be one of the two that we train on the machine’. I was just as happy as if he had said, ‘Hey, we’re going to give degrees next’. But no problem, I would still work on that machine - I was just so happy because it was a challenge. I love something to use

my mind, not just my hands and my skill. You invariably learn something when you find something challenging. You learn something new and I've always enjoyed that.

*****

Evan – Milling

Evan (pseudonym), now some years over retirement age, has worked at the company for over ten years. His apprenticeship, starting in 1958, had been in one of the large North Island pulp and paper mills. While his training had been fairly broad with time spent in "the pulp mills, the paper mills, the sawmills, engineering workshops, chemical plants", a lot of the work he did there was in maintenance. At the time Evan worked at the mill, the company employed over three thousand workers.

It wasn't a good place to work. It could be very dirty, it could be very hot. It could be very dangerous with all the chemicals. A lot of people were killed when I was there … quite a few with various things...

It was a good diversity of work … one day you might be overhauling a pump and then the next day you'd be crawling around in the back of a paper machine pulling things to bits. It wasn't good work but it was good pay, big money there with the unions and everything – heat money, dirt money, confined space money, height money, they had all the extras there.

It sounds like you needed it though.

Well people deserved it I suppose. With the chemicals – when you walked through the building you kept an eye on the ground – any wet spots, you avoided them because that was probably chemicals or something, probably acids frothing off the plate-work and they would burn too … at Stafford's it's all clean. We don't really get dirty there.

Evan worked as a tradesman for about fifteen years “then I went into an office job [within the company] for about ten years, maintenance planning, planning the maintenance. I was actually in charge of all the contract labour”.

> [The mill] was running twenty-four hours a day, seven days a week. That’s why that job I had in maintenance planning was quite stressful because if I made a mistake and didn’t order the men for a shut-down, that’s thousands of dollars an hour or minute sort of thing, going to waste while the plant’s down and you’ve got nobody to work.

Having left before he got too old to “start somewhere else” he worked at a variety of companies including a steel mill and the building of a power station, among others. He started at Stafford after being made redundant from another large Hamilton engineering company which had gone bankrupt.

By this time he had revived his skills in precision engineering and has since worked mainly in the milling section at Stafford. He likes the fact that the workshop is clean and the work interesting and, like many there, he has a definite preference when it comes to the materials he works with.

> If anything I don’t like the machining in softer plastics, the Umpy and that sort of stuff. To me it never seems … I like stainless because you can get it exactly the way you want it…

Evan has continued to work well past retirement age and I asked him what made him want to come to work. He replied that he came for the money and for something to do, and for the company of most on the shop floor. He recounted a discussion with a retired electrician friend.

> He said it's all right for you but electrical work is just doing the same little things all the time. He said, 'You actually make something', and I thought about it and I thought well that's probably right. You actually see something finished rather than just wiring up a switchboard with electrical wires. Not as much satisfaction as actually seeing something finished and going in a container and being shipped off to wherever it's going.

While the idea of making something valuable and useful is a source of satisfaction for many in the company, Evan, like David above, believed this type of work is greatly undervalued in comparison with other occupations.

> If somebody becomes an accountant or something they start on $50,000 a year and go up $10,000 a year from there and all they're really doing is shifting figures around. They're not really producing much. That's probably one of the worst things with a trade. You reach a certain level and that's as far as you could go. You don't keep increasing every year.

> *And yet you're becoming a better and better tradesman.*

> Yeah a very … it's satisfaction in knowing that what we make brings money into the company, not many people can actually say that, would they? … I think the importance of people who make things that are exported isn't realised often. Somebody who makes something that makes millions of dollars and is used to produce butter or cheese or milk powder that earns the country hundreds of millions of dollars isn't considered as important as somebody who sits at a desk and does tax returns for a company or something.

> I think it's a bit unbalanced really, like lawyers and things like that. [Their] basic charge is $250 an hour. I mean they're not producing anything. All they're doing is making money out of people's misfortune and they're earning more in an hour than most people earn in a day type of thing. It's all upside down to my thinking.

Like many on the shop floor Evan has a broad range of skills. He explained that he would have liked to have become an architect but that university was not an option for him at the time he started work. Despite not following this path he has nevertheless designed and contributed to the building of a number of the houses that he and his family have lived in throughout his career.

*****

Two other tradesmen, Tony and Jim, were from England but left the company some time after their interviews. Jim, who worked in fabrication, returned to Britain for family reasons and Tony moved to another company. Tony worked mainly in milling but usually at the bigger mills, the Okuma 4VA and sometimes even on Phil's Kaoming. While Tony had worked in the trade for some years, he had not served an apprenticeship and, as he noted, had "no papers".

For this reason, someone in this situation is generally known as a journeyman. In the traditional apprenticeship system a journeyman was someone who had finished their apprenticeship but was travelling around gaining experience and yet to attain the status of a Master.[120] While this usage is still in place in some circumstances, it appears that in the New Zealand engineering field at least, the term journeyman is used simply to describe a worker in the trade who is without formal qualifications.

Despite his lack of qualifications, Tony's story of learning was not unlike those of many of the tradesmen. He had worked in a number of companies in England but one in particular had provided a particularly valuable experience. The work was similar to his current work but had

[120] This usage seems to vary in different occupations and circumstances. e.g. Emms (2005) uses the word in the traditional Western European sense in her discussion of modern culinary training. Hobsbawn (1984:357) discusses the changing locations of the meaning of the word [along with "artisan"] in relation to class differentiation and stratification in 19th century Britain.

provided an opportunity to work directly with clients in the design process or design solutions for their particular needs.

Among those who work at Stafford, Tony was one of a few who can claim one hundred percent to have “learned on the job” since, in addition to his lack of formal instruction, he also commented that reading about something in a book “doesn’t really make a lot of sense to me so I am more on the practical side of learning”.

Jim, who like Tony, had left England because work was “drying up”, had a background in fabrication and sheet metal work. He had known of Malcolm’s move to Hamilton and came to New Zealand on holiday to check out the possibility of a job. Jim also had experience in metal smelting and recycling, having worked alongside his father-in-law in that business for a time. Jim’s work at Stafford was mainly in the fabrication area where he carried out welding and folding.

Another Briton to arrive at the company while I was there was Blair (pseudonym) who also came from the English Midlands. Having applied to emigrate through a relocation company[121] he was also “without papers” and had been fortunate to get a job at Stafford because of his skill in laser operation and on the strength of the high recommendation he was given by engineers at his former company in Britain. His work there had been in the car assembly industry where he had learned fitting, welding and sheet metal work, and had most recently worked as a supervisor until the company stopped production.

> The work has all gone. The day we walked out of that factory … when I started there, there [were] 2000 people working there. It’s still open now but there’s only about a handful.

[121] Newlife Global (2012).

It was a loss when Blair left Stafford just over a year later. He had enjoyed his work there, enjoyed the culture of the workplace and had worked hard to get the laser machine working efficiently. He had also spent time in the drawing office where he had picked up new skills in operating AutoCAD, having "never touched it before". However, his family (wife and two teenage daughters) had not settled well in their new home and in the end the family decided they must return to Britain[122].

*****

Andy – Fitter

Andy's position as the most experienced fitter in the company, lies somewhere between the workshop, the drawing office, and management, since he has the job of bringing together, finally, all the pieces to assemble whatever machine is being made. For this reason, he may be involved with decisions about the work from the time an order is placed with the company through to its time of despatch. This requires that he liaise with all three groups.

His fitter/turner apprenticeship in the 1970's had been with an "old established company [1918] in Auckland".

> It was a general engineering company. But they were doing a lot of machine components for the pulp and paper industry and we worked in the dairy industry … they had a foundry as well so that meant a lot of castings and bits and pieces. Machining of castings, it was good varied work. There was a good range and lots of engineering history by people that I worked with and was trained by. There were guys that had been

[122] Phyllis Tharenau and Natasha Caulfield (2010) have researched the area of repatriation by self-initiated expatriates in Australia and found that the "mediation of host country embeddedness [and] home country pull" were two significant factors in this process.

> there forty years. They had come there from forging steel, from before they had arc welders.

While Andy acknowledged that many of the processes and much of the technology had changed, this broad education was not wasted.

> …there was a vast amount of knowledge and experience in the engineering trade at the time whereas that skill has gone by the wayside somewhat. In this modern day and age it seems to be more specialised where people are just doing singular type tasks whereas I came from a varied background of engineering where it was quite versatile. You did everything basically.

> *Do you think that is what has made you such a good fitter because you've got that very broad background?*

> Well, it stems back to my childhood basically. I was always tinkering and pulling things to bits and what have you so the apprenticeship in engineering just really finished off what I was already doing for most of my life beforehand … I'm a tinkerer at heart. I potter around and pull things to bits and fix them…

Andy has been at Stafford for over eighteen years and is respected for his knowledge of, and skills in, fitting and assembly. However, his history of employment in the industry had not been a smooth one.

> …after I had finished my training I had basically had a gutsful of standing behind a machine, working in a dirty dungeon so I left and went and worked for a light manufacturing company in Tauranga; and went commercial fishing and did a contract job at New Zealand Steel for a while, and came back and looked after an engineering workshop in Hamilton for a few months and moved on to the hire industry and worked as a sole charge serviceman in the hire industry...

> I would still be there today if I hadn't been made redundant. General hire equipment … you were doing breakdowns and you were delivering stuff. It was a very varied job, servicing equipment. A bit of customer dealings

> and it was a very interesting job. And then it got to the stage where I got made redundant and I thought what am I going to do? I know engineering and it just happened to be at the time that it was paying the most so I rejoined the engineering workforce.

In these two paragraphs Andy indicates a number of the reasons why people stay in particular jobs or not. These same reasons were given by many of the tradesmen and apprentices in their responses to my questions about why they liked their jobs and the workplace: a good (and clean) working environment, varied and interesting work, and being fairly paid for that work. In addition, as noted elsewhere, it is equally evident that the industry is not always a stable source of employment.

Despite living on his farm some distance from Hamilton, Andy is one of the first to arrive at the factory. He starts early so that he may finish early and go home to continue with tasks on his farm.

*****

Jeff – Polisher

Jeff also lives on a small country block about an hour out of Hamilton. The work that he and his colleague in the polishing bay perform is of particular importance in the company as it is often what creates the first impression customers gain when they unpack their goods from Stafford. The finish that is achieved by the polishers is, however, not only important for the aesthetics of a piece but is also often a specified element in the manufacture of components and machinery. In particular, the surfaces of work that is made for the food and medical industries, as noted earlier, must be without blemish.

Though now highly skilled and with a secure reputation after twelve years in the company, Jeff is another who like Blair and Tony “has no papers”. He came to engineering after nineteen years in the freezing works. By the time he left there he knew “all ninety jobs on the chain” and had become a leading hand. During the 1990’s many of the meat processing companies closed their doors. Jeff’s job was one of many that disappeared at the time.[123]

> When I lost my job (late 1994) I was just looking for any job. I worked with a mate for a year mowing lawns. I ended up at a concrete place for a few months in Hamilton. I was on about seven dollars an hour or something – at the meat-works I was on twenty dollars an hour and had to go down to that sort of money. Then my brother in law was working at Avalon[124] and he wangled this job there for me. I jumped up to about thirteen dollars an hour there. On the first day I didn’t even know what I was doing but they were prepared to give me a chance and by the time I did a few weeks they said yep … you’ve got a job. So I was pretty lucky.

> …the old guy that was polishing there at the time was Paul’s [his fellow polisher’s] father and he had been polishing for about thirty-five years or something – very clever guy, grumpy as hell, but very clever guy, so I learnt quite a bit then … and it’s all hands on stuff. You’re into it straight away. Basically you learn it the hard way sort of thing – that was it. When I first started Pete would say do this and do that and then he would leave me to it and that was about it really and it’s just gone from there.

After two years this engineering company also encountered financial difficulties and the metal workers were made redundant. By this time Jeff had become a skilled polisher and was able to obtain work within the Stafford group of companies of the time. From his years of experience Jeff

[123] New Zealand has a long history of meat processing having been the first country to export refrigerated meat. The “chain” system was developed in 1932 as a response to industrial action by meat workers of the time (Tech History New Zealand 2011). This change from using skilled butchers to the breaking down of tasks so that work could be done by “unskilled” or the unemployed, is a classic story of the degradation of labour (Aitken 1985; Braverman 1974; Noble 1979, 1984; Wood 1982). A detailed political history of the meat industry in New Zealand from 1972-1995 is supplied by Calder and Tyson (1999).

[124] Avalon Engineering, Hamilton. A number of other Stafford men have also worked at this company which is now owned by GEA, a multinational process engineering company.

could now be described as a “Master” of polishing. He appreciates the feedback that comes with recognition of his work.

> …one job that we did – those dashers – we did a sample one and I polished it up and it had to go to Germany or somewhere and Roger came up to me a few weeks later and said it was me that had got them the job. We had outdone some German company and they were a real clever company apparently and he said it was the finish that had got them the job and we’ve been making those things for five or six years now – heaps of them.

Part of his job has been to also learn to read and interpret working drawings and know how to meet the specifications of each project.

> A lot of the time we’re left to our own devices and even Kaleb or Roger will actually say to us, ‘What sort of finish should we put on, what’s going to be the easiest to do?’, especially when we’re doing these blenders and things. We were able to say this is going to be the easiest way and this is what we should do otherwise we’ll be there for weeks cleaning these things up. So a lot of the time, they don’t know. I reckon they have probably learnt a lot from me and Paul I would say.

*****

Ryan – Designer/Fitter

On the day I interviewed Ryan he was in the last stages of completing the construction of the large tea filling machine. I watched the machine having a trial run for a short time. He was particularly proud of this piece of work since he had been the main fitter on the job. Ryan had also recently travelled to England with Kaleb for the company, to help complete a similar machine there.

> That's where I first saw that machine – over there. When we came back we brought all that work back with us - so to see it sitting over there in some other country and then to come back here and actually sit down and build it yourself – that was pretty cool.

Ryan completed his cadetship/diploma[125] in engineering around the time I started at Stafford. After one year of full time study at Wintec, the region's technical institute, Ryan was offered a job at Stafford and completed his diploma part time over the following two years. This experience in both the design and the manufacturing sides of engineering gives him a number of advantages over those who have either one or the other.

> Yes, when I'm designing something I'm thinking 'How are you going to make this?' … even if you're not thinking it, it's in the back of your head anyway, where other guys [designers] wouldn't have a clue how to make some things. Some things they design can't be made. It doesn't happen often but – yeah.

His apprenticeship time had been shared with another company at times.

> …because there was both me and another guy from tech and we both applied for the job here and he [Roger] wanted both of us and so did Avalon Engineering, so for a while there we did a shared thing between the two companies. So one of us was here and one of us was down there and then we swapped over every couple of months.

From this it can be seen that Ryan in fact has three major areas of expertise – designing, machining and fitting, as well as skills in managing projects. Dave, who is now a salesperson for the company, Roger, Kaleb and Julian have all followed similar pathways in their training history. For a similar length of training time this multi-level qualification appears to give a huge advantage to those who choose this path.

[125] National Diploma in Engineering (Mechanical Engineering) Level 6. This is the equivalent of Kaleb's and Julian's qualifications (Waikato Institute of Technology 2011).

However, for the moment Ryan is happy doing what he does on the shop floor. I have seen him spending short amounts of time in the design office but mostly he is to be seen working at one of the machines or assemblies. His family background also provided a good learning ground for his career.

> My dad is a mechanic. Granddad was an electrician. I guess it's sort of bred into you – to do something. I was always out in the shed with Dad when I was little – mucking around – I guess that's where it really comes from really.

I asked him if he would like to be doing more designing.

> Not at this stage. I like doing stuff. Maybe in another five years – what Dave and Kaleb have done – move into the office a bit more. But no, I'm quite happy out there.

*****

Many themes are present in these stories. For me perhaps the most outstanding element of the environment of the shop floor is the level of professionalism of the men and their general dedication to the work they do. While, as many of them will note, no job is perfect, it seems that for most who work at the company this is the type of work they most enjoy.

A small number of the tradesmen have worked at the company for many years. Many, despite their high levels of skill and knowledge, have also experienced redundancy. It appears that no matter what training one has had, qualifications achieved or skill level attained, employment in one's chosen field is not guaranteed. In the literature on skills and training there is now a growing awareness that labour supply problems may have as much to do with the availability of good jobs for those who are qualified to do them, and of spaces for those who wish to learn how to do them, as it has with the much argued "lack of skilled workers".

Of particular interest for the purposes of my research in the area of skilled learning, is that the workshop and the men who work in it provide a valuable example of knowledge production at work (Marchand 2010b; Vallas 1990, 1998). The participatory practices which contribute to this and which form a part of everyday work and learning on the shop floor are discussed more fully in chapters seven and eight.

In addition, their histories of learning contribute to a better understanding of what may be necessary for the best chances of success in this field. Their stories of their everyday practice, their interest in what they do and their pride in what they produce contribute to a better understanding of what constitutes good work; and their narrations of how they view their workplace contribute to a better understanding of what makes a good employer. These themes are also expanded on in chapters seven and eight.

A number of things are manufactured in this company besides the components and assemblies. Also being produced and reproduced on a daily basis, and over time, are the knowledge and the culture that sustain the men, the manufacturing work, and the company itself.

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Chapter Six

The Stafford Apprentices and the Making of an Apprentice

> …they go into the workshop not knowing a hell of a lot and three or four years later … they don't actually realise it but they've learnt an incredible amount of things and they've learnt that from the tradesmen and being around them and from doing it themselves. But if they don't form good relationships with the other people, with the tradesmen, the tradesmen won't teach them anything. If you sense that someone doesn't like you or is disrespectful to you, you're probably not going to bother with them, are you? Yeah, tradesmen are pretty much like that.
>
> John – Apprentice Coordinator

The Stafford apprentices arrive at the company via a number of different pathways. Some may come directly from school, having often spent a number of periods of work experience at the company; some may come from institutions such as Wintec[126] where they have undergone anything from six weeks to six months of preliminary trades training. Others may have moved there from other companies as a result of company closure or other issues. Some may have been known to an existing staff member and through this have been given the opportunity to prove they can do the work and from this are invited to begin an apprenticeship.

These experiences of today's apprentices differ from those of many of the older tradesmen who trained in a time when apprenticeship was, in the apprentice coordinator's experience, "embedded in society", and gaining one was as simple as "knocking on a door".

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[126] Waikato Institute of Technology.

> When I came out of school … late seventies, I came out of a classroom where everyone [of the boys] did woodwork or metalwork and all the guys in the metalwork class would say, 'Well, okay, I'm not going to school next year, I'll get an apprenticeship.' - and you would just walk down Te Rapa Straight, knock on a door and say, 'Can you give me an apprenticeship?' and they would say, 'Have you got your School C.?'[127] 'Yep.' 'Okay, can you start Monday?' …and that was it.… You turned up and you swept the floor and you lifted stuff and you went and got the smokos[128] for the first few months and they slowly taught you stuff, until you became slightly useful to them, and then the more useful you got the more stuff they'd give you (John – Apprentice Coordinator).

The apprenticeship then proceeded with time spent on the shop floor under the watchful eyes of senior tradesmen, interspersed with weekly night school classes and several block courses per year at a local technical institute. If the apprentice had served the necessary number of hours they were considered trained. If they had also successfully passed the Qualifying and Trades Certificate exams set by the trade, they could then call themselves tradesmen. If they had completed the hours but not the exams, they were known as journeymen.

The stories of the Stafford tradesmen demonstrate the full range of these various experiences. In addition, as described in the last chapter, a number of the men have no formal training but do have a great deal of experience, to the extent that some can, in my view, be described as "Masters" of their trade. In today's training environment, which is strongly regulated through qualification and assessment, informal apprenticeship does not appear to be an option in this industry. The current Stafford apprentices are all enrolled in formal apprenticeship arrangements.

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[127] School Certificate was part of the examination system before the introduction of Unit Standards based assessment in high schools in 2002. It was usually sat at the end of the third year at high school (approximately age fifteen). It was a graded and scaled exam with a pass mark of fifty percent or above. School Certificate was roundly criticised by a number of authors as a system that acted as a "sifting device" [and where failure was] "built into the system" (Hood 1994:132, 133); Charmaine Pountney (2000) even described it as "Cruel Certificate". The criticism that half the high school population was effectively failing led to a change to a more flexible system which recognises a broader range of skills and competencies.

[128] "Smoko" is the colloquial name for the food brought to work for morning and afternoon breaks. It is also used to describe that time out as well.

However, the ethnography shows that a number of aspects of the process outlined by John above, continue to operate at shop floor level.

Despite the formal requirements and the accompanying ubiquitous machinery and often blunt instruments of institutional assessment, by far the greatest part of the teaching and learning and assessment involved in apprenticeship in this industry takes place in the environment of the shop floor. This teaching and learning is, in many ways, far richer and often more subtle and less easy to quantify. And, as Peter Sawchuck (2003:2) notes, the knowledge that underpins and sustains this teaching and learning, "… is hidden in the cracks and crevices of people's lives in and beyond work". It has its own pace and its own patterns and is almost entirely dependent on those who work on the shop floor and the culture that they maintain on a daily basis.

Before continuing to describe what I encountered in that workplace I will introduce the apprentices who were there during the time of my fieldwork.

*****

The Apprentices

James

James was the first apprentice I met on my first visit to Stafford in 2007 when I went to discuss my proposed research with the owner. When Roger introduced us, James was giving a final polish with a cloth to a large stainless steel item which was about to be shipped to a customer. He had started working at the company part time in the school holidays during the two previous years, and had then begun his apprenticeship “straight from school”. At school he had been able to follow his interest in engineering to some extent but explained that most of what he had known when starting at the company, he had learnt at home.

> Well, I did do metalwork and graphics and stuff like that [at school] but it’s all pretty basic compared to what I would do on a pre-apprenticeship course … I learned to do really basic stuff at school but my brothers and my Dad – they’re all engineers so I sort of picked it up from them as well … we’ve got a lathe and a mill at home.

As with the experiences of the tradesmen noted above, James’ experience of growing up around machinery is one that is common among the apprentices. His brothers work in various parts of the automotive industry and his Dad “used to have a business mid-nineties building race cars”.

I asked him how this had helped him.

> Basically just familiarity with stuff and knowing how to do the basic stuff – once you know that it’s pretty much all the same - it’s just how you apply it to the job that’s different.

Plate 49: James at the Hwacheon lathe.

James' experience in working on cars and with mechanical things in general and his keenness to learn meant that he fitted in well in the environment of the workshop. I came across him one lunchtime when he was busy working on a component of his own and he explained to me that he was adapting an airplane part for his motor bike to make it go faster. Being able to use the workshop equipment to do "homers" at work in his own time was one of the many things that James and others liked about the workplace.

*****

Greg

Greg drives about half an hour into work each day from the nearby town where he grew up. He has always enjoyed sports and has a black belt in Tae Kwon Do. He had almost finished his engineering apprenticeship at the time I began the research, having spent the first three years of his apprenticeship at another company where the work was of a different nature – more tool and machinery making - working with tool steel and cast iron as opposed to the stainless steel and plastics in his current job.

> [The] speeds and feeds were a lot different because tool steel is a lot harder than stainless.

Like James, Greg also comes from a family of engineers.

> My old man used to be an engineer, well fitter/welder, so…
>
> *So what did you have at home – a lathe?*
>
> A lathe, welders, a big workshop. My brother's into classic cars so I've had it more or less since yay high – making stuff.
>
> *So you didn't have to learn some of the things?*
>
> No, I just grew up with them. It was pretty good. My old man used to make those big cranes, weld those up, like our big overhead gantry. He used to make all those… That's going back about ten years but we've always got the tools at home.

However, unlike James who said he could just "read a book and know it", Greg had always struggled with written words. At school he said he had not done well academically but had nevertheless "excelled" in engineering.

> I'm not very good at anything else, apart from making stuff with my hands. I couldn't last at an office job so I suppose it [his family background] has helped in that sort of way.
>
> *So how did you get on having to do written stuff, like coursework?*
>
> Yeah, I got through it but I already knew it before I went to the courses so it was quite good. Especially at the last place I was chucked in the deep end and just had to fend for myself more or less and go from there.
>
> *They didn't have any on-site training?*
>
> No. No-one supervised you or anything like that so I learned from my mistakes and learned from there. They were pretty tough at the other place. Like here if you make a mistake they're all sweet and like, 'How can we fix it?' There, oh god, they would go NATO,[129] F this and F that. So we learnt … and pretty quick. So yeah, it was good.

He noted however, that the learning he did at that company had been in a much broader range of work, "… which I'll always be grateful for", and that he *was* supported by the tradesmen who worked there, some of whom had also moved to Stafford.

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Michael and Jared

Michael and Jared opted to do their interviews together so their responses are mostly presented together throughout the interview data.

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[129] This is a colloquialism which appears to indicate an explosive response.

Michael completed his fitter/turner apprenticeship soon after I began the research. In the year before he had won an award as the top apprentice in the region. His parents are commercial chicken farmers, but he has uncles who are engineers and during high school he decided that was what he also wanted to do. While he has shown that he is highly skilled at machining, his current interest lies more in the fitting area of the workshop. In fact, this preference for fitting had at one point nearly led to his leaving the company. It was an instance when John, the apprentice company coordinator, intervened to negotiate with management to ensure that he had the opportunity to specialise in the fitting area. Since that time he has proven that this has been the best solution for both parties.

On the other hand, Jared (pseudonym), whose father is a plastics engineer, had only just begun his apprenticeship and prefers welding and fabrication.

> I prefer that over machining.
>
> *Do you know why?*
>
> No, I couldn't tell you. I can use a lathe and everything but I prefer more … to do more fabrication, welding and everything.

> There's probably more of an art to fabrication as well, than machining. With the machine you know it's going to turn out right every time but with welding it can be different from one piece to another (Michael).

> Different materials warp with heat and all sorts of stuff. You've sometimes got to compensate for where you're welding by stressing it in the opposite direction … the opposite side to where you're welding it or it will bend to the heat (Jared).

Control against overheating is usually achieved by clamping strips of aluminium behind the parts being welded. These act as a heat sink, thus drawing the heat away from the components.

I asked them what they liked making best of all.

> I don't know … probably just welding stuff together. There's all sorts of jobs you do. I wouldn't say I have a favourite one (Jared).

> It would be putting stuff together or, even if you make something from the start. It's always good to see how it pieces together (Michael).

One day on the shop floor I was watching Michael working on an assembly. I asked him if he had played with Lego when he was younger and he laughed and nodded.

> *So you get quite a lot of satisfaction out of seeing it done?*

> Yes, as long as it works.

*****

Josh

After leaving school, Josh, Grant's son, first started an apprenticeship as a cabinet maker. When work at that company was reduced to four days a week, Josh started working two days at Stafford in the fabrication section, alongside his father. After some time he decided that he would leave his place at the furniture company for "someone who needed it", and pursue his new interest in engineering. Josh had spent about a year working part time at Stafford when he was offered an apprenticeship. During this time he had also travelled to South America and had walked the Inca trail.

While working overseas may be an option for him in the future, in the meantime, he is fortunate to be under the guidance of his father who is on hand not only in the workshop but also at home, to give assistance with coursework if needed. For the moment, Josh is specialising in light fabrication which at Stafford comprises the processes of cutting, folding and welding. The items he works mostly are metal frames and cabinetry for various assemblies and machines.

Like the other apprentices Josh's learning beside his father represents many elements of a master/apprentice interaction.

> I just learn from my Dad. He'll give me a job and I'll have my job-sheet. If it's simple enough I can do it myself now - but usually I ask him. He either does it for me or just shows me, but he usually talks me through it … but I learn pretty much everything from my Dad. I pick up things on my own from watching other people but mostly from my Dad – he shows me.

However, despite having such a valuable mentor on hand Josh is also aware that it is important to learn from a wide range of co-workers.

> Everyone is quite helpful. Even like the other apprentices to me. Lonny's now the new apprentice [in fabrication] but even Jared and Hamish and Cody…[130] All those guys are helpful as well, even though they are apprentices as well. You can still learn from them.

*****

[130] Hamish had just completed his apprenticeship. Cody started as an apprentice towards the end of the fieldwork time but did not complete it at Stafford. Neither of these young men was interviewed.

John - The Apprentice Coordinator

One additional person is included in this chapter. While not an employee of the company, as apprentice coordinator he has a close relationship with the apprentices and others there.

The apprentice coordinator is a key person in the education of the apprentices at Stafford. Under the system the company uses, all five of the above apprentices are employed by John's organisation and contracted to Stafford for the period of their apprenticeships. Having placed an apprentice, his job is to mentor that apprentice throughout their apprenticeship. He also liaises with relevant personnel in host companies to see that they are getting opportunities in all the areas of skill needed to fulfil the unit standard requirements, and to get feedback on their progress.

The following discussion is from the field notes I recorded one day when John was visiting his apprentices at Stafford. He explained some of the elements of his work:

> *All the work is unit based.*[131] *There are lots of practical components. Things have changed a lot from the past but they're still reliant on others in the workshop. There's stuff you can't learn out of books. Ninety per cent of what you're taught is by the tradesmen in the workshop. So I try to encourage them to form relationships, to treat these men with respect because they don't actually have to do it. I encourage them to be a little bit humble.*

> *I also encourage the foreman and the others to show them things. If you spend four years in a good*

[131] An example of some of the engineering unit standards is supplied in appendix iii.

> environment you're going to be a good tradesman. Most of my apprentices don't want to do bookwork and they don't want to stay at school.

> It's to the company's benefit that they offer a good environment. They can do their own training. Some workshops actually allocate space. There should be no need to have people like me. In some ways I can be an intermediary though.

James came in for his meeting with John. I checked that he was happy to have me sit in. John asked James how he was going and James told him what he had been working on. John said, 'Anything you do that is a little bit different, keep a record of it. It's all evidence'. [A camera is available in the office for the apprentices to photograph components they are making.]

John, 'Has anyone said any good things to you lately?' 'Has anyone said any bad things to you lately?' James replied 'No.' to both questions and smiled. John commented, 'They're not that great at giving praise in engineering workshops. If you're not getting any bad comments you're doing well!'

John asked James if he thought he could get one more written unit completed by the next month's visit and James agreed to do this.

Michael came in next. In contrast to James, Michael is at the other end of his apprenticeship. He brought in a thick

> *folder of written work. It included photographs of projects he had worked on. For each job he had completed a form which listed all the steps relating to doing that job. This included a list of the required safety measures and equipment, a photograph of the component and the tools used to make it, and a detailed description of how he had proceeded with the work.*

> *John explained later that Michael had recently been assigned to work on a computerised machine.*

> *Basically they were going to leave him there when he finished his apprenticeship but he didn't want that and would have left. So I discussed that with the company, otherwise they would have lost him* (FND 27.11.07).

Greg, who had spent the first three years of his apprenticeship without such support, had had difficulty keeping track of his work and complained that some of his completed units had gone astray. This appeared to be mostly due to the indifference of his former employer. He also blamed some of the difficulty on "people who sat in offices" elsewhere and, in his opinion, appeared to be not too concerned about his work. On the other hand, the apprentices all appear to have found the support and mentoring they received from John to be invaluable.

*****

The CEO, management, the receptionist, the designers, the tradesmen, the store-man and the apprentices, make up the personnel of the company. As John has explained above, the apprentices must learn to work among these people. The qualities and skills expected of them are highlighted in the next sections, and, like the stories of how they learn best, these contain many contradictions. They demonstrate the very personal and individual nature of learning and of practice.

*****

The Making of an Apprentice

> Who will be the chosen ones, who will choose them, and who will pick from the youths and distinguish who is promising for the future?
>
> J B Van Der Straelen 1885[132]

While it is often said that there are *x* number of young unemployed men and therefore we should be creating more apprenticeships, such a response as a solution to the problem is both simplistic and inadequate on its own. It belies the complexity of what it takes for a young person to be successful in such a venture. It ignores the requirement that to some extent at least, the personal disposition and existing skills of the person must match the type of occupation that is to be learnt; and it ignores the need for there to be good working businesses or other establishments in which the young person can learn. Most importantly, it ignores and underestimates the importance and necessary qualities of the men and/or women who will be the informal and largely unrecognised teachers and mentors of those young people.

From the stories of the Stafford men, it is also obvious that their learning for their job started, for the majority, during childhood and in their families

[132] Cited in de Munck (2010:346)

and the communities where they grew up, not when they suddenly turned sixteen or seventeen and found themselves looking for work. The stories of the early experiences of the Stafford men and the artists are described in earlier chapters. What the stories represent, in terms of their contribution to the participants' success as engineers or artists, and, as human beings, are, I believe, key elements that are largely unrecognised in the current landscape of education and training policy. They are also absent in much of the discourse that surrounds it. This discourse instead, focuses on the transformative power alone, of formal education and training and the qualifications they provide.

As described earlier, the CEO of Stafford has made a deliberate commitment to work at ensuring that he not only acquires apprentices who will fit the requirements of his business for today, but also to ensure that there will be well trained tradesmen for the future. The personal qualities and skills that are necessary to work in the business were important topics for him, and among those I discussed with the men.

When asked what skills and qualities were necessary for the job the apprentices tended to focus on the practical aspects of the work. However, those in management, the apprentice coordinator, and the tradesmen, were more concerned that the apprentice was of a suitable disposition and personality if he was to be successful and fit in with those on the shop floor. Their "wish-list" was considerably longer than that of the apprentices.

The CEO of Stafford has a great deal at stake when he decides who will be his apprentices. Mistakes in personnel at any level cost time and money for the business and can be disruptive of the work, and of the shop floor culture. While his efforts to be more closely involved with schools and transition programmes and with the contacts he has made through these activities now means he has promising students recommended to him, this has not always been so. I asked Roger what he looked for in choosing apprentices.

> Well, I suppose it's a bit sexist but it is a male-dominated industry. There are very few women in the trade so gender is an issue. Farm boys are good because they come with some practical capability, whereas townies tend … but you look at Cody you know – his Dad has got a stock car and Cody's right into building stock cars … and James's Dad is into cars so James is into cars – mechanical capability. We've had all sorts and we have struggled with a few – making the wrong selections.

> Sometimes you just don't know. They turn up and I can think of one guy, Hayden (pseudonym), he turned up and he was a whizz-bang kid, he seemed to be on the surface and he was good for a few months; about six months, and then he just went "dog". His girlfriend dumped him and he just went shocking. In the end we had to cull him. And I suppose now he regrets it all - but at the time – we just don't need that rubbish here. It just drags us down.

He spoke of others who had had "huge potential" - one had experienced the trauma of a close friend's suicide and had been using to marijuana; yet another, "went home at lunchtime and didn't come back".

> But successful we've been - better than fifty, fifty - I suppose - no, better than that over the years; probably sixty/forty, maybe seventy/thirty. Seven out of ten, maybe at the best – six out of ten.

> *You seem to have a pretty good lot out there at the moment.*

> Yes, we have. A lot of that has come about because of the work we have done raising the profile of our business through WECA and *Skillwise* and *Smart Waikato*. I've bumped into a few more teachers and if I wanted kids, good kids, I can go and tap shoulders of say four technology teachers and they just say, 'This, this one, this one'.

> I can't employ any more that's for sure. The other thing is we've got a very limited capability of just volume. You just can't have too many trainees.

> We had seven at one stage and that was just hopeless. I still think we could have five but four is easily manageable. That's right across the three years of learning; having one just about to complete and one just starting, of the four.

I asked Roger what sorts of qualities enable apprentices to fit into their work role at Stafford.

> Well we're a pretty driven sort of business so they've got to be diligent. They've got to have mechanical aptitude. They've got to be interested. They've got to be interested, interested in engineering.

*****

For HR manager Luke, who is also involved in the selection process for new employees, attitude appeared to stand out as *the* most important attribute. Having been brought up in the different cultural environment of China, he appeared to feel that school leavers and graduates in New Zealand had some unrealistic expectations about the working world.

> I do think sometimes they need to go out and see the world because they're sort of stuck in one place and they actually don't know they are pretty lucky to have a good job. They're pretty lucky to have such a good company, a host company. It's really an attitude thing.

> *So you think they don't always appreciate that, some of those things?*

> Sometimes they don't, I have to say. I think it's a general issue with New Zealand kids … The only person that can actually have a bit of control is yourself, really. If you want something to change, you change. If you want something to happen, you make it happen, really. It's a bit difficult and New Zealand is not really keeping good people. That's why so many Kiwis are going overseas and finding jobs overseas. I think it's a national issue.

Luke also pointed out that he felt that New Zealand was missing out on talent because it was difficult for overseas students to stay on here to work, after graduation.

*****

For John, the apprentice coordinator, accurate assessment of a youth's capacity to be successful in an apprenticeship is crucial for his role. He also identified the different skills and qualities needed:

> They need to be good at maths[133] and have mechanical aptitude. People will often say a young guy would be good at this because he is 'good with his hands'. But they are also working with speeds, feeds and variables.

> They're told 'you can do anything' – it's just not true – people have to have capacity. The fabricators need good hand skills. They do bonding transitions, folding and welding. They can visualise shape, have to be a bit artistic, visual, able to think in three dimensions from what is a flat plane. I can't do that. I don't have that skill. I don't think that way. Machinists have to be practical, methodical, mathematical (FND 27.11.07).

Later, during his interview, we were discussing one of the apprentices:

> Yes, his brain is ticking over a bit. He's got a real aptitude for it.

[133] John commented that because his company found it difficult to judge a prospective apprentice's level of mathematical ability from the current qualification system, the company held its own maths test as part of its screening processes.

He said he had always known how to use a lathe, like he was born knowing that.

Yes, some people would never be able to use a lathe and that's the reality of it. Yes, he's a natural.

Like others, "interest" was high on John's list.

First and foremost they've got to be interested in it, keen, that's a big one. Then secondly I have to judge whether I think they have the IQ to be good at it and just the urge to do it. You can quite often tell the kids that want to do it. They're actually quite excited about being in a workshop, they want to have a go at everything, they make stuff at home, they've built a go-cart when they were twelve and just stuff like that. They want to be engineers and they will be. If you don't give them a job, someone else will because they will keep looking; so that's what I look for.

What sorts of qualities enable your apprentices to fit into their work role?

In any sort of workshop you've got all sorts of ethnic groups, religions, personalities but most of them will get on if … I mean, they're all there and … they're all doing the same stuff or working towards a common goal. You'll find if someone is not up to it or drags the chain, that doesn't really get supported by the other people. Or [if someone] doesn't want to be there - if they can see that someone is trying, they will help them. If someone's just there to muck around, well generally the whole workshop, as a whole, won't support them… which is fair enough.

So even though you quite often work as individuals there is a team thing going on. If someone is taking ten hours to make something that you can make in two hours you're not going to feel too great towards that guy. That's just the way it is. So workshops kind of regulate themselves a little bit. If guys want to work then they'll probably fit in quite well. It doesn't matter what race, religion or whatever, if they prove themselves on the workshop floor, then they will be accepted. A bit like a rugby field you know, you have to prove yourself. Pulling your weight, that's the main part of fitting in. Or as an apprentice, you're seen to want to do it or you're seen to be trying your hardest … they'll make a few exceptions for that.

*****

During my time at Stafford, a local high school technology teacher spent time working at the company as part of a one year research fellowship. Steve Andrews teaches at St John’s College, a boys’ high school (ages 13-17), which sits adjacent to the University of Waikato, an ideal location for connecting to the university’s Schools of Engineering and Education.

Steve’s own history of working with machinery dates back to his first vocation as a motor mechanic. As a school leaver in the 1970s he did what he called the “old type” apprenticeship - time served - with two nights a week at night school and block courses, to complete his Trades Certificate. He worked successfully in the business for many years before deciding on a career in teaching.

After twenty years in the classroom as a technology teacher, he decided his time off would be best spent finding out what was going on in the world of engineering. While he visited many companies and associated workplaces and institutions during this time, he was able to spend a focussed period of six weeks working on the shop floor at Stafford. He explained that the time spent reconnecting with the world of the engineering workshop had been invaluable and would be used in many ways in both the content and the philosophy of his teaching.

Steve provided his assessment of the preparation required for apprentices, from a teacher’s point of view. His thoughts on the topic included both academic and practical skills, and as well, the personal qualities and interpersonal skills that must be developed. His interview was recorded at Stafford.

> They’ve got to be introduced to the basic knowledge so that they know they’ve got this toolbox full of tools that they’ve been taught, and then they can apply it in the ways that they think is most appropriate to do the job.

That's the way I see it. The best learning is done in there, so they can actually look at the practical problem that they've got to solve – they have to make things, or the way they think about things – but they do need that toolbox of knowledge so that they can make decisions on it – the best way of making components or operating machines or whatever.

So what is in that basic toolbox?

Well, literacy and maths – we'll probably go back over that again later but … correct procedures of operating machinery, drilling holes, marking things out, handling the materials that they are working with, protocol in the workshop – all that sort of stuff – it's all important.

And it's more than just being able to do those things because you have to fit in, in the workplace, don't you?

Yes, you do. And what's the structure and how do you deal with people and how do you solve problems if you come up to a problem; how do you solve that, who orders all the parts, what's the rules about cleaning the place up, what's the rules about morning and afternoon tea and all that sort of stuff – it's all really important. And once they've got that stuff behind them, then they can make a few decisions for themselves and apply that knowledge into what they are doing in the workshop.

I mean, the good thing about a lot of the stuff they're doing here is there is more than one way to do things and that's great and if they've got that background knowledge, that foundation stuff, then they might do it totally different to the person next door. And if they both work that's fine. I guess that's the way you learn new things; but you do have to have that knowledge…

I think their personality is really important; I think they have got to be nice people and get on with people and have respect for people because you know you are working in an environment where there's thirty people in there and if you think you are the only person or you think you can do what you like, you're going to very quickly run into problems and then the boss has to deal with that. I think that a person that you employ has to be able to take criticism and take advice – that's important – be prepared to learn.

> I think they have got to be reliable and have a background that's reasonably stable, that's important – or prove that they are a reliable person even if their background's not that stable – just prove that they are a reliable person that they are going to get to work on time, they're not going to dick you around or steal from you – all that sort of stuff. Yeah, and I guess the most important thing is that they want to do the job you're offering – that they want to be an engineer or that they know what an engineer or a builder is or whatever – they know what that person is or does and they want to be one. They've got that passion for it.

Steve also identified that many of the qualities required on the shop floor also matched those required of a good tech teacher.

> …that's the good thing about good tech teachers; they've been in a workshop environment and they've worked with the older people and the young people and if they have done really well there then they will do well with teaching, because it's just a continuation really; just the way you treat people.

For a large part of his time at Stafford he had worked alongside some of his ex-students and had enjoyed being a participant on the shop floor.

> For me being an outsider going in there it's been amazing because everybody helps me … I have been working the same as everyone else. Starting the same hours and working the same hours. It's been excellent for me … I've been able to do a lot of machining and welding and that sort of stuff that has improved my skill level. I am really scared about mucking things up; but I haven't yet. But that's part of the deal and these young guys … and they've been really helpful, prepared to help me along.

*****

Knowledge Seekers and "Knowledge Soakers"[134]

A high school or college technology teacher may teach and develop the necessary skills of potential apprentices at his level; the apprentice coordinator may provide valuable support and advice to the apprentices; the CEO and management may work at enabling and supporting a shop floor culture that produces the optimum environment for learning; but a largely unrecognised group is missing from this list. This group comprises the tradesmen who do the work on the shop floor. It is largely they, or at least the majority among them, who work side by side with the apprentices, who will provide the most formative influence on the apprentices' success. These men are the actual teachers of and role models for the next generation of precision engineers.

Kaleb, in particular, as workshop manager, and Julian and Grant as leading hands, are part of the management, but are all closely involved with the apprentices and have all served apprenticeships or cadetships. I have included their comments with those of the tradesmen, as their relationship with the apprentices on a day to day basis has elements similar to that of the tradesmen.

The qualities noted by those above were mentioned again and again as I asked similar questions of others in the company. I mentioned to Kaleb that the apprentices' work involved a lot of different skills and that they seemed to need good manual *and* mental skills and would be always having to solve problems.

> I think that's generally what engineering is about. You have to be a problem solver, that sort of person. Probably go home and play a whole

[134] This is Phil's description of the ideal apprentice.

> lot of Sudoku in their spare time. We draw the line at crosswords, not being very good at our English, but the maths has to be pretty strong.

> …maths is one of the big ones … not just being good with maths, it's being good with numbers. Particularly when manufacturing in general is becoming more computer-orientated and the codes that the machines work in is all number based. You've really got to have your head around the numbers...

I asked Kaleb what he would look for if he were looking to employ or train a new apprentice.

> Attitude … someone who doesn't walk down the workshop dragging their bloody heels. Someone with energy, you know; someone with passion for engineering. Someone who gets a buzz out of turning a lathe on and watching it rip some material off or whatever, someone who actually wants to be here … that actually wants to do the job.

> *What sorts of qualities enable apprentices to fit into their work role?*

> The toughest one for the young guys coming out of school is actually their work ethic. It seems to take about maybe twelve months for the younger ones who have just come out, probably for the most part they've been not excelling themselves at school because it hasn't really done it for them and they come into the work environment and they're not used to – 'Shit, I've actually got to be there on time and you've actually got to do something with your day'!

> When they first start they're generally a little bit lackadaisical, you know, and then sort of a little while down the track you'll see the switch-change and then they'll, 'Oh, that's what it's all about. You've actually got to get stuck in'. Some of them don't, and they're the ones you don't want, but hmmm.

*****

For most of the time I spent at Stafford, Julian was the leading hand in the machining section. It was part of his role to allocate the different jobs to the tradesmen and apprentices. As such, it was necessary for him to know well the capabilities and personalities of the tradesmen and be able to assess the level of the skills of the apprentices. He explained what he looked for in these young men.

> I think two or three big things would be having high levels of concentration because if you concentrate on it you don't tend to make mistakes. Attention to detail is probably another one, and, I believe, work ethics. This is the most important thing. You've got to be here to do your job. If you are motivated enough to do your job then you'll learn adequately. Some people learn slower than others and some people learn really fast. If you are motivated and you've got a good work ethic, you'll get there in the end. When I think back to a lot of things for me, a lot of the things didn't click into place until many years after my apprenticeship, after I had been for a travel and things like that.

> I try to pick up on whether they are observant. I think it's important that they work hard. Slackers don't really have any place. It's okay if you have a bit of a chit chat now and then. And you assume that everyone is honest. Up until the time you're proven differently I treat everyone as honest. And, yeah, they've got to have a good work ethic.

> *What do you believe helps most in developing the skills they need? You mentioned being observant.*

> Yes, but in saying that I guess they want to be helped along too and encouraged by people above them. I do tend to try and keep pressure off them because I do think that is adverse to their learning – which is not always easy to do here. Because, I don't think you want to be pressured into thinking you have to do everything perfectly right all the time, and you should be allowed to make mistakes and things like that. It's how you react or how they react to those mistakes – because doing the same thing over and over again is not a good thing.

In his section, Julian also kept a watch on the students who came once a week for work experience. While he often found it difficult to find things which they could do, he always found the experience a valuable opportunity to assess their potential in the trade.

> What people do is always an insightful thing as well. If he's slacking around sweeping the floor with one hand in his pocket then he's not that enthusiastic. I mean, I started from the ground up. That was my first job. I was a floor sweeper for six months before I was an apprentice. I used to do that every day after school [and on] Saturday mornings.

> …they need the right qualities and someone needs to give them the right work so they can develop.

He also felt it was important that the company provide a good variety of work during the apprenticeship and that it was important even for tradesmen to gain wide experience.

> …I don't think you can stay in one place forever because you get too tunnel-visioned. In engineering you've got to adapt to all the different environments. No two jobs, no two workshops, are ever the same. You've got to have the knowledge and skills and it's all time-served. Then, I think that the good engineers have that sort of brain. They adapt to the environment and figure it out for themselves. They are self taught. Most good engineers are self-taught.

The idea of needing to be an "independent" learner came up in many of the discussions. In many ways this form of learning is not unlike a university education; there are teachers and mentors, information is provided, theory is taught, materials are provided; "hard work", independent research and learning must be done by the student. There is constant assessment of the resulting work and the teachers (lecturers) themselves are continually improving their knowledge of their subjects and practice; and, in turn, are currently the object of other assessors. The materials and the culture of the institution may differ, but the processes and expectations are similar.

****

I asked Grant what sorts of things he would look for when he was training a new apprentice.

> Enthusiasm. Like we get some of these kids come in on work days from schools and you can tell the ones that are really keen … The ones that really want to learn would ask you questions, ‘What do you think, or, what was I doing wrong?’ whereas these others will just have a go, ‘Oh, that was really neat.’ then they’ll wander off, go to the next guy and have a look.

I commented that James had told me he had “always known” how to use a lathe.

> You can always tell those ones … I think it’s just in your blood type of thing, a mentality; that’s me, I want to do it.

As noted in the methodology section, the men chose where they wanted to do their interviews. Phil chose to do his at his home. He does not see as much of the apprentices as others as he is mostly busy at work at the large Kaoming mill. This is not a piece of equipment that is used by the apprentices but he has spent time training other tradesmen on this and other machines. He also had clear ideas about what he would expect of an apprentice.

> I’d be looking for someone that’s got a reasonable maths IQ. That would have to be one thing, and probably someone that you feel is easily approachable. Not someone that’s too sort of out there. I’d be looking for someone who’s a bit quieter that you can talk to and he actually listens to you; rather than someone who is talking back at you all the time. Maybe a knowledge-soaker, I’d be looking for a knowledge-soaker.

> The noisier ones, from what I have seen down there, the noisier ones don’t end up doing as well as the quieter ones. It may be a coincidence but maybe they’re a little bit too self-opinionated too much or something like that. They’re too much out there, but that could be just our workplace.

> It's not necessarily true in other places. I suppose you could get a whole lot of noisy people in one place.

Phil was also adamant that "you can learn something from everyone".

> That's my round-off about learning because I have learnt things off lots and lots of people, people that I don't like, people that I do like, but I have learnt something off almost everyone that I have ever come across. There's no way that you can say that you can't tell me something that I don't know because you can ... and so can he [indicating to his son who was nearby].

Malcolm, in comparison to Phil, was very involved with the apprentices in his section. On the shop floor it was obvious that he went out of his way to ensure that the apprentices who spent time in the turning area were given every bit of help and encouragement that they needed.[135] He had a strong belief in the institution of apprenticeship, having served his own "time" in a training institution that was regarded as among the best at that time in England. He also felt that the background that the person had come from and the interests they had outside of work, were important for success in the trade.

> You know if you've got a guy coming for a fitting job, if he actually enjoys taking things apart for a hobby, say if he'd rebuilt tractors for a hobby, you'd know he had to be interested in what he was doing. If it was a young kid you sort of see what he has actually done at school. Has he gone into this on a whim or has he thought about it? Has he done this sort of work at school? Show him around the workshop. If they seem to know what different things do, you know … if he looked at the milling machines and didn't know what the hell it was you'd think, 'Ah, is he going to fit in'?

What qualities enable apprentices to fit into their work role?

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[135] Malcolm also had a keen interest in supporting other staff members. He described how he had offered to help Sean when he was new to the job of procurement in the office. While mistakes in ordering can also hold up the tradesmen's' work, Malcolm's attitude was one of "collegiality" or, of contributing whatever he could to the smooth running of the workshop.

An outgoing personality I suppose. If you get a guy that sort of clams up and won't ask people things or feels a bit shy about doing it. Perhaps … I've seen it in the past … you get a couple of kids who are a bit quiet at first and then once they've settled in they're more outgoing.

Listening to what people tell you helps as well. You'll perhaps say something to somebody and you think, 'Has that gone in?' and perhaps a bit more man management, learning to communicate with other people. Some people might say, 'Just make us that will you.' no questions asked. Whereas, 'If you make me this…' and they explain to the guy why they want it doing they're going to get an insight into it. Yeah, people skills if you like. It's actually about communicating with other people.

I'd say it also helps ... say people like myself, we've been there, we've done it, we know it can be hard fitting in, so you go and introduce yourself to the lads and say, 'Any problems, come and see me.' and just make them aware that we're there for a reason. We're not there to scare the living hell out of them.

That has really impressed me actually. Just seeing how everybody does that.

And just going back to that bit about the people in the working environment, you know yourself, everybody's got a different personality and you think to yourself, 'Well I've got this apprentice here; I want him to learn something. Who am I going to put him with?' You know from everybody's personality in there, well, 'He's a bit short-tempered, I won't bother with him. This guy's quite patient, he'll sort this guy out'.

You can make or break somebody by putting them with the wrong people. You can't just say right, that's the machine, put him on it with so and so and let him get on with it. You've got to put him around with different people. Each person has got their different attitudes, some have got more patience; some just can't be bothered. They just want to do their job and don't want to show anybody else how to do it. Whereas other people will willingly show people how to get on.

Yes, not many of the other sort there are there?

> [Malcolm gave one of his wry smiles]
>
> Mmmm, there's a couple.

Like Malcolm, Jim had done his apprenticeship in England. He also remarked on the need for apprentices to take some care to fit into the workplace.

> …what you will always find on a shop floor … there is kind of a pecking order, there is a pecking order there and apprentices that come in perhaps a bit full of themselves or a bit big-headed and they know it all, they soon get knocked down the ladder a bit, they soon get to find their place where they are and I've seen it happen before especially if you get a few who're a bit cocky, especially in England. If you get few who are a bit cocky and what have you, a few months down the line they've changed a bit because they've probably said the wrong thing or what have you and they've been sorted out – they've been put right. So there is a bit of a pecking order there, yeah.

> …some apprentices will come in and they'll be quiet and they'll go out of their way to get on with you and that's fine. I'm just saying that some will be a bit cocky. One example is a young lad, a bit hot-headed, may have a car - an example is a wheel spin in the car park - spray everybody's cars in grit, so you can imagine that when he got back he was given a lot of f'n this and f'n that and he was soon put in the position of, 'Oh, I shouldn't have done that.' So that's probably an example of where they get to know where their place is. I don't know whether a pecking order is quite right but they get to know that basically with the older blokes they can't really piss 'em off.

Another tradesman had a related example of the need to fit into the culture of the workshop, although in this case it seemed he was the one having to adjust. He did his apprenticeship overseas and worked in companies where music was not allowed. He disliked the loud music that was often played by some of the apprentices at Stafford. He felt that not only was additional noise undesirable on the already noisy shop floor, "…noise was our enemy", but also that the lyrics were often unpleasant and unsuitable in a workplace environment where there were often visitors.

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While Tony had not done a formal apprenticeship during his time of training in England, he also had equally valuable ideas about the necessary skills and qualities that apprentices needed.

> Communications skills are probably quite important – to try and get the information you want for the job, how accurate, what's important on the job. So that side of it is quite important.

> *So again would you say that's something you've developed along the way?*

> Yeah, just talking to people at the end of the day I think. If you ask the right question you're going to get the answer you're after.

I asked him what qualities he would look for in an apprentice. Again, enthusiasm and conscientiousness were emphasised. He also noted "an eye for detail", and, "adaptability, being able to adapt to the situations put in front of you". Tony believed that good mentoring was important and I commented that I thought it was a fairly supportive environment.

> Yes, we've all been in situations like that at some stage where you need to ask for help so there's no shame in it – saying you don't know. There's a great emphasis on, well, you shouldn't really ask, you should know, and it's like well, if you haven't really been told, how you should know. It's very strange.[136]

[136] Evan also spoke of a similar situation in a company where some of the men had worked: "…that was the trouble they had with their boss. I remember [one of the tradesmen] saying you would go and ask the boss something and he'd say, 'Well you're a tradesman; I'm not going to tell

> *But that doesn't happen there does it?*

> Ummm, you get it sometimes. Some of the guys are a bit like that. They're a bit like, 'It's my information and I'm not giving it out.' and you think, 'You saddo, you must have asked somebody at some stage for help'.

I commented that I had not come across that in the company but that I was not there all the time.

> I don't know whether that's an insecurity in people because they're frightened of their little niche and they're hanging on to their little niche because … you know, they don't want to lose their grip. If they tell everyone the information then somebody else knows as much as them … but does it really matter? Does it *really* matter?

Tony summed up his thoughts on the necessary qualities:

> Yes, you've got to want to do it. You've got to want to learn. It's like anything in life – if you want to do it, you will do it, and if you don't wanna, you aint gunna.

Evan, like Phil above, had worked for many years in the industry but had worked in a wide variety of roles in a number of companies, including management. The most important attribute he found necessary for apprentices, was also interest in the occupation.

> …because if somebody's not interested what's the point in trying to teach them. That to me is the most important thing – see what you are doing – see what the work is, otherwise what's the point?

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you how to do it'. Whereas, he was paying the bloke, if he had told him how to do it, he would have got it done a lot quicker and better. It's just silly not to".

What do you think helps most in developing the skills that they need?

> Just experience really. A good environment and people to point them in the right direction … and experience … it doesn't matter how clever they are, you can't just be good at doing those sorts of things if you do it once. It's experience really and some people have a natural skill. I mean we've been pretty lucky really...

An interest in the work was also important to Andy who was the most experienced fitter in the workshop. He also believed that a mechanical background was essential. When I asked what he would look for in an apprentice I could see that his own experience strongly influenced his ideas.

> Mechanical aptitude; a tinkerer … someone that can fix his own car; someone who has got a genuine interest in mechanical things because without that genuine interest in mechanical things, it'll just be a job. It wouldn't be interesting.

He believed that apprentices learned a lot from hands-on work and being observant.

> Most definitely. There are different methods and different ways that people do things. Just pick me up on that; I'm still learning today! You get someone new in there and doing something slightly different and you look and you ask and, 'Oh okay, yep, that's interesting.' and you keep that on the back burner until it's required and you dig it out when you need it, and there you go. Yes, I suppose everybody does things slightly differently. The power of observation is a very strong tool.

> A lot of people walk around with blinkers on … If you're not aware of your environment you're not going to live too long … humans are fragile creatures. We might think we're hard but we're soft. Safety is common sense. That goes for all safety. We all have little accidents.

I haven't seen anything go badly wrong out there.

> No, we’re pretty good.

He also acknowledged that apprentices need time to settle into their work routine.

> …when they’re apprentices they’re still kids aren’t they. They still want to play up and have a good time like kids do but I think it’s just a matter of time till they get a bit of responsibility under their belt and they start settling down. Most young people just want to have a good time.

Although Blair had never done a formal apprenticeship, but had nevertheless learned his trade over the many years he had worked, his summing up of the qualities he would like in an apprentice were from a very personal perspective. Having recently come from England where he said engineering apprenticeships had become “very rare”; he admired the system in place for the apprentices and enjoyed the culture of the shop floor at Stafford.

> I would like to have an apprentice, to be honest. One who would listen to you, take on board what you are saying and is quick to learn. Not quick to jump in and take over, but you would want him to be able to have *some* initiative. I would like him to come and ask you questions all the time. The more they show willing, interest, that’s a decent apprentice to me.

> You can see that with the guys there. They are always listening and watching and reading, doing the bookwork as they call it. That’s what I would like, if I had an apprentice like that. Because you can get people doing apprenticeships that are not really interested in doing it but you would soon find; I would know straight away. If they showed interest and were willing to learn, yeah, I’d show them the ropes and everything. But if you get somebody who’s not like that – I wouldn’t show them bugger all. Because you are wasting your time; you know they are not going to be there.

> But it's a fine line isn't because they have just left school and they've come into a work environment. That's a big jump for them; from going to school doing six hours a day to doing eight or nine hours a day.

I asked what helped most in developing the skills that the workers need.

> Having the right equipment helps. The right information to hand … You've got to have the right set-up and staff. As long as you've got the skills, that's a big, big plus. They've got that there, they're quite fortunate really.

I came across Blair one day on the shop floor. One of the young men was working alongside him. "See, I've got my apprentice", he stated, laughing and looking very proud. This occurred not long after he had done the interview and I could see that even though he joked about it, it was something that was very important to him.

David did his apprenticeship in a large company in India. In his case, the company had a more structured and hierarchical system, which mirrored to some extent that of the wider society. Like Luke, he also had a more formal approach to both his work and his expectations of apprentices. However, in comparison to his fellow tradesmen, he placed less emphasis on prior experience, and focussed more on personal qualities and skills.

> I would look for the ability to take on responsibility; the ability to plan; again I would say, respect for machines and people around you – three things … I think a lot of things can be taught into people, into a person, but I do believe certain things are in the people - like you should be able to think and forward plan and think out of the square sometimes.

> Sometimes there are a hundred and one ways of how to do it and you can't use all hundred and one. And again, just because someone has been doing it a certain way for a long time doesn't mean that's the way to do it. There could be another way. If you don't think there's another way to do it, there's no progress. It's as simple as that, so you're stuck then in a rut …

Graham, a welder, explained that he had struggled with aspects of his own apprenticeship because of a lack of academic skills. In comparison with those who believed that most of the work was learnt on the job, he was quite emphatic about the need for apprentices to have a good education.

> I think that's ninety percent of the trade. So if I was to employ someone I would make sure they had that background. Like I was saying, maths, tech drawing - theory comes with learning this stuff - but having that in your education. That was my struggle all through my years. I didn't have that. I never did tech drawing at school. And I struggled and struggled for years. I was always way behind everybody else because I was trying to learn that. The basics - and the same as maths - I wasn't very good at maths, so I struggled there as well. It wasn't until years later that I picked it all up.

> I wouldn't take on someone who had no education – just because he was a good fellow…

Ryan, who had recently completed his cadetship, repeated many of the qualities mentioned by the other tradesmen but summed up his list of what was necessary, very concisely. On the shop floor he did not generally give long explanations of his work either – he simply wanted to get on and do the job.

> Hardworking, enthusiastic, that's probably the main thing. They're actually interested in what they're doing … makes it a lot better. Yeah, that's probably about it really.

*****

The Making of an Apprentice – the Apprentices

As noted above, when considering what skills and qualities they needed for the job, the apprentices themselves tended to focus more on what was necessary from a technical or practical point of view. The apprentice group was also a comparatively much smaller group than that of the tradesmen; however, there were a few themes that were common among them. Their experiences growing up have been noted above. All of the apprentices interviewed had come directly from school and since they had not done pre-trades courses, that early experience within their families and communities had been crucial to their learning.

While I did not spend time in workshop classes in the contributing schools, the apprentices themselves reported having had varying experiences. These mostly depended on what was available in terms of workshop facilities, and who was available to teach technology. They felt that what they learned at school provided some of the basics for their current job. For most it had been their favourite class.

Most had also spent varying amounts of time out of school on work experience at the company. This appears to be a valuable transition stage which allows them the opportunity to get a feel for what it might be like to work at the company or in the industry in general, and, as can be seen from the conversations above, for those at the company to assess the young men's potential. The apprentices' stories continue here first of all, then along with the tradesmen in the later sections which describe work and learning on the shop floor.

I asked them which skills they thought were more important, their manual skills or their mental skills. While my thesis argues that the two are inextricably intertwined, I was interested to know the opinions of the young men on this topic.

> Probably the manual skills because then the mental skills you're going to pick up over time … Depends on what you are doing too. I mean with fabrication most of the stuff's laser cut and then it's just press bent so by the time it gets to us it's knowing how to tack it together, what heat to have it at so it's more manual skills than any sort of calculations involved in it (Jared).

> You have to be hands on really, and probably just people, people skills. It wouldn't be too much because you're going to learn it as you go. People are going to tell you if you're doing it wrong anyway (Michael).

> I just think if you know how something goes together then you can work it out (Jared).

> *You need to be able to imagine things.*

> If you've got a picture of the finished product then you can look at it and work out how everything works … work off that (Jared).

> *You all seem to be pretty good at maths.*

> Not really [they laugh]. I've sort of forgotten it all since school. I was, at school, but I've sort of forgotten it. I'm not very good at maths at all (Jared).

> *So what about all those numbers on the lathes and the milling machines? You're constantly calculating and watching those go around [on the datum].*

> Like I said before, that's just how it sounds but you'll get used to the speeds and feeds that you can push that machine to … and the different

> materials that's on it. To do it properly - you can work the speed rate and the feed rate out off the charts on the walls - but more by feel or sound of how it's working (Michael).

James, on the other hand, felt first off that maths was quite important but in his answer he switches constantly between "thinking" and "doing".

> Everybody told me that I really needed to know it but the only maths I've used so far has just been quite basic stuff. Like the most advanced stuff I have used has been trig and I have always found trig quite easy. The most important skill is probably just manual stuff. Thinking about the job is pretty important because you don't want to get half-way through a job and find you can't finish it because of something you have done – like you can't hold it in the chuck or something like that. It's a bit of both really (James).

Greg's answer to this question largely ignored the manual side and he asked for clarification of what I was implying by "mental" skills.

> The most important part; the mental, as in thinking?

> *Like doing your calculations and having your knowledge of your metals.*

> That's always important. Yeah, you need to know what's what. You've got to transfer from the drawing like, if it's steel, know that … that's got to come into it.

I commented that I had been surprised by the amount constant measuring and calculation involved in the work.

> Yes, I suppose because we are precision engineers we are getting right down into the .001 or whatever. Things have to be within the tolerance I suppose, but even the fabricators use quite a lot of maths to get their angles right, to get everything square. I suppose it's just a different diversion, a person that's good at literature, they can do that.

While Greg indicated that knowing maths was an important part of his job, he did not believe that the maths he had learned at school was appropriate.

> They teach the wrong stuff. As in algebra; I don't use really much algebra in engineering, whereas we still use imperial in engineering because we still make a lot of stuff for America. They don't really teach that at school. …Pythagoras and all that sort of stuff, trigonometry, that's probably ideal for engineering. You've got to know all your angles and that sort of stuff, how to work out angles, whereas algebra and all that sort of stuff…
>
> *So you almost need an engineering stream of maths?*
>
> Yeah, rather than mathematician sort of maths.

The many conflicting answers I received about the usefulness of maths to both the tradesmen and apprentices are perhaps partly indicative of the nature of knowledge accumulation. Tradesman Graham, noted above, was acutely aware of his lack of academic background in maths; to the extent that it had affected his apprenticeship. Some areas of maths appeared to be more or less useful to the men depending on the nature of the work being done. But in addition to this, for many their knowledge of maths had become tacit and therefore not something that was foremost in their thoughts as it did not cause them any problems. Like other forms of tacit knowledge, the use of mathematics, for many of the men, had become a taken for granted skill.

In reconsidering her fieldwork Lave (2011) notes no significant differences in the maths abilities of the schooled and unschooled tailors who were the subjects of her research. The necessary maths was learned in various ways in the processes of doing the work. Likewise, the use of mathematics at Stafford varies according to the different types of work; it is fully tied to the nature of each job. Greg, as he explained above, had never learned imperial measurement as it is no longer taught in New Zealand schools, but had had to quickly come to grips with the system when he found it was required. Malcolm had also been surprised at the need to use imperial measurement. He found it ironic that he came from Britain where it had formerly been used and now had to use it again for the work that originated from the USA.

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Apart from Michael who noted that “people skills” are useful, few of the apprentices mentioned interpersonal skills. Greg was rather more emphatic when I asked him what other skills and qualities were necessary.

> Patience.
>
> *Patience?*
>
> Yes, definitely. Things do go wrong and if you get more and more frustrated they just go more and more wrong all the time, and I don’t know … I just think you lose your train of thought, I suppose. Patience is probably a big one.

*****

As noted at the beginning of this section, the above stories demonstrate the importance of the knowledge and qualities that young people bring to the workplace.   At the same time it is obvious from the above remarks that as far as qualities are concerned some tradesmen noted qualities which were contradictory to those of others. Again, as in learning, this indicates the very individual nature of practice.

While formal learning has contributed to the apprentices' knowledge base, much of their learning and personal development has been the result of their experiences in the families and communities in which they have grown up. On the shop floor this amalgam of formal and informal knowledge and personal qualities is tested in the new environment of the workplace.

The gradual assimilation of the young person into the workplace via either independent efforts or formal programs to secure unpaid work experience can be seen to have been important as a means for both the student and the company to assess an individual's capacity for likely success in undertaking an apprenticeship. The next chapter describes in more detail the many elements which contribute to learning in the practices and work of the shop floor.

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Chapter Seven

Learning on the Shop Floor - Part I

> Fortunately for capital … skill is … passed on informally and on the job, it remains on the shop floor. If it wasn't there, finished parts would never make it out the door.
>
> David Noble (1979:42)

Despite the huge increase in training programmes and the implementation of "Modern Apprenticeships", in the engineering field at least, David Noble's observation is largely as true today as it was when he wrote it more than thirty years ago. While I will show that learning is also built on the life histories and the skills that have been nurtured in the families and communities the engineers have grown up in, learning how to do the actual work carried out in a particular company occurs in the working environment of that company - in this case, for the tradesmen and apprentices, on the shop floor.

As I set out to write up what I had learned about how learning took place at Stafford, I thought that the place to start the story was from my fieldwork diary. From this I could describe the factory, the work produced there and how it was done, the men who did the work and how I had experienced the environment of the shop floor. I could describe instances when I had observed (and occasionally been able to listen to) the usually short episodes of teaching and mentoring that occurred in the course of the work. There was a pervasive awareness though that everyone was there to get on and do the work of making the high quality components and machines that the company is known for.

However, in addition to these “on the ground” observations and descriptions I kept returning to the even greater amount of data that I had collected from the interviews, where the men had time to describe what they did and what they thought about it, at length and in their own words. As I tried to find a way to begin to report my findings about the shop floor, I realised more and more that how I had learned most about how learning takes place there was from the men themselves during those interviews, and from the comments they shared during work, rather than from what I had observed.

This “observation” in itself may appear to run counter to the project of ethnography which relies on immersion in the field and participant observation as the tools of research. However, I was not at the factory to learn how to be a precision engineer but rather to learn how others experienced this process, what the work entailed, what supported the learning and what made it difficult, and how these experiences were located within the broader socio-political environment.

While there is emphasis on learning from observation or, “watching” in the processes of both ethnographic fieldwork and apprenticeship, the greater emphasis is on the “doing”. In that sense, the participants and I were there to “do” different things; they were there to learn precision engineering while I was there not only to learn about the above but also to continue my own education or, “apprenticeship” as an ethnographer. Thus I was dealing with the acquisition of skill (both my own and theirs) in numerous ways, and often all at the same time.

While I did not immerse myself in the task of learning to be a precision engineer, I did experience the shop floor in many ways other than the visual or the social. Through the senses of hearing, smell, and touch as well, I was able to experience the feeling of what it might be like to work on that shop floor and to be an apprentice there. I learned about what was made there, what the materials looked and felt like, about the smells and the sounds, and about the tools and machines that were used, about the men who worked there and, as much as I could, how those men experienced their work and the workplace. I could do this only by learning, as much as I could, to not only look but also to hear, smell and touch as they did. Also, like most of the apprentices, I knew to treat the men with respect if I was to have access to the knowledge that I hoped to gain.

One outstanding similarity between "my work" and "their work" that became apparent was that the apprentices were embarking on and I was continuing, in this new context, what Cristina Grasseni terms "an education of attention" or "good looking" (Grasseni 2007).[137] Grasseni describes this as "…a relational and contextual process that shapes specific skills of perception, relation and cognition, which are in turn instrumental; to justify and reproduce specific contexts of action" (2007:206). Grasseni's research expands the growing literature which highlights the embodied nature of learning and practice by considering, "ways of looking at the world":

> …different ways of seeing exist in direct relation to a phenomenology of skills. In other words, different capacities to relate to the landscape are closely bound up with the skilled practices that unfold in it (Grasseni 2007:204).

[137] Grasseni's research has focussed on a number of "fields" including the processes of topographic map-making, and, of the development of the aesthetic judgements of those involved in cattle breeding in Northern Italy. In the first example she describes the way different users of an environment "see" and describe the same environment according to the way they experience that environment. In later research she describes the way vision and aesthetic judgement is learned by those of a cattle breeding community, through the total immersion in that business, from a very young age, of the children of families who are involved in the cattle breeding business.

Keller and Keller (1996:28) also argue that "…what one knows about the environment is orientated to what one does in that environment", and that this requires a "dual focus on both mental representations and practical actions".[138] For manufacturing engineers it is not only ways of doing and seeing that must be learned but also ways of listening, and of sensing through touch and felt vibrations, as they become more familiar with their machines, tools and materials and the information these may provide.

My concerns (as noted in the methodology section) about being too intrusive aside, I realised that it had not been easy to "see" learning in itself as it is largely an internal process; it belongs to the learner and it is not always an instantly realisable or recognisable phenomenon, as pointed out by many of the men. In addition, it takes place over varying periods of time, and the awareness of its occurrence is recognised sometimes in geographical locations away from the specified, or original, site of learning. It appeared for some, to take a change of context for a sense of what had been learned, or of how that fitted within the broader context, to be realised. Knowledge may hover, unconnected, below the surface of awareness.

Grasseni (2007:209) in her research among cattle breeders in Italy also notes her moment of understanding which she recognised not during the time of the initial two seasons of her field work but after she had "toured some other fifty stables with a breed expert and I learnt how to look at cattle with their 'professional vision'". This is likely a common experience in all learning – everything is not always obvious or can be comprehended at once. We may look, but we do not necessarily comprehend what we are seeing or see it as others do.

[138] Keller and Keller's work in this instance draws on that of Sperber and Wilson who argued that "cognitive processes are designed to let you know as much about the environment as possible" (cited in Keller and Keller 1996:28).

Matthew Crawford also describes the experience of "looking without seeing":

> Countless times … a more experienced mechanic has pointed out to me something that was right in front of my face, but which I lacked the knowledge to see. It is an uncanny experience; the raw sensual data reaching my eye before and after are the same, but without the pertinent framework of meaning, the features in question are invisible (Crawford 2009:91).

This phenomenon relates in some ways to the Dreyfus brothers' (Dreyfus and Dreyfus 1986) notion of the early stages of learning where the learner is overwhelmed by information and cannot yet order that information or determine its relevance.[139] However, insights of the type noted here may continue to occur long after the later levels of proficiency and even expertise have been attained as new situations and challenges will continue to arise.

Likewise, many of my own insights about the field often came during times of reflection on what I had seen or heard or otherwise experienced, in discussion away from the field, or when reading or rereading literature (and not always that which was directly related to the topic). During the interviews I was able to seek clarification on events I had witnessed but for

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[139] The Dreyfus brothers (one a philosopher, the other an industrial engineer) developed a model represented by five stages (Dreyfus and Dreyfus 1986). Very briefly, and drawing on Dreyfus (2004) and Eraut (2001:111), they are:
Level 1 "Novice", where practice is almost entirely rule-based.
Level 2 "Advanced Beginner", where aspects of a situation are recognised but their comparative relevance or importance are not clear to the learner.
Level 3 "Competent", where procedures have become standardised and routinised but the learner now has to take responsibility for some of his or her decision making. This can create renewed anxiety.
Level 4, "Proficient", where the learner has a more holistic view of situations, is able to assess what is important and is able to make decisions more easily, but is still guided by maxims.
Level 5 "Expert", where practice has become tacit, understanding and decision-making are intuitive and new problems are approached analytically.
As Eraut observes, "…their theory was first developed as an attack on the claims made by experts in artificial intelligence, before becoming a more broadly based theory of expertise. Moreover, they see their model as defending the contemporary experiential approach to philosophy against the rationalist tradition of analytic reasoning and the formulation of rules…" (Eraut 2001:109).

which I needed additional information. On reflection, the learner may similarly identify and tell you what they know about their learning, what the best conditions for its occurrence might be, and who or what helps most to create those conditions and to enable the learning to take place.

Despite not becoming an engineering apprentice, I could nevertheless gain some sense of when an apprentice or tradesman felt competent, and even expert, in a particular technique or process, by observing their demeanour while they were working. It was possible to see a change in a number of the apprentices in terms of their general demeanour and air of confidence, from when I first met them, to the couple of years later when I was completing the fieldwork. However, the times when the men reported they were actually learning most were the times when they were stressed, or else very focussed and deep in thought or discussion about how best to approach a task, or when the task challenged them to bring all their skills and existing knowledge together to carry it out. It also occurred when mistakes were made.

These instances reflect the way emotion in its many forms (Dreyfus 2004:178; Jarvis 2009) can be a strong element in the processes of learning. It appears to heighten the senses, strengthening the embodiment of what is being experienced and through this process, may cement the event in the psyche; possibly in the same way that physical trauma or, on the other hand, excitement and elation, are not easily forgotten. The stories the men told of their learning were often tied very closely to the felt experience of the learning situation, whether that was a sense of success and achievement, fear, frustration, embarrassment, or pride.

When the apprentices or tradesmen were stressed or experiencing difficulties, they knew who they did and did not want around, and it was usually not an observer. These were often not times when it was appropriate to stand about watching or asking questions, but they were the times when knowledge itself was also being built, made, or, “manufactured” (Knorr-Cetina 1981; Marchand 2010b; Vallas 1998) concurrently with the objects, components and assemblies made at the company. This process of knowledge building applies not only to an individual’s knowledge but also to the wider “stock of knowledge” (Keller and Keller 1996; Stout 2002) which all in the company may draw on. Likewise, confidence, trust and respect may also be built (or lessened) in the same interactions.

Grasseni’s (2007) notion that skilled practice results from the “education of attention”, or “good looking”, is easily recognisable in the practice of precision engineering. Very early on, I quickly gained a sense that attention to the task at hand was an essential element of the work and of learning. It may also be argued that it is this largely self-directed “education” of an attention that is constantly judging, constantly analytical, that helps to train the mind of the precision engineer to continue to think analytically about both the work at hand and the work as a whole. Being able to think critically, analytically and creatively are among the most important skills that the engineer possesses.[140] They likely also help to account for their ability to provide rich analytical descriptions of the work they do and thus to account for the invaluable knowledge I gained from the longer discussions with them.

On the shop floor, learning on many levels was occurring at all times and all over the place. This was not only in relation to the work being done but also in the gaining of knowledge of the workplace itself and of those who work in it. Like the apprentices, I could also gain from what I observed, an idea of how the work was done, who did what, some of the things that

[140] While it is recognised that there are differences in the forms of work produced by trades engineers, engineering designers and “professional” engineers, creativity, critique, and analysis are common to all three.

bothered the men and the things that gave them satisfaction and a sense of pride. I gained some sense of the personalities and the qualities of both the men and the culture that helped to make the workplace one where the majority were happy to work and as such, provided a “good” place to learn and to acquire skills and knowledge, and where high quality goods did “make it out the door”.

The following, therefore, interweaves the insights I gained from my time observing and interacting with those on the shop floor, from the one-on-one interviews which I carried out with the majority of the Stafford staff and related informants, along with further indications of where related literature may be used to expand the discussion.

*****

Experiencing Learning

> At the heart of our understanding of learning is experience; it is the whole person who has the experience and not a part of that person.
>
> Peter Jarvis (2009:141)

My first insights into learning on the shop floor came from the comments of the tradesmen and apprentices in the first few days that I sat down with them at tea and lunch breaks and as I walked about introducing myself, asking about their work and explaining briefly what I was hoping to achieve by spending time there. While their fuller and often more detailed and reflective descriptions given during later visits and the interviews confirmed what I had heard then, these comments neatly encapsulated many of the men's theories and experiences of how they learned to do their work.

The following excerpts are taken from the field notes that I wrote in those first few weeks of visits.

FND 21.11.07

> The men I sat with during the tea break asked me about my work so I said I was looking at the way people learn and in particular here, the way the apprentices learned their trade. With tea breaks being only fifteen minutes long, the most important activities are having your tea or coffee and food, a quick chat with your mates and, for those who smoke, a cigarette. Conversations therefore are not usually long, with answers offered in the midst of the above activities.

>> Everyone learns differently (Julian).

>> It used to be good when an apprentice worked alongside you and you'd give him some things to do and then you would feed him a bit more as he got more confidence (Grant).

>> Some people want things all laid out but that doesn't really work. I mean you have to help them a bit but they really have to learn it themselves (Julian).

> Well, if something doesn't work they just have to ask one of the old buggers. It's something they have to do. You can ask someone to do something but then they have to go off and work out how to do it. That's the best way. The young ones need to be able to ask the older ones. There are plenty of people to give you a hand and tell you how to work. We had one young guy who, if he made a mistake, would go off and try to fix it himself. In the end he made it much worse. With engineering you have to be able to think laterally – how to do something (Grant).

Later, I was watching apprentice James at the lathe and asked him if he had learned to use the machine at school. 'No, I've known how to do it all my life. My father is an engineer, and my two brothers.'

We went over to the *Boeringer*, an older lathe. James said 'No one likes this machine. It's called Dr Evil'. (The name had been etched into the green paintwork of the machine.)

He returned to work on his usual lathe but was having difficulty trying to get the component he was working on to spin evenly. He had measured and adjusted it many times but it would not sit right. 'I might have to talk to Jules about that. I'll just go and see him.'

The part was an auger and drive head. Julian came over and said to James, 'So what do you think?' James said, 'I don't know.'

A discussion then followed. I was unable to hear the details but it appeared that various ideas and explanations were being considered. (The men seem to speak fairly quietly during these longer discussions of the more complex problems.) James told me later that the problem was that the opposite end of the auger was not 'true' (i.e. it was off centre) and I asked if it could be fixed. 'It can, but it will take a lot.'

> It's hard to define the line when you are taught something and when you just 'pick it up'. This lathe was new to me (the *Hwacheon*). It's not all computerised parts [as are the NC machines in the next bay]. With the other one [Dr Evil] you have to use packers to get the right height. It's a real pain in the arse. With this one, when it is set, that's it, you know it is right.

> Sometimes you have to make a new cutting tool. I learned to do that from the book [*Metalwork Technology*, Amoakohene and Sackey 1996].

James was turning some Roboloader (robotic loader) parts.

> The shavings [metal] are really sharp. I have learned from experience to always keep the lathe clean. If something flies off it can pick up that rubbish and spin it into the machine or throw it.

He wore a glove to remove the coiled metal filings then blew the area clean with the compressed air nozzle.

When I started I didn't know what anything was. Now, when I have seen things finished, I can say 'I made that part'. That's what I like about it.

He was using a small micrometer and I remarked that he was constantly measuring things.

It's all about accuracy. It's nice when you make it and it fits together.

Whatever measurement you put into this machine you have to add .03. Once you have wound it in and out a couple of times it becomes automatic.

So you have to know your machine?

Yes, when I came here I had to fiddle around quite a lot. But once you know it, it's fine. There's quite a lot of feel for measuring.

So you have to be good at maths?

A lot of maths you learn at school you don't use. I mainly use subtraction and addition and trigonometry. You have to know your trig really well. Anything that has to have a bearing in it has to be within 0.01 tolerance. The micrometer can measure to within 0.001 tolerance. That's really cool. I once

> made something that had to be within eight microns. But you don't get that very often.

The expected tolerances are on a chart on the wall. Everyone is working to specifications, some of which are provided by clients, others of which are drawn up in the Stafford office. The men always have the design and specifications of the part they are making either pinned up or on the bench nearby. James keeps his attached to the lid of his toolbox with a strip of magnetic tape.

James finished the part by using sandpaper held against the spinning part. I have noticed that the men will often check the smoothness of a part with their bare fingers while it is still spinning on the machine.

At tea break I sat with another group of men. Another apprentice, who was seconded to the company through a Genesis Energy[141] scholarship, was at Stafford to complete some sections of his qualification. When I said I was looking at how people learn things he said, 'It just happens. The best way you learn something here is by having something fly off the lathe – by being scared – and by seeing guys without fingers.'[142]

Back at James's lathe he was completing the last of five SS assembly wheels. As the machine slowed he held the sanding strip to the component then again held his finger

[141] Genesis Energy runs its own apprenticeship programme but apprentices sometimes move around for the opportunity to gain the units not available at the company.

[142] While the apprentice had obviously met some engineers "without fingers", I only ever observed minor accidents such as cuts from sharp metal, in my time on the shop floor. Different tradesmen had different opinions about the level of safety awareness in the company. These differences seemed to derive from the experiences of some of the tradesmen who had worked in other countries and included both positive and negative comments.

to the spinning part to check the surface. I thought he must have enough knowledge of what he is seeing or touching to know that this is a reasonably safe thing to do, as I imagine that any small imperfection spinning at that speed would cut his fingers or, worse, if it caught on his clothing draw his arm into the machine.

I spent time watching Malcolm (ex England and the most experienced tradesman currently working in the turning area) working at the Alpha, which is a numerically controlled (NC) lathe. While instructions are programmed into the Alpha lathe from the computer, manual set-up and constant monitoring are still necessary. On a couple of occasions there was a high whining noise as the part was machined. Malcolm said this was because the speed was too high and had to be adjusted.

4.12.07

Luke suggested I spend some time with Jared, a new apprentice. He was helping fit out the new section of the building. The week before he had been constructing benches for the work bays and at this time he was fitting brackets to hold gas bottles in place. I watched for a while, helped with a couple of things then returned to watch the lathe operators.

Malcolm was working with PETP, a dense and somewhat brittle type of plastic, to make a set of twelve identical slide line assembly rollers. He was trying out different cutting tools. As the rollers were to be concave in shape he was using a radius or grooving tool (rounded tip as opposed to the pointed cutting tip of the straight tool), but the reading on the programme he was using would not match what was happening on the lathe. His prototype piece was not right.

He took a good part of the morning to get the pattern of the component correct. He said there was a discrepancy between the software and the lathe. 'The machines aren't talking to each other. It will run true from the other computer but not this one.'

When I returned a short time later he had corrected the error and had started on the next piece. He said he had also found 'a better way to do them'. He was then able to set the programme for the remaining parts, without further alteration.

I commented to Malcolm that he still needed to know how everything worked on his machine, even though it was mostly automatic. 'Yes, and things can wear down, so you have to then compensate for that, so you really have to know your machine well.'

*****

Work on the shop floor is not only about making components and machinery but also about attending to the needs of the workshop itself. The workshop and the machines and workstations also have to be cleaned and maintained.

"Sweeping the floor" appeared to have been a common first workshop experience. However basic, a task such as this can provide an opportunity to begin the process of becoming accepted into the culture of the workshop; the seemingly simple job of sweeping the floor, many tradesmen's and apprentices' first industrial workshop experience, is an opportunity to get to know the shop floor and those who work there. A keen young person can observe and take time to ask questions of, and get to know, the tradesmen. As John the apprentice co-ordinator remarked, most tradesmen are proud of their skills and the work they do, and will respond positively to those who show such interest.

As noted above, I had first met James (a new apprentice at the time) when he was giving a final polish with a cloth by hand to a component that was about to be packaged for shipping. This simple task can provide an opportunity to appreciate at first hand the quality of the work being produced by the company – an opportunity to run one's hands over the metal, observe and feel the finish, and to think about what the processes of making that part had entailed, the many operations that had been necessary to produce the piece, and the order in which they had to be carried out. It may also be an opportunity to think about what it might be like to be able to make such an item and to feel the satisfaction of seeing it completed, and also, to think about where it might be going or what it might be used for. For James, who already had some experience of working metal, a certain amount of "imagery" (Keller and Keller 1996) of these processes was already available for him.

Josh, who had been part way through a cabinet-making apprenticeship, had spent a year working part time at Stafford before beginning his apprenticeship in fabrication. He had spent that year, "Cleaning up, cutting materials and things like that".

On another occasion I found Lonny (a high school student), who was doing work experience during the school holidays, polishing down his first weld; he had constructed a frame for one of the water baths (used for cooling metal during the welding process). Making items like these, and that which Jared (above) was constructing, also provides an opportunity for an apprentice to demonstrate his ability to carry out a variety of tasks; for others to judge the work and the apprentice's way of approaching it, and also for someone new to the workshop to feel as though they are creating something tangible to contribute to the workplace. Looking back after a few years on the shop floor they may also judge this piece of work and assess how well they had done and how well the work had lasted.

Lonny appeared proud of his work. He had been offered an apprenticeship place at Stafford but had decided to go back to school to do the seventh form first. He said that if had had to choose between the apprenticeship and school, he would have chosen the apprenticeship. "I love it here, but since I can come and start next year, that's what I'll do. I've got plenty of time, so I'll spend another year at school. I'm not in a rush".

Work experience also provides an opportunity for the student to assess whether or not he (or she) is ready for the world of work.

*****

A number of aspects of learning are evident from the stories of the tradesmen and apprentices and the above conversations. An interim list of these aspects might include the following (in no particular order).

- These participants state that most of the learning is done on the job.
- Most of the teaching of the work carried out there is done by the tradesmen on the shop floor.
- The tradesmen are not employed (at least in this instance) first and foremost, as teachers.

- Not every tradesman is willing to “teach”.
- Formal schooling, while given some recognition, is not accorded as much importance by most participants as on-the-job learning.
- In learning there is no “one-size-fits-all”.
- “Everyone learns differently.”
- For the apprentice to begin to succeed he must form good relationships on the shop floor.
- “Most good engineers are self-taught”.
- Much of the learning is self-directed.
- The apprentice must know when it is necessary to ask questions and seek help.
- The apprentices must have a disposition or aptitude (or, as John termed it – capacity) that suits this type of work.
- Man-machine interaction, in this instance, is not a matter of simply turning on a switch and feeding in some material or, performing some other “automatic” operation with or on some material. A machine is effectively another tool in the tradesman’s hands and how to use it well must be learned through experience and with continual attention.
- It takes some time to get to know any particular machine, even though it may be exactly the same type and brand of machine as others already used. I also came to realise that this is a particularly individual experience, as two different workers will operate the same machine in their own way, to some degree.
- Emotion, in some of its many forms - fear, frustration, embarrassment, pride, elation - plays a part in learning (Jarvis:2009).
- The senses, in particular sight, smell, hearing and touch, play a large part in everyday work on the shop floor and, through that, also in learning.
- Challenge is a strong motivation for learning and for achieving job satisfaction.
- Mistakes are a part of learning.

- The better the environment of the learning site, the better the quality of learning.
- Learning does take place in poor learning environments although it may be a dispiriting experience for the learner, and there is the risk that the techniques learned may be faulty or inadequate.
- The effects of deindustrialisation and the sometimes fragile nature of employment in the industry, despite the best efforts of all concerned, are a feature in many of the men's stories and thus affect learning trajectories.

The comments are listed in this brief manner simply to provide some convenient flags for the reader and a sense of the myriad and sometimes seemingly contradictory ways in which the men spoke of their learning experiences. At another level they introduce "messiness" to the narrative, and disjuncture (Biesta 2007; Jarvis 2009; Lave 2011; McWilliam 2005); both of which, in themselves, speak to the nature of "good learning". Messiness and disjuncture resist attempts to impose order or to make claims for a common set of explanations. Yet in the processes of trying to heal disjuncture and tidy up messiness, or, "problematic contexts" (Keller and Keller 1996:176), we strive, sometimes make mistakes, find solutions, and thus learn from the experience.

This description applies equally well to contradictions which emerge in fieldwork data as it does to the tradesmen and apprentices in the course of their everyday work.

> Ideas acquired through past experiences are at risk as subsequent experiences unfold and practices are at risk in reflected thought. The process is one of constant negotiation of enactment and understanding wherein structural resources and the results of prior actions inform activity, which, in turn, is a resource for revising those very structures. As a result, a human acting in the world is scientist and *bricoleur* (Keller and Keller 1996:175).

*****

Management and Tradesmen

> I think for the young guys it's actually a pretty good environment out there, in terms of learning, I mean you don't hold their hands, they've got to stand on their own two feet … you get some guidance, you get somebody looking over your shoulder to make sure you don't hurt yourself, things like that, but you've pretty much got to learn it on the job yourself. Try this, try that. Not a lot of hand-holding in our learning that goes on here, eh?
>
> Roger Evans CEO

An apprentice's progress throughout his apprenticeship depends on a number of elements including his skills levels, the availability of suitable work, and the availability of staff to mentor and guide them at the necessary points. While off-site courses may proceed to some extent, regardless of what is occurring in the wider business world, the on-the-job learning that appears to be essential in many fields depends on having good workplaces for learner participants to gain "real" experience.

Those who manage the apprentices at Stafford, and the tradesmen who mentor them, all noted that the pressure of work seemed greater than in the past when they were able to learn at a slower pace. It is likely that the structure of the Modern Apprenticeship system also impacts on this situation in the sense that there is a need for more specific and more detailed accountability in meeting the requirements of the numerous unit standards that make up the formal side of an apprenticeship. The following describes some of the approaches that are taken in the processes of supporting apprentices in the workshop and enabling their learning experiences.

At the time I interviewed Kaleb, he had also taken over Julian's job temporarily so was doing not only his workshop manager job but also some of the tasks formerly done by the leading hand in the machining section. Although Julian and Grant had mainly been involved with decisions about the apprentices' work, Kaleb was also allocating jobs on the shop floor more frequently. He described the process:

> Grant does a fair bit of that down his end of the ship but generally we've planned a bit further out in advance of that and well, it's like, this is coming right about this time and such and such will be finished so how about … this would be good job for him to tackle … particularly we do that more so with the younger fellows coming up. We try and tailor, pitch the jobs to them … that are at the right level, just to try and keep developing their skills a little bit, and if they've made a bit of a meal of the previous one, you know, you won't throw something at them that's more challenging, you'll keep it at that level until they've honed in on those skills a little bit and then move it up from there.
>
> *So you really have to know your people very well and you're doing that job that the old master/apprentice relationship worked on. The master knew where to feed in the appropriate level.*
>
> Yes, we've all got different skill sets and you've got to maximise what you've got. Certain things suit certain people. Some people aren't perturbed about doing a hundred of something; some people will get frustrated with it; so yes, it's balancing our resources with what you need done. That's probably the biggest part of it.
>
> [We] try and encourage a bit of innovation from the guys out there, without trying to stifle and say, 'This is the way it should be done, do it this way'. That's an old school of thought and you end up with robots, not people.
>
> We try and facilitate a bit of discussion at the start of jobs, again, particularly with the younger guys to try and get them thinking about what's required at this end to make sure they take the right steps.
>
> *What do you see as the best ways for apprentices to learn?*
>
> Get in there and do it. They need some coaching too, and that's something we always struggle for, is just putting the time aside to spend time with that person; show you, leave you to it, come back, have a look, show you some more. It's hard to dedicate that time.

I commented that despite the time pressure there seemed to be a kind of informal expectation in the workshop that the tradesmen will help the young guys and that there always seemed to be a lot of bouncing around of ideas between them all.

> Everyone has a different way of doing it and it's about finding the way that works best for you. Take all the ideas on board and try them and at the end of the day you're going to come up with something for yourself, that works for you. So there's no harm in looking at different ways. What one person does one way for one thing and may be great but something else he mightn't want to tackle it; but that's all part of the learning process. You've got to walk around with your eyes open and try and absorb what you can from whoever you can.

I commented that they all seemed to be very generous with their time.

> Maybe they just want to stop for a chat!

When I asked Julian, "How much is learned on the job?" he also confirmed the predominance of "learning by doing" and identified elements similar to those Kaleb had spoken of.

> I think it's all learned on the job to some extent. I think the degree that you end up with, the skills that you end up with, is directionally proportional to how motivated you are on the job and how easily you pick things up and learn for yourself. It's easy to go through life with people doing a job and people say do this, do this, do this. It's people that can figure it out for themselves, they are the ones that learn more; because they can adapt that knowledge to various situations, because no two situations are ever the same.

I commented that I had noticed that Julian often turned a question back to the apprentices.

> Which is a very good way to learn. It's hard sometimes from a supervisor's point of view because sometimes you are so busy you want

to get something done and you say, ‘Oh, just do that’. You’ve got to check yourself and say well it’s not that advantageous for them to have that. But in saying that, sometimes the problem is more complex and they need a straight forthright answer.

They’re stuck because they have already come to you and they’ll say, ‘Well, how will I solve that?’ and I will say, ‘Well, this is how I would do it but you could also do it like this. You do it for yourself.’ And it may not be successful for them but I think they learn about that and if it isn’t successful I guess that’s where the motivation comes in. They would think, ‘Well why wasn’t it successful? I won’t do that like that next time’ or, ‘I’ll change it slightly’ - because there’s a learning process.

Being observant is actually another very important one. That’s probably how I learnt a lot. Because you watch and you try and replicate what they do and then you try and analyse it and think through why – because being observant actually stops you asking stupid questions too, because if you watch and pay attention, you can answer your own questions.

Like Kaleb, Julian also talked about the need to give apprentices work appropriate to their stages of learning.

…before I give someone something, they’re never going to advance their skills unless I give them the opportunity to do something. The owner and others like to see them working hard and trying their best so I think, ‘Well, I’ll give him a crack at this one’. Those are motivating factors for me all the time because at the end of the day I have to get these things done on time. I don’t want any slacking. They’ll say, ‘Why don’t I get good things?’ and I’ll say, ‘Well you work hard and I’ll give you good things’.

I commented that it seemed that it seemed like a bit of a juggling act between trying to get the work done and trying to nurture the new talent.

Everybody seems to be pretty good at helping everybody else out anyway.

> Well, I think that's the whole engineering field in general. It was very much like that when I was young and was doing my apprenticeship. Most of the older guys would probably tell you the same; that there were certain tradesmen that you could go and talk to and they would help you out. If you asked questions and you were observant of how they did things - and I think that still applies to this day.

Apart from some of the men commenting that not everyone was amenable to answering apprentices' questions, it was not something that was ever obvious to me. I suspect that most very quickly work out who are the "go-to" people on the shop floor. In some ways, as a researcher in the same environment, I probably tended to do the same thing.

While those at the management level had a specific focus on the apprentices, and the responsibility to ensure that the they had access to the appropriate jobs that would allow them to develop their skills at the different levels, much less structured and spontaneous was the informal learning that occurred in the ebb and flow of work on the shop floor. This learning occurs when a tradesman such as Malcolm, who has a strong interest in encouraging the apprentices' progress, notices that something is not quite right and steps in to offer help; or, from the apprentices' situation, when they need information or help and ask a question of another. The ability to know when it is necessary to ask a question or ask for help is, also in itself, a skill that must be developed by the apprentices (and continually practised by the tradesmen).

Grant spoke earlier of a situation where this was not the case and recalled this again during his interview.

> …you get some that just go too fast, you know, they are trying to run before they can walk. You didn't meet Jason (pseudonym), the apprentice. He didn't last. I think he only lasted about a year and a half, two years, and we got rid of him. He was sprinting before he'd even crawled.

Wanted to do everything?

Yep, and then he'd make a big mistake and instead of coming and asking how to get it fixed, he'd have a go at it and of course it would get worse and it'd get worse and in the end it was in the trash… and he wouldn't learn … I mean in the end the only way you learn is by making a mistake but come and ask somebody, don't just try and fix it. If you can fix it and it works, sweet, but if it doesn't work don't just try to keep making a mess of it.

We were discussing Grant's own apprenticeship which was time-served with some off-site courses. He thought that was a better system.

At the moment we're that busy, we haven't got enough tradesmen, so you basically give the apprentices a job and hopefully give them a bit of insight into how to go about it and let them go to it. You just don't get the time to be by his side a heck of a lot, as you should.

So they're left quite a lot on their own?

Probably a bit more than they should be – yeah – but that's just the reality of business now; if you had the staff or the tradesmen – and the time - because firms don't like two guys doing one job sort of thing so … You're sort of thrown to the wolves basically. Here's the job, go and figure it out.

When I asked Graham (a fabricator) about learning on the job, he said it occurred, "All the time", and from lots of different people.

Just about every job I get I'm learning. Grant will come up and say well maybe you should do it like this and then you sit back and think and listen and go, 'Yes, maybe that is a way'. So yeah, listening, I have found. I might be different from Grant, Grant will be different from Gary but at the end of the day the finished article is going to be the same. We just went around about it different ways. There's a big variation in how people go about things.

David, however, while acknowledging the importance of building knowledge in this way, also pointed out that knowing myriad possible approaches could also be a problem. “That can also be dangerous because sometimes I can’t make up my mind as to how to do it – too many options. Again, that can be a negative.”

Andy, who is the senior (or a “Master”) fitter is more likely to be dealing with those at a later stage of their apprenticeship since experience in fitting on the shop floor appears to come after having gained experience in machining and fabrication. However, it was obvious that Andy did also keep a watch on what was happening with the apprentices, and an open mind about still being able to learn from anyone on the shop floor. I asked him what he felt was the best way for apprentices to learn.

> Depends if they want to be taught; if they don’t want to be taught then the only way they’re going to learn is the hard way, by the mistakes they make. If they want to be taught well there’s plenty of people with the experience to show them. Everything basically, everything right from day one; it’s learnt from doing it.

*****

While there was full consensus about the importance of learning on the job, many also spoke of the importance of good teachers and mentors. Roger (above) spoke of his inspirational mentor. Andy the fitter had trained in a workshop where some had practised their trade for forty years and where “…there were a lot of people there with a vast knowledge of the trade”.

Phil had had very little experience of precision engineering machinery when he had started his apprenticeship. I asked him if it was scary being dropped in the deep end.

> No, it wasn't that scary really. When you've got someone that knows what they're doing and you follow him step by step … you seem to pick up on what's right and wrong with what you've been taught…
>
> Probably the biggest thing was if something went wrong I wasn't to blame - because he was right alongside me. That made things easier … the bloke that was teaching me, he had probably been working in the trade as long as what I have been now, probably twenty five years plus. So he was pretty clued up about what he was doing.
>
> I suppose the easiest way that I found in learning was being shown, or seeing, a way of doing something that *was* very simple, in my mind … if that makes sense to you (Phil's emphasis).
>
> *Like the best way of doing it.*
>
> The best way in my mind of doing it and seeing it … 'that's good, I'm going to have that' and in it goes [to the mind] and it stays there. And that could come from anywhere. That could come from any person, not necessarily one person. It could come from anyone.

Malcolm recounted an experience that demonstrated the importance of being close by to the new apprentices at work. The anecdote also demonstrates that watching, alone, can also be inadequate as a way of learning, if the person watching has insufficient knowledge of a particular technique or of the tools to be used.[143]

[143] This incident is similar to Grasseni's (2007) and Crawford's (2009) experiences of not knowing what they were "seeing". It is also similar to the tradesmen's claims (discussed later) that written or verbal descriptions of a technique without some knowledge of the "doing" of the technique, is not a lot of help.

> ...one of the young lads … to start with, he'd only been there a week or so and they put him on the lathe behind me and like you say I am good at picking up noises and I thought, 'What the hell is that noise?' I said, 'Any problems lad?' He said, 'Yes, I can't get this boring bore to bore a hole. 'Oh, okay, I'll be around in a minute. So I finished up what I was doing and went to have a look. I said well 'Where's the hole?' He said, 'I'm trying to bore it with this boring bore'. I said, 'No, you're supposed to *drill* a hole first and then put the boring bore in'. He was trying to bore with a boring bore on a raw piece of metal.

> And he said 'But I have seen you do it'. I said 'No you haven't'. He said 'I have seen you put a boring bore in without drilling a hole.' And I said 'You haven't.' He said, 'You have, I'll show you.' and he came around to look at my machine. He went, 'That there.' I said 'No, that's a U drill, mate. It *looks* like a boring bore but it's actually a drill'. He'd just picked this up by seeing what I had done and he thought, 'Oh, you can bore holes with that drill.' And at first I think he thought it was just a boring bore and it's actually a double headed drill … and he had been leaning on his handle trying to bore this hole and I laughed like hell. So three years down the line he's a damn good engineer now.

Malcolm also spoke of the depth of experience that is in the workshop. His comments demonstrate the importance of nurturing and maintaining shop floor knowledge. When I asked him about who was helpful on the shop floor, he also provided an example of one of the ways that such pieces of knowledge are passed on.

> Again, the people that have been there the longest; you've got a couple of long servers there and you've got some with very good knowledge of engineering. Then again I'm passing my knowledge down to some of the younger kids. So I'm sort of somewhere in the middle. I'd probably see a job and think 'What's that then?' Andy Houvil would know straight away, or Phil would know, because they've been there probably forty years between them … so if they haven't seen it before, it's a new job. 'Oh, it's one of these again. I've got a bit of tooling for that. I can remember how I made that.'

> And young James that's working with me at the moment on the lathe, he'll look at a drawing and I'll say, 'I know exactly what are you making here, mate.' and point him in the right direction. Just somebody knowing where something is, say there's a certain tool, or a certain sized drill or a reamer for doing a job. You'll think, 'I know how to do this, mate.' It'll save you hours … just somebody knowing where something is.

This knowledge is what Keller and Keller (1996) term the "stock of knowledge" that exists in an artisanal worksite. It is likely, at least in part, to also be the form of knowledge which Sawchuk (cited above) described as being "hidden in the cracks and crevices". It is a form of knowledge for which there would be little point in attempting to keep in any way, in written form, since its use is fleeting and often serendipitous, depending largely on who is about at the time of its need. It is also a form of knowledge that may be changed as it is passed on from individual to individual – each tailoring it to his own needs. The important thing is that it must exist and the more of it and the better people are at getting and sharing it, the more valuable it is. In other words it is not only the knowledge but also the practice of sharing it that must be passed on.

Those in the above section all wove their own experiences of and reflections on, learning, into their discussions of apprenticeship learning. Their comments also illustrate again, their search for continual improvement in their practice, and the importance for themselves, of continuing to learn. CEO Roger was no different in this outlook.

> There's a lot of learning goes on by watching what other people do. Seeing how it's done. I mean we had a job just recently. It turned to custard on us. It was tricky at the time. We had to scrap the bloody thing. It cost us thousands. We're learning; even at the top end, we're still learning.

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The Apprentices' Experiences of Learning on the Shop Floor

> In activities that are directed toward some end … the goodness of the end in question isn't simply posited. There is a progressive *revelation* of *why* one ought to aim at just this, as well as how one can achieve it.

> As you learn your trade this particular end takes its place in a larger picture that is emerging, a picture of what it means to be a good plumber or a good mechanic [or engineer]. Usually there is a real flesh-and-blood person who embodies this ideal, whom you emulate …
>
> The progressive character of revelation energises your efforts to become competent – something about the world is coming into a clearer view, and it is exciting. The sense that your judgements are becoming truer is part of the experience of being fully engaged in what you are doing; it is a feeling of joining a world that is independent of yourself, with the help of another who is further along.
>
> Matthew Crawford (2009:207)

Despite the Stafford apprentices being “Modern” apprentices, it could be seen that their learning experiences on the shop floor were largely similar to those of the tradesmen with whom they worked and whose apprenticeships had been worked under purportedly “different” systems. While in some situations engineering apprentices will have done a pre-trades course, the Stafford apprentices had all, like the majority of the tradesmen, come “straight from school”. Their experiences at school in workshop classes varied, but, as shown above, all had grown up around machines and the people who worked with them. Their comments about the formal side of their apprenticeships are noted in other chapters. The following therefore, focuses more on what or who they found helpful (or difficult) in the workshop.

Along with Julian and Grant as leading hands in their respective areas of the shop floor, Malcolm in the turning section, was also frequently cited as the “go-to” person to help with lathe problems. Evan and other senior tradesmen in the milling section helped out there. These men were held in high regard but at the same time there was a sense that everyone on the shop floor could contribute something to discussions about the work. I asked the apprentices a number of questions about their experiences of learning. I asked what was helpful to their learning.

Greg, who had had difficulty with reading at school, described his on-the-job strategy of knowledge accumulation.

> Probably someone showing me what to do would be the easiest ... And then learn from there. I refer a lot to past experiences to help me get on with whatever job I need to do. Like you saw that job I was doing with the U in it. I just used past experience … okay, what do I do? Okay, what have I done in the past? Okay, I just use that to apply to this job and we'll see if it works.

> *So you build up a library in your head…*

He reframed my bookish description:

> Yeah, a memory, yeah, I think that's how I learn probably. It's like little scenarios and I put them all together and that's what I have got.

Greg referred to this personal memory on a later occasion, as his "memory bank". This, like the similar experiences described by the other apprentices and tradesmen, may be regarded as an individual "stock of knowledge". In this scenario the stock of knowledge entails the "notion of knowledge as potentially reorganisable according to the task at hand" (Keller and Keller 1996:9). As such, it represents the cognitive processes at work in not only artisanal production, but also in the many professions and other forms of work, and even everyday living, where those involved encounter new scenarios, carry out new tasks, solve problems, make diagnoses, or travel along other new pathways.

*****

Working Things Out

James' answers to the questions revealed another aspect of the work that I came to realise was important, not only in the learning process but also as an essential element of job satisfaction for many of the men. He indicated that being challenged by something new represented a good learning experience for him.

> Probably when I am given a job that I don't really know how to do it, and I'll think about it and if there's anything I don't know how to do or I don't understand I'll ask one of the guys about it and then they can tell me what they think and I can try it. If it works then I know it and if it doesn't then you try something else.
>
> *What are some of the things you find most difficult?*
>
> Just getting a job that is quite hard. You might not be able to hold it the way you normally would with another job. Just having to think about it a bit more than you normally would. I did a job this afternoon where I couldn't actually hold it in the jaws because I needed to machine the outside but I couldn't hold the inside so I just had to squash it up against the chuck. Stuff like that where you can't do it the way you normally would.
>
> *And no-one else could work out any way of doing it?*
>
> I'm sure if I asked someone they'd be able to give me a million ways to do it.
>
> *So you just wanted to plough on by yourself?*
>
> Well, I have sort of done a job like that before. I wasn't a hundred percent sure it would work, but no, it was good.

James is, in this instance, drawing firstly on his own knowledge and experience before asking others. He also provides an example of the way that within the “procedural enactment” of his hypothesis (or practical attempt to achieve the planned outcome) “ideas are at risk” even while the enactment has the potential to provide him with a new source of knowledge:

> Knowledge and action are continually in revision and development; we must understand them as mutually constructed and equally dynamic entities (Keller and Keller 1996:109).

Keller and Keller emphasise the role of imagery in the processes of artisanal blacksmithing. In the blacksmith’s case, apart from when replica pieces are being attempted, the idea of the finished object may not always be fully realised but is dependent to some extent of the progress of the work. For the engineers the design is known; what is not always known is how to set about making it. It is depicted in two dimensions and must be imagined in three dimensions. Their challenge is to find the best way to achieve exactly that designed object, to the prescribed dimensions.

A large part of the imagery required of the precision engineer is of the tools, techniques and processes he will draw on to *man*ufacture a particular piece. Most importantly, he must also “imagine” the order in which these processes will be used and procedures carried out if the end result is to be attained. The necessity of this form of planning is a key part of the shop floor work at all levels. Every part may require a specific sequence of procedures and also to fit with other parts whether they are to be assembled in-house or not. All who work at the company have to be aware of the procedures necessary for the movement of those components to other areas of the shop floor for further additions or alterations and, finally, to the processes of assembly and final polishing and finishing.

Knowing where and how each step fits within the wider requirements of the workshop can be described as one of the meta-level parts of practice and of shop floor knowledge that the apprentice should gradually acquire over time. The more complex examples of this were evident in the descriptions given by the more senior tradesmen, in line with their more complex level of knowledge. For those such as the shop floor manager and the leading hands, who have to know who can do what and when, and where that needs to happen, knowing how work should progress through the workshop, is the essence of their roles.

I had commented to Greg that, having expected the work to be of a more manual nature, I was very surprised by the amount of mathematics and analysis the men had to do.

> Yeah, reading the measuring equipment and all that sort of stuff.
>
> *Yes, and being able to interpret drawings...*
>
> Yes, take it from 2D and put it on to 3D. Pull it off the paper and put it onto the material. I don't know, but I suppose it's like artists sort of look at it. Oh yeah, this is what it's going to look like when it's machined...
>
> *Your imagination.*
>
> Yeah, I know what it's like; I've just got to get all the numbers in the right place to make sure it all corresponds with the drawing.

Greg described another situation where he was struggling for a solution for milling some plastic components and had called James over to ask for some ideas. He and James had then worked their way through the problem together. Their backs were towards me. Greg had glanced in my direction but turned back to the work. I had watched for a while from a distance but moved on as, rightly or wrongly, I got the feeling that they did not want a spectator, certainly not one hanging over them.

> We discussed it, because that's how I learn. We just started throwing ideas around, how we can do it and, yeah, we came up with an idea and it worked fine. Okay, we defied a couple of tradesmen's advice but … well they said to use two cutters which I found was a bit stupid … it was going to take twice as long. They reckoned use a slitting saw to do the little slot then cut it out with a triangle tool that you make up. I just thought well why do that, we'll just make a complete one and take it all out in one cut and see … we'll go from there.
>
> *So you made a special tool for that job?*
>
> Yeah, a triangle with a little leg on it.
>
> *You made that there. Where do you make the tools?*
>
> Tools, for the plastic, we just made them out of stainless. Stainless cuts them nice. But you've got to know how to put all the cutting angles on it, and everything so it cuts, which, being a tool-maker I should know how to make tools and stuff.
>
> *So your knowledge from before helped you because some of the other guys didn't know that process.*
>
> No, they didn't, exactly. And I felt that it was a lot faster. And it worked out fine. Everything came without any problems.
>
> *They would have been impressed?*

> Yeah. It was good. I get into a bit of a 'trance' and start thinking about things, 'Oh, what do we do?', and we try tilting the head on the mill one way up and it doesn't work, can't quite get there, so we tilt it right back the other way – yeah, worked out fine.

I commented that having a wide variety of work must help.

> Definitely, yes – you build up a memory bank so that you know what to do next time.

Evident in the exchange between the two apprentices, is the emergent nature of knowledge building (Biesta 2007; Keller and Keller 1996; Edwards 2010).[144] In his description and analysis of his processes of problem solving, Greg is also using what Dewey described as the "dramatic rehearsal (in imagination) of various competing possible lines of action" (cited in Biesta 2007:15). Biesta explains further, again drawing on Dewey's work:

> The choice of a specific line of action should be understood as 'hitting in imagination upon an object which furnishes an adequate stimulus to the recovery of overt action'. Whether this choice will actually lead to coordinated transaction – whether the problem will be solved – will, of course, only become clear when we act. Thinking, deliberation, cannot solve problems, nor can it guarantee that the chosen response will be successful. What it can do is make the process of choosing more intelligent than it would have been in the case of blind trial and error (Biesta 2007:15).

While "trial and error" and finding one's own way are noted as important for learning, the apprentices can also be seen to acknowledge the importance of their more experienced mentors.

[144] Keller and Keller (1996:175) conclude that "productive activity is creative, innovative, and flexible" and "that humans acting in the world" exhibit simultaneously within themselves "the crux of emergence and the context in which knowledge and practice can be construed as both principled and protean".

In an example of the value of having experienced teachers with "old knowledge" Josh, in the fabrication section, described how his father had shown him a solution for a job where the customer-supplied specification had not shown all the necessary dimensions of the component. He explained to me that the job could have been taken to the office and the designers would have drawn it up on Autocad and from there been able to supply the dimensions needed. But that would have been "a bit of a process". Instead, his father had taught him

> …the old way of drawing it full scale on a bit of wood or a bit of steel and then measuring it there, instead of going into Autocad and doing a scale view. Just do a full size, take the measurements from there and then cut it.
>
> *So you're making your own pattern.*
>
> Yeah. Getting our own measurements...

It was also perhaps an instance where there was a clear preference for a "hard copy" template, and even perhaps not just a way of finding his own solution to the problem but also a way of not having to ask "the office".

From these and other discussions it can be seen that there are many different kinds of help that are given and received in the course of the work. There is straightforward advice on how to approach a job or information about where to locate something, often given in situations which are themselves "straightforward", e.g., to a new staff member or, when pressure of work means there is little time for explanation, elaboration or analysis. There is the mentoring that is given to apprentices where advice may or may not be given, but where information emerges through discussion or demonstration, or from a short period of supervision where the apprentice may attempt a new procedure. Emphasis is given to the idea that there may be many ways to approach a problem and that each person will find their own “best way” to practise.

*****

Learning from Tools and Machines – Speeds, Feeds and Variables

From spending time on the shop floor I realised that the men learned also from the machines that they worked with. I wanted to know more about what they thought about this as a part of their learning experiences. I asked them what they learned from working with the machines and tools and how they learned what they were capable of.

> What are they capable of as in…?

> *Like how you learn how far you can push them?*

> I think that just comes with experience and past experiences. Oh, okay, I’ve got this sort of material, I can put it on to this sort of feed and this sort of speed and try to get the maximum usage out of the machine, rather than running it slow and spending forever on a job. That’s how you get your speed up so the company’s making money … and know what the tools can handle and what they can’t (Greg).

Like the tradesmen, Michael commented on the differences between machines even when they may appear identical.

> …not every machine is the same. Depending on how old or new it is … I suppose it’s like a lathe or a mill. It says in the book … you would probably push it a bit harder and it cuts at faster feed rates than it says in the book but you sort of learn that… once you’re on it and you can hear

what it's doing, that helps if you can push it a bit harder. I suppose the book's not always right. It's a safe guideline.

You want to be able to have long-term reliability instead of wearing it out all the time.

James had some similar comments on the subject, shown in the following discussion after I had asked him the same questions.

Well, there are tables and charts and stuff of what a tool can do but you might go and put that into practice and then you might find that something else works better – like running it a bit faster or using a different cutting fluid or something like that. But generally the tables are pretty accurate.

So it's that speeds and feeds thing?

Yes.

And knowing your machine?

Yes, that's another big thing.

Mmmm, they all seem to be different and change…

Yes, there are some machines that might not be entirely accurate and you have to know the machine to compensate for it.

I remember on one of the lathes you said that you add something each time you put work into it.

Yes, the computer is about .03 out.

Did somebody tell you that or did you work it out?

> No, I figured it out pretty quick, but then I was saying to one of the guys that it was out and he said, 'Yeah, I know, its .03'.

We laughed.

So no-one had told you?

> No, but you soon find out when you start buggering stuff up.

While the apprentices quickly learned that they had to get to know their machines, the tradesmen, like Jim, in his comment that "those machines have got habits", were equally clear about the importance of this aspect of the work. Malcolm's answer was typical of many.

> Mmmm, each one, each machine's like an individual … if you had a bank of machines and you think they're all going to do the same thing; they don't. They've all got their own little quirks. Some like, if you think you want to racket some material off you'll think well I won't use that one because the horsepower's not up on that machine, or, this one's better at screw cutting, or, this one's more sturdy for heavy cuts, or this one's better for finishing. It's all down to getting used to the machinery you work in. I suppose it's like driving a car … you know what your own car is going to do. If you get in somebody else's you may be a little bit tentative with it. Each machine, it's just about getting used to it.

> Some machines you can suss within a day. Other ones can come back and bite you in about a month and it's, 'Oh, I can't get away with that'! Like that NC that I'm working on now, I'm working now a lot faster than what I did when I first went there. I mean, I knew how to work it, but I didn't know its own little quirks and foibles. But the more you work it, the more you get used to it.

A short episode on the shop floor demonstrated not only the necessity of knowing a machine well, but also an example of the way shop floor learning is an ongoing part of the men's lives. It also provides an example of the use of the senses. The tradesman in this instance had only recently been switched from the milling area to one of the lathes.

> *Julian had been showing a tradesman something on the lathe and said he would come back in five minutes.*
>
> *They had been discussing the feeds and speeds as it appeared that the bearings on the machine were wearing. The tradesman was listening intently. I asked him what he was listening for. 'I'm listening for the rumble. Yesterday it was noisy. If that is vibrating then it causes the chuck to vibrate and can put the whole thing out.'*[145]
>
> *He smoothed off one end of the part then seated it back in the chuck and screwed it in. Jules came back and tightened it further, '... so there would be no gap'. They examined the swarf that was coming off the piece. They then discussed the tools, feeds and speeds and the depth of cut again (Plate 49).*

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[145] The tradesman also explained that vibration could cause "chatter marks", grooves which would ruin the surface of the component.

Plate 50: Examining the swarf.

The tradesman told me later: 'The way I was doing it would have cost, taken much longer. These machines are only making money when they are working'.

Jules had said 'You're getting a 4 – 5mm cut now. You won't get it twice as fast but you'll probably get seventy-five percent faster' (FND 5.2.08).

I came across the tradesman later that year when he was turning a large (150mm diameter x 700mm) solid piece of stainless steel. Again, he was working very tentatively:

> *He said that the stainless steel alone was worth $2000 so he felt a huge responsibility to not make a mistake (FND 23.9.08).*

Also evident in many of the above exchanges is the awareness that the tradesmen have for the needs of business profitability. Both their wages and their actual jobs depend on the machines being in operation as much as possible, and that during that time they are used skilfully and efficiently.

*****

While the men must get to know a machine's capabilities, this is only a minimum for doing the job. Getting the best out of a machine depends on the operator's knowledge and expertise with that machine. Roger spoke of this when he was discussing the problems they had had with the new Victor multi-function machine. There had been difficulties in trying to get the programming to match what they wanted the machine to do. I asked if trainers were supplied by the companies that made the machines.

> The guys that operate the machines – they know a lot more about the machines than the service people we get to come and train us. Because all the service engineers know is how to service them and they know the basic functions of the machine. But to actually make them hum – you only get that when you get super-skilled like Phil – and Malcolm in some respects. They're the ones who make the machines hum.

He also noted at another time that Malcolm had brought the use of the Alpha lathe "to a whole new level".[146] The point about a person knowing what a machine does or how to make it work, but not know how to make

[146] Similar instances are recounted by other authors. Stamps (1997) for example, tells of an instance where a highly automated machine always ran better for a particular operator but nobody could ever work out why.

something on that machine, was also identified by a number of the tradesmen and is discussed in the next section.

*****

Learning by Doing and Learning from Reading

A number of aspects arose from my questions about learning on the job, in comparison to learning from books. Firstly, for the apprentices, there was some focus on the immediate written requirements of their apprenticeships. The second aspect of the topic derived from my interest in what the tradesmen and apprentices believed they could learn from books (or, codified information), in comparison with what they learned from others, and from the machines, "on the job". A third aspect, that was related to doing the job, was the usefulness or otherwise of written technical information, manuals, tables and charts. Lastly, it became apparent that issues to do with a lack of codified information at appropriate points were responsible for some of the bigger frustrations that the tradesmen and apprentices experienced.

As a first year apprentice, Josh found he had to do quite a lot of reading, with course-work from NZQA, block courses, and the written work needed to complete his unit standards evidence for the apprentice company. "It's sort of like half and half, half books and half practical, but there is quite a lot of bookwork" (Josh).

James' answers also moved between ideas of learning from books and learning from doing. He told me one day while I was watching him at work that he had learned to make tools “out of a book”, but that not everyone would be able to do this.

> …it’s weird, I’ve just always been able to read things, read something and remember it. It just sticks. Yeah, you can learn some things out of a book but some things you have to be shown. A lot of the time in this trade it is just experience. Like doing a job, there might be a few ways of doing it but you don’t know which one is the best until you do it, and there’s not really anywhere you can read about that sort of thing.

> *Are there any ways that the written components do help your learning?*

> Yes, there’s stuff you can’t learn [on the job] about the metals themselves … that stuff you can pick up from a book … but actually machining the metal, using it, it’s more experience than knowing about it.

In this instance James is describing the way “knowing about” something may be insufficient for the work or “knowing how”. It is in the embodied experience of doing the work that the knowledge is gained.

Greg felt he gained little from trying to learn from reading about the job. Despite this, he had a pragmatic view of his difficulty and had found ways to compensate for it.[147]

> I suppose there’s two ways and one’s by doing and one’s by reading or something, learning like that. People that read a lot of books are usually very smart, have a lot of knowledge, if they can retain all that from those books; whereas you look at someone like me, just because they can’t spell and read so good, they more or less put you in a class and say you’re dumb. It doesn’t mean you are dumb, you’ve just got a different train of thought, I suppose.

[147] Greg frequently referred to his lack of ability to read and of being considered “dumb” at school because of it. On the other hand, his ability to make things, his affinity with the machinery, and his ability to do maths, he took for granted. He also seemed unaware of the extent to which he was outstandingly capable of giving detailed and articulate descriptions and analyses of his work and practice in conversation.

You've got a different sort of knowledge.

> Yes, a different way of processing it … anything I read … it doesn't register. I have to do it and I have to … like if someone shows me I can do it and if I do it myself I can do it and if I mess it up, I learn from that and carry on. So I can't really read a book and think, 'Oh yeah, I know about that'.

Michael and Jared showed a similar preference for learning from doing the work. I asked them whether they thought that the written work they did for their unit standards was helpful in their work. Michael commented that for a while he had written down notes while he was working and that these could be helpful for remembering some procedures. I asked them if they learned much from reading books.

> I more learn from doing things. If someone shows me … I learn straight away. More so hands on than reading out of a book (Jared).

> I'm pretty much the same. I can't just read a book and do it. I've got to sort of do it myself to work it out (Michael).

*****

The tradesmen, having worked at the job for many years, also strongly believed that the job was learned on the shop floor. While they acknowledged the usefulness of some tables and manuals, it seemed that they had left "bookwork" learning behind, many years before. Their answers and other comments also often emphasised the use of their embodied knowledge, in preference to always relying on tables or other technical information.

I asked Kaleb how much he thought he could learn about the work from formal study or from books or following manuals and such things. He spoke of his time at Polytech when he was doing the theoretical side of his cadetship and noted that he often found it difficult to understand how he would apply what he was learning in practice.

> I'm a pretty strong believer that the best way of learning is by doing. You can have all the theory in the world and you still wouldn't be able to do the job. But if you can spend some time with someone who can actually show you, I think you can get a lot more out of that. You do need to reinforce the theory, but you do need to do that in a practical way, particularly in this field of work where it is a very practical job and all the guys here - they are all practical people, so you confuse that with a whole bunch of theory - it doesn't go very far (Kaleb).

I asked Julian a similar question and in his answer he identified what I suspect often caused difficulty in following technical instructions – the problem of interpretation. This is also one of the reasons why a written explanation of a technique is frequently inadequate. He pointed out the need to have the practical experience or basic skills before the theoretical knowledge made sense.

> Because there is so much interpretation involved. We're not talking about getting an engineering degree are we? We're talking about learning engineering work … because there is definitely a difference between a degree in engineering and this. They have no practical experience on any machine - ever. The brightest dude in the world – but that's different from learning machines.

> …I think you need to understand the tool before you can read about it and use that type of information, because reading about it you have no practical understanding of it, so I don't really see much in that. I think when you've got experience you can go away and read a manual, or about something that you may specifically want to do and you should be able to figure that out. And then go back and adapt what you've learnt to a machine, but I think primarily you've got to have that basic knowledge of the machines and what they're capable of prior to reading a manual.

I mean a manual will help you, don't get me wrong. It'll show you how to use a machine but it doesn't necessarily tell you how to make something on a machine, if you can get the distinction there. Because the other thing is, you are employed to make things.

Andy's response was equally clear. I asked him how much was learned on the job.

Everything basically. Everything right from day one. It's learned from doing it. Whether it's before your training or not. You can have an idea but until you do it it's not proven. I'm not an academic. I loathe bookwork studying. That's not my cup of tea whatsoever. I'd much rather be doing it, learning from my own mistakes or learning from other peoples mistakes. Just, actually, doing it.

You still have to know the fundamentals. A bit like English, you've still got to know how to spell and read and write, without that you're lost. You don't need to know about Shakespeare and Napoleon and all that … that's history.

Yes, you've got to know the basic rules and things.

If you can read and write and spell and add and subtract, follow formula … trigonometry is the main one in engineering which basically comes down to algebra, formula and stuff like that … But there are manuals and little booklets with all the formulas, charts and all that so it's not difficult to pick the book up, because sometimes you want to use it one week and then you might not use it for a month or two. It's very hard to keep fluent at something if you're not doing it all the time.

You need to know where to look for those things. It seems to me it's like in research; you need to know where to find things.

Well, this computer has Google.

Malcolm, while emphasising the importance of shop floor learning, also believed that the different forms of learning were useful.

> Myself, I learned an awful lot through the 'old hands', the people that were on the shop floor. You'd go to college, you'd learn it, the way the lecturer told you and then you'd go to work and watch a guy who'd been doing it for years and they'd know all the little shortcuts that they had learnt along the way and little things you can get by with, and you just learn lots more off the old hands … definitely. I mean it was a definite advantage to go to college and learn off the tutors, in the classroom environment. You're learning your maths, your physics, your tech drawing etc … definitely; for working a machine, go with a guy who's been doing it for years; definite.

I asked Evan about "book" learning. He had had a long career in a variety of areas of manufacturing.

> It doesn't matter how much you read a book or read a manual, unless you actually do it, get used to doing it, you can't … I mean somebody could read how to machine a particular thing in a book, but really you just wouldn't be able to do it by instructions in a book.

> I just need to do it. Ninety-nine percent of what I have learnt in the last forty years has been purely by doing it; definitely by doing it. I think with most people, that sort of work you don't really learn a heck of a lot by reading how to do it, because everybody tends to do things differently.

Phil had similar feelings about the value of reading about the work.

> Well, I hate reading books anyway. I'm hands on. I like getting in there and actually making the parts. Seeing the finished article; start to finish. You've got a block of whatever and it turns into this finished part. That's what I do. Reading books won't tell you hardly anything, really, practically, or it could confuse the hell out of you – if a book was trying to describe how to make a part.

> *And the manuals that tell you how to operate machinery?*

> Oh yes, it's a far more difficult thing to read a book and try to get around things by what a book tells you, than actually … do it.

The challenges of the interpretation of technical instructions are one aspect of the difficulty of following written or verbal descriptions of techniques or processes. The other is the difficulty, as described by Marchand (2007, 2010c), of explaining the “multimodal” actions that may be required to perform even quite simple tasks. It is then easier to understand the reluctance of those who work with tools and machines to use codified material as a whole or to attempt long verbal explanations. While “manuals, tables and charts” and some technical information may be of intermittent use, the ways of doing the work are learned best by watching others and through trying it for oneself.

*****

Some of the tradesmen did, however, articulate the usefulness of learning from written information and also the necessity of recording certain information on the shop floor. Problems arose when this did not occur as it should have.

Blair came to Stafford specifically because of his experience with laser machines. While he had “no papers” and had learned most of his engineering on the job, he had been frustrated by the lack of written information in relation to the Stafford machine's past operation. He emphasised that there were times when information *had* to be recorded and available for others to read and use.

The laser operates through a computerised system, and with the variety of work carried out at Stafford, individual programming is required for each job. When there are re-orders of a similar job, these may occur some weeks, months or even years apart. There appeared to be several problems with the operation of the laser machine; firstly, it had been set and reset in an unsystematic way, and, secondly, the setting and resetting had resulted in the machine's operation being affected.

> …that laser. There's a stack of manuals with it. We've got problems with it at the moment – just little things that are not working properly on it that should be working; so you have to study the manuals to find out how it works, so you can check to see if they are working right. Luckily we have got a computerised data base for some of the workings on it – some of the features, but some of them we haven't.

A further difficulty resulted from the lack of recording and updating the files of work done so that they would be accessible to others in the future. In the fabricating section of the shop floor, the laser machine is located next to the folding press, since laser-cut material is then often folded before going on to the welding section.

> What me and Chris [the press operator]148 have been doing in the office is organising all the files and folders as well on the computers, get the drawings right, the access right; because when we first started you just couldn't find out anything. Now we've got them all in alphabetical order and we know which customer is where, and two clicks and we've got the job. Before, you were having to do searches on Windows, just sitting there for twenty minutes while it searches all the files and folders … so now we've organised it all.
>
> *So hadn't it ever been done before?*

[148] Chris began working at Stafford some time after I started the research but for a number of reasons an interview with him did not eventuate. He came from a career in the aviation industry and with a great deal of expertise. He was soon involved in not only the work at the new press but also as a part of the design team.

> No. People were just saving it anywhere they liked which is ridiculous. We're still finding it now, where they give us a job and there've been delays, and you'll go and find it and they've been doing it for the last ten years, the same job, and I can't find it. That's where it should be, in that folder, and someone's moved it or not saved it … It's the only thing that irritates me is that most of the information is in somebody's mind!

As he noted, if that person is away on leave or overseas, or has maybe left the company, the information is no longer immediately available, if at all. Drawings were also often changed but the changes were not saved on the computer programme which controls the laser cutting path for that component.

> So when I cut it on the laser they'll say, 'Well that's wrong, that should have that bit.' I'll say, 'Well where is the information?' 'Well it's up here.' 'Well that's no good to me.' We've overcome that hurdle, just about. Having that information in your mind is no good.

> They've got to learn to record their information so other people can use it if you're not there. And that's what we've done in the office, me and Chris. Before, it weren't there. The place runs, but it runs very, very slowly because somebody's not there - that information has got to be tracked and traced and found. I found it very, very frustrating when I first started. But we're getting there slowly.

A similar problem caused ongoing frustration in other areas of the shop floor. Whereas in the above case the gap in the communication system was largely between tradesmen, in the following scenarios the "gap" in the system is between those on the shop floor and the designers - "the office", or, the client's "office". In this case components or assemblies which were altered during the processes of the work, to improve the design or correct an error, were not updated on the specifications. If the item was made at a later date, the same problem was encountered, particularly if the job was being done by a different tradesman. One tradesman explained:

> I have had drawings for four or five years and every time it turns up I'll write on it, 'That's Wrong'. The next time it comes out; the same thing again. They're never corrected. I mean, I can remember them but if

> somebody else gets them … he doesn't know there's a mistake, it's done wrong, or … some silly things.

*****

While other office/shop floor issues also caused frustration, the tradesmen, wherever they knew why an issue had arisen, were generally tolerant of the situation when they could see both sides of the problem and felt that it was unavoidable. Wherever they could be, some were proactive in trying to minimise the problem. Malcolm provided an example of this when he spoke of his frustration at having to make separate lots of the same component, sometimes only hours or days apart. Although the cost of the time taken to do a new set-up each time falls on the company, the tradesmen themselves do not like inefficiency on the job, or, the feeling of having "their" time wasted, or not used in the best way.

Sometimes this problem was unavoidable due to the erratic nature of some incoming orders, but Malcolm would often try to find out if it was likely that more of the same were coming. Given that a lot of the time spent on a job can be in the set up, he could then rearrange his work to try to group them together. As explained earlier by Kaleb, this strategy of grouping like runs of work is part of the overall management of the workshop. However, given the range of items made, such planning also relies on information from outside the company.

While some of the issues can be seen as more to do with the work systems within the company, some are also, effectively, to do with the writing or codification of the correct information, in the right place, at the right time and the accessibility of that knowledge to those who need it. However, these issues are often seen by the tradesmen and apprentices as management (or "office") issues.

*****

Makers and Designers

While the working out of how to proceed with any particular job is under the control of the individual tradesman and often relatively unproblematic, difficulties arising around what were perceived as “design problems”, or “office problems”, were at the heart of another frustration that the tradesmen and apprentices experienced. Some designs, either in-house or customer provided, proved difficult or impossible to actually *man*ufacture. The main source of these problems was perceived by those on the shop floor to be the lack among the designers of practical experience in machine use, in hands-on knowledge of *man*ufacture or of assembly processes, and in particular of those who were university trained.

As noted by a number of the participants, the experience of making provides a useful dimension of knowledge for designers. Those without such experience sometimes designed parts which were impractical to manufacture.

> Well, you’ve got to have both sides because you can draw things [but sometimes] I’ll say, “Well we can’t even make it”. We can’t even fold it. It won’t physically … it just won’t go on a press. You can draw anything, but you can’t make everything (Grant).

Lack of designers’ knowledge of available sizes of materials could also result in unnecessary machining. Another common problem that arose from the same source, that occurred when it came to the fitting stage, was that a piece of metal may have been cut to the designed size and shape but the designer had not allowed for the loss of dimension that occurred when the piece had been subsequently folded. When it came to be fitted, the piece no longer matched what it was to be attached to.

Malcolm remarked that there did not appear to be a lot of consultation between the designers and the tradesmen, but that they did get together sometimes and, “Sometimes in the right order as well”!

> …we usually sort it quite quickly … sometimes the shop floor guys will go back in and say, ‘I think this is a bit better. Let’s scrap that join and start again and take it from there’. It’s all down to the learning curve. We usually get there quite quickly.
>
> *Right, so you think there’s not a lot that can be done to improve it?*
>
> Possibly, like if you had some of the guys from the shop floor on the design team and got round the table and sorted it. There could be a bit more of that.[149]

This problem between designers and makers is, as the apprentice coordinator observed, an old one, “an old chestnut”. I did not interview the designers at Stafford and spent only a very brief time in the design office. In that short time I did gain a sense of the complexity they faced when asked to design new assemblies or mechanisms and the many components required for those. The range of work that is undertaken at the company is very broad and ranges from simple components to complex mechanisms and structures. In a sense, the designers approach a job from the top down, whereas those on the shop floor are making and building such items from the bottom up. The challenge for the designers is to design a machine that works and for the tradesmen to make a machine that works. That machine is then *man*ufactured, component by component.

[149] During later discussions with Roger, he pointed out that he had begun inviting a tradesman to each weekly management meeting on a rotating basis and that this was proving a very popular intervention. Also, Chris who came to work the new folding machine, along with Blair who worked at the laser cutting machine, were spending more time in the design office than their predecessors.

Many at the company commented at various points that the best way to avoid these issues was for the engineer designers to have a practical component in their training programme. The CEO had commented that those such as Ryan who had both practical and design skills, were of great value in this respect. At the same time, from talks with Ryan, it was fairly clear that regardless of his training in both areas, his preference was still for the challenges of making, fitting and assembly.[150]

The CEO had had discussions with the engineering department at the university about introducing practical internships for degree trained designers. However the duration and timing of a programme suggested by the university did not match what the CEO believed would be necessary or practical in terms of the reality of the work of the company. He said that for such an internship to be useful it would need to be of at least six months duration (FND 23.9.08).

Steve Andrews, the high school technology teacher, also emphasised the need to train more technician/designers who understand "the whole process".

> We're doing okay at the two extremes. We can turn out mechanics, plumbers and electricians, and we've got the academic people in universities doing research, but we need more in the middle – the technicians who can design and invent, and also make things and make them work. Three good designers can keep fifteen tradesmen in work – that's impressive (FND 19.5.09).

[150] CSI CEO Danny Ryan whose work was described along with that of the artist/makers, had a structured focus on apprenticeship in his former manufacturing company. Being larger and with a greater number of apprentices than at Stafford, he had had a system where trades apprentices and design office staff spent time in both areas of work. He felt that this strategy helped bridge that gap between the "office" and the shop floor and the difficulties that arise when designers have little knowledge of actual *man*ufacturing. While it was not considered a formal cadetship arrangement, it nevertheless served a similar purpose. However, regardless of the size of the company, his ethos and goals in general were similar to those of the Stafford CEO.

While many of these issues may not appear directly related to apprenticeship learning in the company, it is important that they are considered. The apprentices are faced with many of the same issues as the tradesmen. They not only have to learn how to do their work, they also must learn the ways of the shop floor and of the systems that operate in the wider company. They must learn how best to negotiate their way through those systems, identify where there are problems and what they can do to ameliorate any shortcomings or to assist in such situations. Again, these are skills that like many others are learnt in doing the job and would likely vary in different workplaces.

Despite the above problems, it is very clear by now that most within the company, in particular the tradesmen, do value the learning that is done on the shop floor, far more than any other form of learning. Instances of when they feel it is necessary to have information recorded grow out of the work itself and are particular to the needs of the processes of it. While many are clear on what written information they do require, and may acknowledge the value of certain areas of book learning, this is considered only an adjunct to the "real" learning which is done during the processes of "doing the work". Much of their knowledge of language, literacy and numeracy, like the many other forms of knowledge which underpin their shop floor learning and practice, has become tacit.

*****

In addition to the requirements of doing the job or, for the apprentices, completing the necessary unit standards for their apprenticeship, the general interest of the men at all levels in the work they did meant that many instances of self-initiated learning also occurred on the shop floor and often in their own time. These appeared to be driven simply by a wish by the person to gain a new skill, as a way of broadening their knowledge. Josh, whose apprenticeship is in light fabrication, provided an example of this when he mentioned that as well as his current job he would like to know how to run a lathe.

Would you go on a block course or just ask someone there to show you?

No, probably get, just even Malcolm to teach me, even after work sometimes, or even at lunchtimes, just show me and then ... do my own things.

On another occasion I came across Greg, when he was still an apprentice, showing one of the older welders how to use the lathe. As a fabricator, the man did not need to do turning, but simply wanted to know how.

****

While a number of problems and issues of contention are included in the above sections, the general overall feeling about the workplace was a positive one. Every person I spoke with had a number of things they liked about the workplace, their workmates, and the work itself. The importance of these elements and the way in which they may enable, or, on the other hand, may be detrimental to learning, should not be underestimated.

The ongoing learning experiences of the men, accelerated and enriched by actually doing the job, are continued in the following chapter. Also included there are the stories of how the men experience their workplace and the importance of the culture that exists there and finally some of the less visible elements of practice. These stories will demonstrate elements of the apprenticeship experience which are either not a part of assessment or are otherwise taken for granted. They are, however, essential parts of the experience of apprenticeship, work and good learning and emphasise the human and sensual elements which contribute to those experiences.

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Chapter Eight

Learning on the Shop Floor - Part II

Challenge, Complexity and Culture

> *There are only three reasons why they are here at this company:*
>
> - *the work is interesting*
> - *the culture*
> - *the wages*
>
> *The workplace has to be dynamic, has to be challenging, you have to keep engineers interested.*
>
> Danny Ryan CEO, CSI[151]

In the above comments, Danny Ryan summed up neatly, the reasons why he thinks a majority of the men were pleased to work at Stafford Engineering. While these three elements have already been indicated in earlier chapters, in this section I will focus more directly on how they are experienced by the men in their everyday work. This will highlight the importance of the kinds of work being done; the importance of

[151] FND 26.8.08. As noted in chapter four, Danny Ryan formerly owned an engineering company but is now CEO of a design-only company.

variety and challenge, the men's pride in being able to do it well and the satisfaction they gain from it. On the other hand, contrasting comments demonstrate the very personal and individual nature of practice and the need to have a disposition that suits the work. The work made, the conditions of its making, and the culture that enables it, represent a complex amalgam which, when well made in itself, is the locus where knowledge may also be made and learning may flourish.

In addition to the above I consider the importance of information gained from the less visible aspects of the work; through the use of the senses and the importance of both these elements, and the effects of emotion, to both the work and the learning of it. I expand my discussions of the use of language in relation to skilled practice. I also discuss the way that knowledge is manufactured and sustained through the processes of the work. Essential to the apprenticeship and wider learning that occurs there are the social processes which are involved in the participatory practices which underpin the maintenance of workplace knowledge.

*****

"Nice parts", "Good Looking Pieces" and "Beautiful Things".

Despite being mostly only a short time into their careers as precision engineers, the apprentices already had clear ideas about the sort of work they liked.

I asked James what he liked making best of all.

> Stuff that challenges me pretty much … where you're making a part where there are several different operations that you have to do, you have to think about how you are going to do the job … yeah, just the stuff that makes you think about it.

Pride in what he did was also evident in James' answer when I mentioned that sometimes they didn't know what the parts they were making would be used for. Any one machine under manufacture comprises a multitude of parts.

> Well, on the drawing it does tell you what the part is for but then there might be twenty other parts that go in that assembly and it's just what each part does. Sometimes you will make something then a few weeks later you'll see the machine going together and you'll look at it and you'll see your part sitting there.
>
> *That would be quite neat.*
>
> Yes.

****

After chatting with Greg one day I made the following note:

> *Greg showed me a part he had made when others had said he wouldn't do it. It was a screw and bolt mechanism which works beautifully. He keeps it as part of his 'evidence' and is very proud of it (FND 23.9.08).*

Later, in his interview he explained further:

> I need to do something precise and then stand back and have a look and then 'I made that'.
>
> *You get a lot of pleasure out of that.*
>
> Yes, accomplishment, something like that. Yeah, take pride in your work.
>
> *What makes a piece more attractive or a more exciting thing to make, for you?*
>
> Probably the more intricate, the more challenging … as in the way it's machined, how it's machined, the size of the tolerances. Yeah, and just really having to think about it...

He also liked variety in his work.

> Yes, that's what's so good about it. You can go to work the next day and 'What am I going to make today?' rather than you're just making this product and that's it; you're on a production line and you're making 20,000 of these which is pretty dumb. You'd go bored pretty quick.
>
> *And what are the things that are important that you gain from the job.*
>
> Satisfaction, experience; you always learn from the job that you have just done and you're only as good as the job you've just done beforehand. You're only as good an engineer as what you put out, so … I don't know, but if you're just making simple components then that's as good as you're going to get, so you need to try and up-skill. I enjoy that sort of part of it.

*****

> I prefer framework – like building frames. When they're polished they look nice so it makes you appreciate what you have made and you want to make more. Yes, I don't mind making frames, even though they annoy you sometimes because they bend, get out of square but – they're clean to make (Josh).

*****

The tradesmen were no less proud of the work they made and also enjoyed the challenge of more complex and interesting work. During Grant's interview I commented that I liked the look of the dashers that were made at the company.[152]

> Yeah, they're a hard case machine alright – a work of art really. It would be interesting to see it going inside the machine with all those blades flailing around.

The challenge of the work and pride in his workmanship were obvious sources of satisfaction for Jim, a fabricator:

> I think it has to be - there was a job today I've enjoyed. I like to work with pipe work, stuff that intersects with one another because after working at Grigg's and working with thin sheet again, it's made me pretty good at it and my welding's neat and I keep the distortion down and they generally give me those sort of jobs I think because I can generally do a good job of it. But I like to make these little hoppers … I like making those and this thing I was making today, where all four pipes had to interlock with one another and then the big pipe goes on top of that. Are you there Tuesday next week? It will still be there so have a look round for that. Have a look underneath where all the pipes – where it's all welded all the way around (Plate 51).

[152] The dashers are mechanisms for food mixing machines. One is illustrated, fixed in the late, in plate 28.

Plate 51: Jim's little hopper.

Malcolm also confirmed the need to be challenged and showed his pride in his work:

> …there are some particular jobs … you just get a bit of satisfaction out of making and you think, 'I made that, that's good.' For example the other day when I made that plastic bottle,[153] the amount of people that passed that around the workshop and said, 'Look at that, look what he's just made.' It's novelty value on it. And you do. You think oh…

> *So challenge, because that was going to be a bit of a challenge.*

[153] This was to be made from a cloudy white solid plastic (of which the customer had supplied only one piece) and was to serve as a prototype which could then be used by the customer to get the correct dimensions on their filling machine (FND 11.3.08). Malcolm had been obviously excited about this project but he was also frustrated at that particular moment as he had just been given another more urgent job which had to be done first.

> That was a challenge on the writing the programme aspect. But again, once we had made it [designed the programme], I fired it out in about twenty minutes. And I said to them in the office, 'If you want any more of these making, we can make stacks of these dead quick, we can make them dead quick'. I hope they want some more.

> I enjoy things that's more complex. Yeah, a bit of a challenge. I like things like that (Malcolm).

*****

I was watching another tradesman one day, at one of the Okuma milling machines.

> He was machining six components from round, 100mm diameter, solid stainless steel blanks. The middle part was to remain solid, while either end was to be machined to form one short, and one long, cylindrical part to extend from the opposite ends. These two sections of the component were also to be offset (Figure ii).

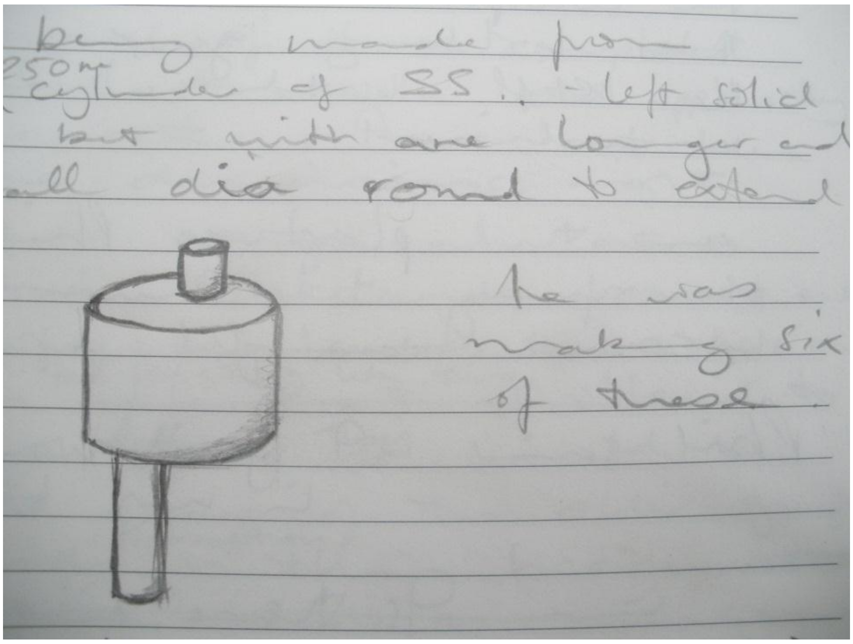

Figure ii: Sketch of the stainless steel part.

The programmed sequence was up on the wall of the work area. 'This will be quite good when it is finished. It will be a good looking piece.' He also took me to another part of the workshop where a completed assembly stood and proudly pointed out the parts that he had machined for it (FND 4.12.07).

Evan had a similar outlook on the things he made and described a mechanism that the company had made at one time for a local meat research facility.

> We used to make one thing up, it was a left and a right and they were beautiful things, all different angles. One degree here, five degrees there, little cuts in and out … we made a Perspex stand for one and they sent one to some sort of a [trade] show in South America. I used to make a left and right and put them together. I used to be very proud of these things because they looked really impressive. Stainless is good like that.
>
> *So it was the intricacy and the challenge.*
>
> And the finish on them; there was so much work involved in the things, the little one degree angles, five degree, two degrees, just a triangular shaped piece. We haven't made them for a couple of years.[154]

*****

David's story of helping his father to fix a music player was told among those of the Stafford men. He mentioned it again when I asked him what made him come to work.

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[154] Chick and Roberts (1987) studied the way machinists judged the work they did and found that they judged parts primarily in terms of their complexity. "…good machinists enjoy meeting high standards in performing lathe operations in an efficient and error-free manner. They are able to choose the best sequence of operations to produce a finished product and the more complex the part the more important this sequencing will be. They appear to regard meeting specifications, the production of a fine finish, and quality workmanship as marks of craftsmanship. The more complex the part, the more difficult it is to achieve these qualities" (Chick and Roberts 1987:305).

I think it's again how we said when we fixed the player, when you finish a part, it's pleasing, you're very happy about it and I think it gives you joy that you're creating something. I don't mean to be mean to accountants … but chartered accountants and government officials – have only one job in common – to keep their jobs alive. So they put in more rules and they put in more rules to make your accounting more difficult.[155]

I mean, if you're going to do something, you've got to do something with a structure to it.

You actually make things, create things.

Yes, I find other things a waste of time sometimes.

*****

A number of other instances of the many ways the men gained satisfaction from their work have been described in earlier chapters. Roger also spoke of his pride in building a company which could withstand the ups and downs of volatile economic cycles. Those in management positions were also proud of the items made and gained equal satisfaction from seeing projects completed and from knowing that their decisions and management had helped in that process.

Seeing work done properly, fitting together, and working smoothly, was important to Andy the fitter.

Yes. Do it once and do it right, or don't do it at all!

Important things that you gain from the job?

---

[155] David's wife is an accountant and he added that he wasn't intending "to be mean" to accountants per se.

> That's a difficult one. It's interesting. You get a good sense of creativity, a sense of achievement. You start with nothing, you start with raw materials and it turns into something and at the end of the day it's a finished item. People look at it and you get visitors look at it and you put it beside other people's work and it puts it to shame (Andy).

I asked Blair what he liked about his work at Stafford. His answer reflected challenge, pride and satisfaction, and, the need to earn a living.

> I like making everything and I like watching it come together on the shop floor. When it goes past me it's just a flat pattern, it's just flat, and next time I see it, it's been folded up and welded and it's a part that's going out onto a machine. I think that's bloody marvellous.
>
> *What makes you want to come to work?*
>
> Well, it's the challenge, at the end of the day. Never a dull moment at that place … but the main thing you go for is money. But it is interesting when you have got a job that keeps you occupied and keeps your mind ticking over. 'What do I do now?' 'This is a new one on me.'
>
> *Things you gain from the job that are important?*
>
> Job satisfaction for one; when you're seeing these things going off to Australia and America, you think, 'Oh, I helped build that.' That's good. To see the parts that you have cut, programmed up and drawn – when you see them actually working on a machine, you can think, 'I drew that on the Autocad, I folded that or laser cut it.' It's amazing. It's nice to actually see something (Blair).

As noted earlier, when I talked with Ryan, he was still at work and was testing the tea packing machine which he had built largely on his own. The factory was quiet, as being around 5.00pm; most of the tradesmen had finished for the day. We watched it running for a while. Once we had settled in the lunch room I asked him if there was anything in particular that he liked to make.

> Yes, being a fitter, most of the bits are already made – you're just sort of putting it together - but I get a lot of satisfaction from a big machine like that. Like sitting down at the start with just a folder of just drawings and stuff everywhere and then just pulling all your parts together and actually building... As you're building it's just like - can't wait for the day it works, and then at the end you push the button and it works. It's pretty cool, you stand there and push the button and it works - and you've built it from nothing!

I asked him what he particularly enjoyed about working at the company.

> I don't know … pretty cool machines really. I mean I walk around the supermarket and grab an ice-cream and … 'I built the machine that made that'! Stuff like that is quite cool. It's like those tins of baby formula. Mike made the machine that puts the lid on them, so every time I walk around the supermarket I think, 'I know where they come from'.

With these comments in mind, I thought at the time, that having a part in helping to create the things that are necessary for the world that they live in, can also provide a sense of belonging *in* that world. It illustrates the role that satisfying work may play in the creation of personhood (Jarvis 2009).

I asked Tony what, among the things that he made, gave him the greatest satisfaction. He replied that although the job could sometimes be a "bit treadmilly", he enjoyed making everything as best he could with the machinery available, and, "Just the job really; the challenge of doing the job".

Variety was also important for Tony and he described some of the jobs that had interested him in other companies. He spoke of making ultrasonic equipment for the Euro-fighter. He had also developed projects at that company and had enjoyed that "specialised" work.

However, I came across Tony on the shop floor on two occasions when he did not appear as impressed by what he was working on at the time:

> [He] was making two hundred plastic hinges – a '…tedious, uninteresting job … Cutting toenails would be more interesting' (FND 5.2.08).

> Tony - making twenty-five confetti blowers where the confetti would be fired by an attached gas bottle. He exclaimed, shaking his head, 'This is what it has come to!' (FND 1.4.08).

That work on the shop floor could not always be "challenging" and "interesting" was accepted by all the tradesmen, as many noted that sometimes jobs were "more mundane" or "boring" or "treadmilly", or, that you "had to take the bad with the good", as a part of any job. In a more extreme reaction though, one tradesman disapproved of the type of goods that were made at the company.

We were discussing some small parts he had welded:

> 'Just doing more brain-dead stuff … probably part of something that helps to add [he listed a whole string of food additives] that we don't need in our food' (FND 11.3.08).

He then launched a long tirade against the evils of processed food. His stay at the company was a short one.

Another young man found the scale of the work carried out at the company did not suit his disposition. This appeared to manifest in an attitude that in the end resulted in his leaving the company. He had been told at his performance review that he was a "…non-productive liability". It was written clearly across the lid of his toolbox, "I am a non-productive liability – circa 2008".

> He asked if I had learned much from my time there. I said 'Yes, heaps. I find it really interesting.'

> He said, 'That's good, because it bores the shit out of me'.
>
> 'I try to stay away from this end. I spent a year working on these two machines (Hwatcheon and Dr Evil) but I don't like this stuff. There's no imagination. Well, you can apply it to other things but it's all the same … I worked out at [another] company. That was big stuff. When the crane moved something there, it was twenty or thirty people involved and if it was a fraction out, it could trip and it would mean someone could lose an arm. They used radios and it all had to be coordinated. It was a bit of an adrenalin buzz I guess. Yes, I guess I like a bit of adrenalin' (FND 22.1.08).

From the above comments it is obvious that even within this one workshop, different forms of work require that the person has a disposition that suits that type of work. Matthew Crawford (2009:73) has also noted the way that different human types are attracted to different forms of work but that work also plays a role in forming a person. Where and when this occurs and the extent to which it occurs can, in this instance, be seen to be variable.

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The Culture

It is clear from the descriptions, stories and conversations above that the culture that exists on the shop floor is dependent on many elements. It is not fixed, but is sustained (or not) by all those involved, and in the ebb and flow of the work. It may be described as an entity that must be continually built and rebuilt; at some times strong and self-affirming, sometimes somewhat serendipitous, and at others, fragile. In the above section, the men described what they liked (or disliked) about the work they do. In this section, their comments illustrate the additional ways in which they create and sustain the "culture" of the company.[156]

From the first time I walked into the workshop I experienced the feeling of being in a professionally and well-run workplace. This first impression did not alter. Many people visited the shop floor and they were always treated with courtesy and professionalism. While I remained essentially a "visitor" from another "culture" I did, over time, come to know the men better, and was included more in their conversations about the everyday minutiae of the work, and learned to some extent, of their lives outside of work.

During the interviews I asked them more directly about what they thought of those they worked with, their preferences for different techniques and materials, and what they thought about the company in general. Instances and examples of preferences for working on, or with, the different processes or materials are indicated in many of the comments above. This section therefore, focuses more on the men themselves and their attitudes to their workmates and to the workplace.

[156] While a great deal has been written about "company culture", it frequently appears to be biased towards a management view of what that culture should or might be. The culture I describe here is based on what I observed and on the viewpoints of the men who work on the shop floor.

Being able to work with people they could "get on with" stood out as being as important as the work itself. For some it had been the reason for leaving previous places of employment. The nature of the work done at Stafford, means that most spend a large part of their day working independently; at their particular workstations. They may stop work to clarify design issues; move around the workshop to collect necessary tools or materials, or to seek advice or a fellow worker's input, but for most of the time they are intent at their machines or on whatever project they may be working on. Brief social interactions occur during these activities but mostly there is an atmosphere of steady, focussed attention to the work.

However, underlying and supporting their individual work was the need to know their workmates well; to know who knew what, who could be easily approached, who would be most helpful with a particular problem, when, or with who could they share a joke or other non-work related problem or anecdote. Without the existence of these activities, the company could not flourish, and parts and machines may not "make it out the door", and good quality knowledge creation and sharing would not occur. The following conversations provide examples which illustrate the many elements of the culture. What the men told me in the interviews matched well with what I observed on the shop floor.

****

A "Good Bunch of Guys"

> *What are some of the things that you value most about your workmates?*

> Their sense of humour (Jared).

> Yeah, and I suppose they're always there to help if you want to ask something. They're always helpful. I suppose then you get some guys who can't really give a stuff and can't really be bothered. I won't say any names (Michael).

> *What makes you want to come to work?*

> I suppose you have to (Michael).

> It's money! I suppose just to learn, I guess. There's always something different to do each day (Jared).

> Yeah, that's true (Michael).

The above exchange illustrates the points made earlier by Danny Ryan. The two apprentices like the interesting work, they hint at the culture on the shop floor and the (mostly) helpfulness of their workmates, and, that they need to earn a living. In the section above, the men spoke of their pride in the work they do and the satisfaction they gain from it and what makes it interesting. Additional aspects of life on the shop floor and the interactions of those who work there further demonstrate the importance of a "good" workplace and "good" workmates.

For Kaleb, as workshop manager, fostering a good shop floor culture was of particular importance. I asked him what he liked about the workplace.

> I like a lot of the guys here. We have got a pretty good bunch of guys to work with so that's always a bit of a bonus every day. You can have a bit of a laugh along with most of the guys and still at the end of the day

you're getting things done. It's good to see the fruits of everyone's labour come good you know.

Are there any things that you find difficult?

It would be the same answer really – some of the guys here.

It's swings and roundabouts really. Everyone has their off-days, and some days you end up shaking your head to yourself and thinking jeez ... what's? That's the biggest learning for me at the moment I suppose - sort of standing back and trying to be a bit more reflective about it - and look at how we can work on whatever problem. It has just changed the nature of what I am trying to solve really from trying to solve a technical problem to solving a people problem and get the guys motivated and work through whatever the problem is and try and get things going again.

Julian also mostly enjoyed the company of those he worked with.

There are guys I've been working with for a long time and that I have really good personal relationships with. They're good friends so that's pretty good.

What are the things that you value most about your workmates?

I don't know really. Loyalty of your friends I guess. That's a hard question for me to answer. I just enjoy working with most of those guys.

You also said you like people to have good work ethics. You obviously respect that in people.

Well, I think you tend to gravitate, or are more friendly, with people who have similar beliefs and philosophies as you do and therefore more work ethics. You naturally do that in life with anyone. You tend to be friends with people that are similar to you. I guess it's no different from here. So all those same sort of principles with friendship – something you apply. In fairness too though it is still work – it's a little bit different from the social side of life as well. There's definitely a distinction between the two. You

> can have a few barnies[157] with people at work. It comes down to personalities too I guess.

Grant, in his work of supervising in the fabrication area, also did the job of a tradesman. I had asked him what he liked about the company.

> There must be something because I've been there for six years now and everywhere else I've given sort of two and a half years and moved on. There's a good bunch of guys.

While there appeared to be grumbles at times from one or other person, Grant probably summed up what I gathered was the general consensus on their boss (the CEO):

> You look after him and he'll look after you. You get your work done and he's pretty happy. Kaleb's a good guy. It's nice and clean - and the type of work basically.

> *What are some of the things you value most about your workmates?*

> They're good sort of guys. They'll give you a hand when you need a hand. They're pretty trustworthy. I've been in a few firms where you can't even leave anything around and it'll get stolen. I mean I can leave all my tool boxes unlocked, go away for my holidays, come back and everything's basically still there; might have been left a bit over there but it is basically still there. Yeah, they're actually quite a good bunch of guys. I've been to other firms and there's always a few that just wind you up and you just can't be bothered with but no, it's pretty good.

When I asked David similar questions, his reply was rather more mixed.

> Most of them are very nice people. The language may be issues[158] - but most of them are there for the right reasons too and that's what you value

[157] A colloquial term for arguments.

> about them. There's always the bad egg amongst them; you never get a perfect place. I remind myself quite often about that. It's very difficult to get a perfect place anywhere. It's never going to be perfect.

The above men were not the only ones to note that a shop floor was not always a harmonious place. Phil also had a fairly pragmatic view about the things that can go wrong between co-workers.

> Yeah, people in general is probably the hardest thing, and it's going to be one of the things that works against you sooner or later because people are just like that, aren't they.
>
> *That probably happens everywhere.*
>
> I think so.

Despite this, he seemed to value those he currently worked with.

> Workmates … to be able to socialize with them … quite easily … at the end of the day, even through the day at lunch breaks and tea breaks to be able to approach any one of them and talk to them, and no problem with that. Not all of them are like that, but they're not too bad generally speaking. There's not many oddballs in the squad (Phil).

Graham, among others, felt that respect was an important part of shop floor culture. I asked him what he valued about his workmates.

> Yeah, I suppose respect is probably the biggest one – both ways – be courteous, you know, all that. Yeah.

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[158] While David recognised that others believed that swearing was not unusual in technical and industrial workplaces, he still did not think it was appropriate. "I still query that, I still honestly query that. That's not the only adjective [f***] you know. Surely there are other adjectives that can be used."
Swearing tends to be more frequent among some of the apprentices. If the older tradesmen swear at all it is usually because they are frustrated or genuinely cursing about something that has gone wrong.

A number of the men also mentioned the flexible working hours as being something they enjoyed.

> The variation of the work; the people in general; there are some real nice people there. Ever so flexible on the hours you work. If you want to go somewhere early afternoon, you can just go in early in the morning. As long as you have done your eight hours they don't seem to bother you (Malcolm).

Most valued the friendship of their workmates. The social club was mentioned by many, as a good idea. This was mentioned frequently by those from overseas as it did not appear to be a feature at the companies they had worked at before. In the time I was there, I saw invitations for staff to participate in a variety of social events.[159] Blair summed it up in his thoughts on his new place of work:

> I just like the workforce, the social club they've got. That's all new to me. Yeah, pay two dollars a week and going out for meals and trips and I think that's marvellous. You can take your wife. There's good camaraderie there on the shop floor with the lads and that.
>
> *They're a good bunch aren't they?*
>
> That's what I like about the place, easy going. It's pretty easy going (Blair).

*****

Shop floor culture is also of great importance to apprentices. As apprentice coordinator John noted, "It takes a good workshop to raise a good apprentice." Stafford Engineering appeared to me, to be a "good"

[159] One of these was a "Moonride" (night-time cycling) through a Rotorua forest, another, a fishing trip.

place to learn the trade. During visits I saw many instances of tradesmen helping apprentices to solve problems. During the interviews I asked the apprentices many of the same questions as those above. Jared's and Michael's comments feature above. Other apprentices expanded more fully on the topic. Josh commented that he was pleased to be learning to weld and learning a trade. I also asked him what he valued about his workmates.

> They've all got a good sense of humour. They're not all coming to work - work, grumpy. You can stop and have a talk to them. You don't spend like hours talking but you can just stop and have a chat, keep working, they'll have a laugh with you, they won't be angry all day.
>
> Everyone is quite helpful. Even like the other apprentices to me. All those guys are helpful as well, even though they are apprentices as well. You can still learn from them (Josh).

*****

Greg had recently moved to Stafford from a company that was failing. I asked what sorts of things had helped in his new place of work.

> No-one on your back; no-one looking over your shoulder and saying, 'Hurry up, when's this done? When's this done?' It's quite good; they just leave you alone and they know it'll be done when it gets done. They're not on your back.
>
> [At] my other place the stress level was through the roof.
>
> *So they didn't actually trust the guys to be just getting on and doing the job, they had to be constantly…*
>
> Yeah, walking around and looking over your shoulder all the time. I can't work like that with someone looking over your shoulder. 'What are you doing that for?' 'Why are you doing this for?' I think as far as Stafford's are

> concerned, at the end of the day if the product is correct, also speed and time comes into it, but that becomes quicker as the more experienced you get I suppose.

Greg also enjoyed the company of his workmates.

> Just getting on with the guys I suppose, is all good. We all swear and stuff like that but that's engineering. Yeah, we all have a laugh and have a joke. No stress, I suppose.

*****

A Clean Shop

An important aspect of the company that was mentioned by most of the men was the fact that the work they did and the environment in which they did it, were both "clean". The following comments are typical.

> Well, it's got a new smoko room. There's plenty of light, it's nice and clean, tidy. It's the cleanest place that I have worked in. The fact that there is plenty of light, it's relatively tidy and clean. It's not like walking through a dirt floor place. There are some of those places still out there but hopefully not too many, but yeah, some places get pretty messy, engineering workshops, they don't get swept out or whatever (Phil).

I had asked Andy about his preferences regarding the materials he worked with.

> Stainless steel, plastic and aluminium are the best. Anything dirty like cast iron and steel – I don't like working with. It's dirty, filthy. You can see inside there it's a clean manufacturing facility and that's because we use clean materials. If we used dirty materials it would be a dirty place. Like other dirty engineering shops.

> At the end of the day it comes down to housekeeping. If you are clean and tidy it will stay clean and tidy. Where I did my apprenticeship it had been there since 1918 and it had gunge on the walls this thick (Andy).

Andy also liked the fact that the workshop was well-resourced in terms of the variety of machines. This meant that if the tradesmen needed a part unexpectedly, it could usually be made in-house. Where there is a more limited range of machines, fabricators and fitters may have to wait until such a part is made at another company, thus delaying their own work.

David appreciated a well organised workshop.

> I do like the fact that there's a lot of emphasis on neatness … and there's a lot of respect and it's pretty well structured too. So if you have a problem you know exactly who you go to and more often than not your problem is resolved.

Apprentice James spoke of the importance for him, of there being a stable workforce, as it took time for him to develop trust in new workmates. He mentioned this one day while I was watching him at work.

> *James commented that he didn't like a high turnover of staff – he wanted stability. 'It means you know who you can trust' (FND 26.8.08).*

He explained further during his interview when I asked what improvements could be made at the company.

> The workshop, probably keeping a staff of guys that are just always there. Like I have noticed with this business that we sort of have guys come and go quite irregularly. Obviously there are a couple of guys who have been

> there twenty years but I can't remember the amount of guys that have come in, worked for six or twelve months and then just left.

*****

The Money

> *What makes you want to come to work?*
>
> Well, I haven't won Lotto so I've got to make money somewhere (Grant)!

While I did not specifically focus on wage issues within the company, I gained a general sense that most of the men at the company felt their wages were reasonably fair. While the wider issue of the work in this trade being undervalued was noted by Evan, it seemed, at the local level, that the wages paid at Stafford engineering were on the "good" side, with only a few other companies paying higher. The men were all on individual contracts which were renegotiated each year at their performance reviews. From what I gathered, no-one at the company belonged to a union but a few noted that they had in the past. One tradesman commented that they had had a visit from a union representative but that none of the men, for whatever reasons, appeared interested in joining.

When asked, "What makes you want to come to work?" money was sometimes mentioned first but the answers were usually then qualified by remarks about the other elements that made the job attractive.

> The money! No, that's not quite true. The money is obviously quite a big part but I enjoy making things as well. I enjoy making it right first time and the challenges that it has put in front of me. But the money is quite

> important. I don't know how Kiwis feel about that, but it is for me quite an important thing; because it's the money side of it that enables you to do other stuff in your life (Tony).

This following exchange with Julian showed that work and money, and those he worked with, were all important to him:

> I still enjoy getting out of bed and coming to work. If I didn't, I wouldn't be here. I don't know. It's a hard question … you've got to have money to live with. You can't sit on the beach reading books for a living.
>
> Modern society is more motivated for training people to go for more money and there's nothing wrong with that. You've got to look out for number one. I mean if people are prepared to pay you more to go somewhere else then you are silly not to take it. I mean loyalty takes you only so far and there's nothing wrong with that but if you've got responsibilities too, then the fact is that money is definitely a motive. The reality is, if the boss turned around and said that they are in business for the love of it, it would be nice; but every boss that I can ever think of would say they are in business to make money.

Evan, who had had a long career in the trade, was no longer required to work, but continued to do so, as much for interest as for the money he earned:

> Money, something to do … people often say 'Why don't you retire?' but to me, I'm scared to retire because I've known so many people who've retired and they think, 'Oh, I'm going to go fishing; I'm going to play bowls', but you can't do that twenty-four hours a day can you? And so many people just sit and watch TV and then die. Because I can retire, I am sixty-seven and I get the pension (Evan).

*****

Experience - "Mother of Every Certainty"

> Experience does not err…. Men wrongly complain of experience, which with great abuse they accuse of falsity ... They say that knowledge born of experience is mechanical but that knowledge born and ending in the mind is scientific ... But to me it appears that those sciences are vain and full of error that have not been born of experience, mother of every certainty and which do not likewise end in experience; that is to say, those that have neither at their beginning, middle or end passed through any of the five senses. True sciences are those which have penetrated through the senses as a result of experience.
>
> Paracelsus[160]

While the above focussed on those aspects which we may consider the more practical and social elements of shop floor culture and learning, the following includes discussion of the less visible, embodied elements of practice and the way these may structure the experience of learning.

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The Senses

The judgements that relate to the learning and performance of many of the techniques of precision engineering and the artists' practices are largely dependent on the senses; the strength or delicacy of touch or amount of pressure to be applied; the sense of smell if metal is overheating; the sound of a machine that is under stress, or of a component that is no longer spinning evenly; the visual signs (again) of overheated metal, or distortion, or of uneven finish or pitting of a surface. In addition to the need for constant awareness of these factors which apply to the work at hand are the wider environmental concerns; an awareness of safety through the

[160] Cited in Smith (2004:89).

sounds of others working nearby or the awareness of the temperature as it changes during the day and how this may affect the material being worked.

The use of the senses of sight, hearing, touch and even smell are evident in the practices and processes carried out on the shop floor. They are seen in the anticipated slowing and stopping of the spinning lathe as the turner stands ready to perform the next part of the process; the knowledge and judgement of the rate of spin derived through a number of the senses that gives the turner the confidence to test the smoothness of the part with his fingers while that part is still spinning. It is seen in the constant judgement of the welders as they apply heat and molten metal to weld together components or to fill pits and cracks, and it is seen as the polishers finely judge the force and speed of their numerous pieces of polishing equipment to get the best finish on the metal without compromising the strength or chemical structure of that surface.

The importance of touch and sight and knowledge of materials was demonstrated by Greg one day as he worked at an urgent one-off job:

> Greg was modifying a tube-clamping die … 'The chips (of swarf) are a funny shape, hot and blue. We think it is high tensile' [steel] (FND 5.2.08).

The shape, colour and temperature of the swarf provide important information. To me, before I was aware of what I was looking at, these curls of metal were simply pieces of waste material. For the men, "reading the swarf" provides valuable information.

I was also constantly aware of the importance of sound on the shop floor. I commented to Malcolm that the tradesmen seemed to hear things which I was not even aware of.

> A lot of it is not just the ears though. Sometimes you feel the vibrations with your feet. I used to work with a deaf guy and he was so clued up because he could feel the vibrations through his hands and feet. Couldn't hear a word you were saying to him but he could work a machine brilliantly. He would perhaps have his hand on the tail-stock or something like this and he'd say feel the vibration, that's not what it should be doing ... He could feel the vibration through his fingertips. He was as good a machinist as any fully hearing person. Yeah, you do pick little vibrations up … perhaps you haven't noticed it but probably if you spent five years in the workshop you would probably start noticing these things. You do hear vibrations through different things, fingers, feet.

Likewise, Phil was very tuned in to the sounds of his large milling machine. He was looking particularly concerned on one occasion and had been alerted by an unexpected sound in the drill – a high pitched noise.

> *He stopped the machine after the first couple of holes, concerned that there was something wrong with the drilling head. He said, 'No, it's okay. It's just that the metal is thinner than usual and it's creating that high pitched sound' (FND 5.2.08).*

I also commented to Tony that everyone seemed to be aware not only of their own work but also to that of the whole workshop especially if there was an unusual sound.

> They're waiting for the crash … That's why people are like that. I'm not sure whether it's the fright and flight syndrome … I think they're probably ready to duck! It's quite a dangerous environment. It doesn't seem it, but it is quite a dangerous environment. You could easily lose yourself.

Jeff also commented about the importance of being constantly aware of sound and vibrations. He recalled a particular instance where a young man was wearing a baggy sweatshirt and this had become caught in the large stand-up mop machine. The machine had been slowed only because of the thickness of the shredded garment caught up in it.[161]

> We just heard a machine making a funny noise and the floor started to vibrate and we turned around and this thing was wrapped around it about twenty times and he was just trying to hold himself away from the mop … you can have your back to it, you can be working and making your own noise with what you're working on - and it was just this noise and a bit of a vibration and – but if there was no-one in there he wouldn't have held himself away from the mopping. The mop would have flicked him right around like that because you wouldn't stop it.

Being tuned in to the sounds and vibrations of the workshop is however not only a matter of safety as demonstrated in the stories above. The use of all the senses in this work can also be seen as one of the foundations on which the learning for and practice of this work is built and sustained.

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There is a particular stage in the process of making and tool use where the maker appears to be at one with his machine or tools.[162] Keller and Keller note Douglas Harper's (1987:117) description of this in what he names "kinaesthetic correctness" or (following Pirsig) "mechanic's feel" that he observed in Willie's automobile workshop.

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[161] The mop machine is effectively an upright large spinning mop-head against which components are held for polishing.

[162] Wilson (1999:63) describes the process of "becoming one" with tools or machinery: "The mystical feel comes from the combination of a good mechanical marriage and something in the nervous system that can make an object external to the body feel as if it had sprouted from the hand, foot, or (rarely) some other part of the body where your skin makes contact with it".

> Willie's working method builds on a detailed knowledge of materials and develops precisely the kind of tactile, empirical connection that leads to smoothly working rhythms, appropriate power and torque, and the interpretation of sounds and subtle physical sensations (Harper 1987:118; Keller and Keller 1996:136).

There appears to be a stillness of the mind, a focussed concentration that is both intense and calm. Despite the continual background noise (and intermittent louder sounds) there is a sense of quiet, focussed attention in the way the men work. In addition to the times of concentration on problem solving or of having to be especially attentive to a particular process being undertaken, there is a form of attention which occurs when work is running smoothly and the maker may allow his thoughts to be elsewhere or, in a more reflective mode. The expert appears to be working effortlessly, smoothly, and without hesitation, and, it may appear, without thought. Thought however, has become embodied knowledge and within that knowledge lies the ability of the person to subconsciously predict, act and solve problems. At the same time, full awareness always hovers just beneath the surface of this seemingly suspended attention.

I observed the same sense of stillness of concentration as I watched both the artists and the engineers at work. The machines or the tools and the maker who is using them appear as a singular mechanism. It can be observed in the photograph of Susan Flight carefully sculpting clay, or of Ruth Davey watching as paper and plate roll through her printing press. I observed it frequently within the engineering workshop while watching the tradesmen at work.[163] It is what Greg was describing when he spoke of getting into "a bit of a trance".

However, I knew that when he described this phenomenon he did not in any way mean that the job did not have his attention; alertness is never far

[163] Marchand (2008:260) also observed this "calm focus" among the woodworkers he studied.

away as there is always the potential for tools to slip or cut or for the machine to malfunction. The operator may appear oblivious to his surroundings but he is not – the surroundings simply occupy one more area of the attention where all the senses are in play. In the workshop, among spinning machinery, or, at the furniture maker's circular saw, there is no place for careless daydreaming. It may however, in some circumstances, allow for the emergence of creative thought.

When the work is progressing smoothly the act of making may also stimulate the phenomenological processes of creativity. This may be seen as an instance of "flow" (Csikszentmihalyi 1996) where the human organism is in a form of balance which allows for reflection or for the emergence of creativity. It is where "mental calculation becomes automatic" in the manner described by Dreyfus and Dreyfus (1986). This was borne out by my earlier research with the quiltmakers where a number reported using *making* as a tool for *thinking* (Wanigasekera 2006:118). Ruth Davey, Susan Flight and David Fowler related similar incidents in their work where the work itself stimulated ideas for future work.

I have also used this technique as well, to get past "writers' block" and focus my mind on the task of writing. The physical act of writing words – even if these are copied or paraphrased from an existing text – has enabled me to continue with my own work of writing. My goal is known; my difficulty lies in creating its shape and in the filling in of that shape. I know the actions that are needed – writing or typing – and in using these actions, stimulate further action and creative thought. Ruth Davey described a similar process of leaving work at night, at a point easily picked up and continued, as a way of "getting into it" the next morning.

"Doing" can therefore also be a stimulant to further doing and to thinking.[164]

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Emotion

Emotion, both positive and negative, may be seen as intimately tied to the senses and is identified by a number of authors as a strong influence on the learning experience. This is also evident in many of the men's conversations as they recalled times of fear or struggle, of accidents or failure ("war stories"), elation, satisfaction, or pride in their work.[165]

> …we can have both conscious and pre-conscious experiences and the latter occur before the conscious ones. The pre-conscious are those sense experiences – a sight, a sound, a feeling, an emotion … and so our first impulse is to respond to the emotive experience rather than to the rational explanation that follows soon after … the emotional dimension may help determine the experience itself (Jarvis 2009:141).

Jarvis describes this (following Goleman) as the, "emotional sentinel" and a "key to learning".[166] This is illustrated in Tony's comment which shows how struggle, or the challenge to find a better way, provided a learning experience.

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[164] Jonah Lehrer (2012) makes a similar claim for the use of "mindless" activity or relaxation in creative thinking and problem-solving.

[165] Julian Orr (1996) invokes the notion of war stories in the way the photocopier technicians, who worked in the field independently, would discuss their various experiences on the job whenever there was an opportunity to get together. Devoting a whole chapter to discussion of the notion, he describes the way these discussions provided invaluable knowledge as information about fixing various problems emerged. Similar discussions take place at Stafford during breaks or after work beers.

[166] "Those experiences that are emotionally charged are more likely to be recalled at a later date than others that are more ordinary and everyday. Hence our biographical memory is more likely to be biased in favour of those emotionally charged experiences" (Jarvis 2009:141).

> I guess every job you do is a learning curve. I've also done jobs in the past where I do it a certain way … and you've done that and you've struggled on it and next time you get it in you know where you struggled on it and you think 'Well I'll do it slightly different' and you find another way around it. So you can learn by every job you do.[167]

Anxiety and stress are evident in Greg's story as he described the way he had carried out a particular job, the milling of twelve wallet-sized plastic components which had a complex profile along one side:

> …so I had like a roughing cycle in my head, so I had four numbers that were all thing [roughing cycle][168] then I had the finishing cut which was all those numbers, so I had eight sets of numbers and one read-out and nothing set on the read-out and you'd go to that number, okay, that number, that number, okay; now come back and do the finishing cycle … I'll go this size, this size, this size on the finishing size.
>
> *You didn't have a programme, just had to keep repeating it out of your head?*
>
> Exactly and memorise those numbers and hope like hell that you don't lose track of those numbers and go too far.

The above exchange is an example of how an apprentice has managed the information involved in getting a job done. His description of the incident shows the need for the ability to be able to plan, think logically, and retain a series of number groups in his mind while at the same time taking great care not to ruin any one of a finite number of pieces of raw

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[167] Jarvis also comments on the way humans generally cannot live with disjuncture and in doing so also describes an element of the emergent and often very personal nature of the learning experience. "People who cannot live with disjuncture are motivated to heal it and to bridge the gap: it is this that is the key to learning … achievement need, commitment, and optimism and initiative [are at work] and at the time we put them into action we may not know how to do what is demanded … but we know that if we are to achieve our desires we have to do something about them and we learn in the doing since we will probably not know when we set out…" (Jarvis 2009:141)!

[168] In the process of milling down the material the tradesman will often first make rough cuts of the required shape in the same way that a sculptor will first remove bulky areas of unwanted material. As the work progresses the pattern becomes more and more accurate in relation to what is specified.

material he had been provided with for the job. This also provides an example of the impact of emotion on learning. The heightened sense (or stress) arose from the knowledge that, should he damage any one of these components, he would be seen to have failed to deliver the job as required. Focussed concentration was needed and was galvanised by this knowledge and the resulting pressure. The processes of doing the job were thus more strongly etched on his consciousness than those of more straightforward jobs.[169]

This phenomenon was described and alluded to many times as those on the shop floor told of incidents and accidents, times of stress or elation. It could be seen in the rise in attention levels that occurred in response to unusual or unexpected sounds within the workshop. It arose at times when they were working with limited or expensive materials, or, from the anticipation of being challenged by something novel or complex.

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Skill - A Language without Words?

In chapter two I described Marchand's insights into why it is difficult to describe many elements of skilled practice especially those elements which are often described as tacit knowledge. While verbal and written language may provide the tools and means which enable thought there are also other forms of language or sources of information which are necessary to the learning of skilled practice. Among these are the languages of movement and touch. These languages are both interpersonal and intrapersonal. They are learned through watching,

[169] This is similar to Matthew Crawford's claim for the value of learning through mistakes, or the need for, "education that kicks back.… When your shin gets kicked by a mule or a kick-starter, you get schooled" (Crawford 2009:59).

through imitation and mimicry, through "parsing"; and through "trying it for oneself".[170] They are subtle and complex and made up of a stream of simultaneous and overlapping micro movements and impulses. They are often invisible to the eye and thus difficult to describe in verbal language (Marchand 2007, 2010c).

At an individual level, these languages are acquired through the processes of kinaesthesis and proprioception, that is, the multiple impulses that pass instantaneously through the senses – between eyes, ears, skin and brain, through movement, touching and sensing. Proprioception occurs in the moments when skin contacts material and the craftsperson instinctively uses the resulting information to inform further actions. This is how the medical practitioner assesses the tension or temperature of a patient's skin purely on touch and how the ceramicist assesses and judges texture and balance. This was demonstrated in the workshop by the frequent checking of the smoothness of components, or instances such as when Luke, while showing me around the workshop, seemingly automatically ran his hand over the surface of a stainless steel part as he walked by. This is embodied, largely non-verbal knowledge, even while the result of it may subsequently be translated into a verbal description.

Sennett (2008:95) also acknowledges the limits of language as perhaps *the*, fundamental human limit: language is not an adequate 'mirror-tool' for the physical movements of the body … what we can say in words may be more limited than what we can do with things.

At the same time he notes the fact that he has written, and we are reading, a book about practice. Instances of this difficulty are evident in many of the participants' conversations, but at the same time they are clear about the

[170] As noted earlier, Marchand (2007, 2010c) invokes the linguistic notion of parsing, as it is used to acquire and analyse speech, as a metaphor for the way skilled movement may be learned from another.

necessity of engaging in thought and discussion. The following excerpts are from fitter Andy's interview:

Exchange no. 1:

Any things that you don't like assembling?

Not really. Work's work. I'm a middle aged man, work's work.

Decision making and working out on the shop floor – plans?

That comes from experience. It comes from experience. I can't explain it. It's something I can't explain.

How do you know how to put things together?

No, I can't put that into words. It's just natural to me. I don't know how or why.

You just have a sense of how things fit?

It probably comes from me tinkering for forty odd years.

Exchange no. 2: (discussion about apprentices)

If they don't know how to do it they can ask a question. You can show them and you can ask them how they might go about it and then if they've got an answer for you, fine, ask them the reasons why and they can come up with an answer so their mind is ticking over. Make them think. Making them think. Because if you can't think, well, it's pointless.

So you make them think through the problem?

> Well you could show them and then just walk off. They'll do it but if they don't think about it they're not going to learn anything. If they can think about it then they can understand the reasonings behind it.

While in the first exchange Andy indicates the difficulty or inadequacy of using language to describe how to do something, in the second exchange he identifies the closely entwined nature of doing and thinking - action and theory, using language - on the job, and the need for analysis and theoretical understanding in the learning process. Even while he knows the difficulty of explaining some things, he acknowledges the importance of symbolic reasoning and the value of verbal discussion and analysis. The difficulty in the first instance appears to be in framing complex, often multi-sensory information in a manner that provides a relatively brief and hopefully lucid explanation.[171]

The nature of the "difficulty" has two different aspects. The first is well described by Marchand and Sennett, as noted above, and relates to the difficulty of describing multi-modal physical actions; the second, I believe, relates more to the individual nature of skilled practice and knowing. In skilled practice there appears to be a form of silent, internal "discussion" that operates and that is not always easily articulated immediately, but has to "come into clearer view" (Crawford 2009), be "reconstructed" or "make sense", to each individual in his or her own way. It is perhaps because it is a personally tailored self-explanation that it is often said that such knowledge is difficult to "put into words". The "mentor", aware of the individual nature of practice, struggles to find words which will adequately

[171] The work of the shop floor is in no way generic. With such varied work, different combinations of physical and theoretical knowledge are needed at different times and in different situations. In the welding and fabrication area of the factory manual dexterity and skill are important alongside theoretical knowledge and may often require demonstration; in other parts of the shop floor the knowledge in use is based more in mechanical and technical information and processes and may thus focus more on discussion.

translate his or her technique in a way, and with words, that may make sense to, and suit, the "learner" and his or her particular style of "doing".[172]

This also explains why it is necessary to demonstrate, in many instances, as a way of teaching. It is easier to demonstrate the technique or discuss the elements of the procedure and allow the learner to assemble his or her own answer or method than to attempt to engage in a complex answer which may not suit the other anyway. Words may constrain as well as enable. In other words, language is also both material and tool. We learn about the material and about how to use it as a tool and come to realise that as material and as a tool it is more useful in some situations than in others.

Andy also summed up his own theory on why an explanation, either verbal or in writing, is usually inadequate as a way of learning a technique. He explained in the same way that other participants had described, that written instructions alone can be inadequate.

> …reading about something is having an interest but it's not actually hands-on. It's not a hands-on experience really. You can read about something and be an expert on what you've read but it doesn't make you an expert when you come to do it.

Or, as Kawori Iguchi (2000:140) argues, "…learning is part of the outcome of practice, rather than of instruction in it". Iguchi's ethnographic study of Japanese flute players also alerted me to this second aspect of the problem of language in learning. Although I was aware of the individual nature of learning in general, and had heard similar comments from many of the participants, I had failed to realise its importance as an explanation for the difficulty of "explaining things in words".

[172] Marchand (2010c:S117) provides a similar example and argues that this reconstruction of information is what "drives skill learning and acquisition".

Iguchi described the way much of the knowledge of flute playing is kept from apprentice learners. This is not only because of the knowledge being passed on through heir transmission but also, and more importantly in relation to the engineers, it is because of the masters' belief that each player must "come to it" in his or her own way: "…each performer had to find his or her own best way to put the actual notation into an actual performance, and this was done only through trial and error" (Iguchi 2000:143).[173]

While Iguchi is discussing reading in relation to musical notation, his comment may be equally applied to any person who is trying to follow instructions, either verbal or written, for other forms of practice. "Reading", as Iguchi notes, is therefore a method of "deepening one's knowledge". The writings are only grasped after a certain amount of experience. Likewise, many processes in engineering, as explained by a number of the participants, are only fully understood after a time of practice.

Noel Sweetman provided a further example. I had asked him how much he had learned from his father.

> …in the early days he critiqued everything and that for sure was a help but we never worked together, couldn't work together. We've always worked parallel … I have copied some [things] – certainly method – but you have to find your own way of doing things that suits you. So you can show someone how to do something – if that's comfortable for them; that's fine. If it isn't you have to leave them to find out what's the best way for them – to do a particular thing.

[173] "…reading [the notation] appears not to be a retrieval of information that gives every reader an equal amount of knowledge. Instead, its significance and benefits are unveiled in accordance with the amount and quality of experience its reader has accumulated. Reading is a life-long endeavour, as it is who you are that determines what you read into it and not the other way round" (Iguchi 2002:145).

This was also evident in Susan Flight's observation about providing information to students – that "information can also be a box" from which they have to "step out" and find their own answers; "…this may be true or it may not be – you try". Similarly, the apprentices were all aware of the need to work things out for themselves and all emphasised the importance of listening to, and watching, others. James' observation was typical of this process:

> Probably just talking with the guys … you'll be doing a job and having a problem with it and I can go ask Jules about it and he'll sort of tell me to think about it for a while and then I can bounce ideas off him and then obviously if I don't figure it out then he can just show me. He's quite good. It's best to try to figure it out yourself.

Again this demonstrates the idea noted above, that solutions are best when "assembled" individually by the learner, in his or her own way. Biesta describes this process of reflection:

> It is precisely because our experimental problem solving is embedded in symbolic operations – in thinking and deliberation, in language, stories, theories, hypotheses, explanations, and the like – that we not only learn at the level of our habits; we also add to our 'symbolic resources' for addressing future problems … knowledge understood as a symbolised account of the relation between our actions and their consequences, only comes about when we embed our 'existential operations' in 'symbolic operations' – when, in other words, we embed our actions in thinking, deliberation, and theorising (Biesta 2007:15).

Effectively Biesta is describing the way the nature of knowledge acquisition is embodied and holistic; it involves a constant moving around and back and forth between the different parts of the human organism.

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Ironically, many elements of the learning of many mechanical and precision engineering techniques can be seen as similar to Hart's description of learning to read. At the same time in his description of learning to read, Hart identifies the dialectic nature of the interaction of a new skill or knowledge with existing knowledge and past experiences:

> Reading a page of prose is, it is held, a highly complex skill involving a whole hierarchy of sub-skills; and the more complex the passage … the greater skill needed to read it properly … Whatever skills are picked out in the reading of prose or poetry, your ability to read consists not in the exercise of those skills but in the ability to use them properly, so that they don't get in the way of your responding as fully as possible to what is before you … what you have to bring isn't skills; it's yourself (Hart 1978:206, 207).

Hart may disagree with my comparison since he appears to be happy to regard mechanical practices such as mending cars as skills since they are something that people do "depending on their inclination", as opposed to reading, which he views as being a part of people's humanity and "far more intimately related to ourselves", and therefore *not* a skill (Hart 1978:210).

Hart is clearly wrong here. His description is reflective of an unconscious hierarchy which puts book learning above hands-on activities and learning. One need only encounter a group of men admiring the workings of a machine or else huddled under the bonnet of a car to realise they are equally "intimately related" to that activity (Crawford 2009; Harper 1987). I would argue that they *would* consider their knowledge of these activities a part of their humanity, a part of who they are as persons in the world. Further, both reading and fixing cars and machinery require the use of various forms of accumulated theoretical knowledge, i.e. "a whole hierarchy of sub-skills".

But, as Hart further notes (208):

> If you haven’t anything to say for yourself, then no repertoire of ‘reading skills’, no mastery of the ‘register’ of critical parlance, can compensate. Literature only speaks to those in whom it can find an echo, those who have some depth to them, who have lives of their own, feelings and interests.

Such is the difficulty in attempting to attach skills to a person whose life until then holds little experience in the given field. If there is not much of a “self” or if that self is a somewhat dysfunctional and impoverished human being - unable to “respond fully” - then he or she faces an uphill battle to even begin to understand an unfamiliar field.

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Trust, Respect and the Stock of Knowledge

Crawford’s (2009:207) description, cited earlier, of the revelatory and emergent processes of learning from more knowledgeable others fits very accurately with the processes that I observed taking place on the shop floor as the apprentices (and to some extent those tradesmen who were new to the company) gradually developed confidence in themselves and in turn earned the confidence and trust of those around them.

The skills of questioning are essential if the apprentice is to access the knowledge of others. They are also an essential element of the functioning of the business as a whole. Like the many other elements of learning, they are skills that take time to develop, and depend on the parallel developments of trust and respect. It can be seen that trust and respect are also emergent qualities/entities within the context of work on the shop floor. Like knowledge itself, these are also created within the processes of the work. The comments of the tradesmen and apprentices about their fellow workers and colleagues noted above demonstrate the many ways this emergent process occurs and the conditions that are necessary for it to happen.

These qualities can be encouraged by management but in the end, whether or not they are generated, depends not only on the culture of the company but also on the individuals who make up the population of the workshop at any time. Stability of the workforce was important in this respect for James, for example, who stated that he did not like too much changing of personnel as he liked to know who he could trust.

At several points throughout I have used Keller and Keller's (1996) notion of the "stock of knowledge" which exists within artisanal workplaces. At any one time this is made up of individuals' accumulated knowledge which may or may not be fed into communal knowledge. Trust and respect are shown to be an important part of shop floor culture. They are also necessary to the maintenance and sharing of this body of knowledge. While its exchange may take place, as in this instance, within a field of capitalist production, it is effectively, beyond the norms of the system of capitalist production even while that system can be seen to be making use of it. Allowing others to see or share one's knowledge in this way is not often a direct exchange but more a form of asymmetrical or delayed gift exchange.[174]

[174] In the use of the terms "asymmetrical" and "delayed" gift exchange I do not wish to engage in arcane anthropological discussions of kinship theory where these terms have technical meaning. They simply provide a practical way of describing knowledge giving and sharing on the shop floor.

This knowledge does not have an explicit value and the giving and accepting of it are subject to varying sets of values and criteria. It must be available, even while its use may be fleeting and serendipitous; i.e., it depends on who is about at the time one wants to know something. However, the work could not proceed easily without it and the formal parts of the apprenticeship system would not survive without it and without the men who provide it. These exchanges underpin artisanal learning.

Thus, it can be argued that apprenticeship itself resists commodification even while the apprenticeship system in its current form can be seen to have been partially commodified. The mentors and masters, and even the apprentices themselves, as they share and create knowledge, are the key actors in the replication and multiplication of trades learning and in the maintenance of the apprenticeship system. The men's stories tell of a more organic and thus more grounded form of teaching and learning, and a more valued form of assessment for those who work in this industry than that attained formally.

The role of the "masters" is absent in training policy and is not explicitly acknowledged in any form of reward within the company; rather, it appears to be an implicit expectation that goes with the job. It may be seen as belonging to the culture of the shop floor and, by elision, to the owner of the company, but it would not be possible without the tacit consent of at least some of the men. This form of teaching is an informal and often spontaneous one. The sharing the men do stems from the relative autonomy of their roles as skilled craftsmen, and from being decent human beings who are prepared to work collegially and to nurture the skills of the younger members of their group.

Therefore, the best that business owners can do is to provide good work for the men to do and good machinery for them to do it with. At the same time, in acknowledging the issues noted above which arose because of a lack of recorded information, it is also obvious that there is a line to be drawn regarding which forms of knowledge may remain "in somebody's head", and those which must be committed to paper or computer programme so that they may be available to be shared in a more systematic manner. It is perhaps a location where the traditions of artisanal knowledge-sharing come face to face with the processes of multi-layered management and the construction of projects which require a combination of the knowledge of any number of contributors.[175]

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Negotiating one's way in relationships on the shop floor to gain access to the knowledge that is available there depends on many factors including the personalities of both apprentices and tradesmen. It is also an area of interaction which may be influenced by earlier experiences. For those who have grown up with and already know the ways and language of "men and machines", patterns of knowing how to access information about such work provide another advantage not available to someone new to the field.

This gap was evident in the stories recounted by those such as Malcolm, when he told of asking "the lads" about various tools and "their eyes glaze over and you know they haven't got a clue". Knowing *when* to ask, *what* to ask, *who* to ask and *how* to ask are, in themselves, essential skills if the apprentice is to access the knowledge of others. *How much* input from others is necessary also appears to be a very individual element of the process. Like the tradesmen, the apprentices all emphasised the

[175] It must also be remembered that it is incorrect to suggest that artisanal knowledge was not in the past written down. Pamela Smith's (2004) exploration of embodied artisanal knowledge provides many examples of such information. Of note is a minutely detailed description of the long process of producing the many hues of a particular colour in a Dutch painter's studio.

importance of listening to, and watching, others, but in the end "assembling" one's own answer.

The best option for "management" therefore, is to provide the best environment in which knowledge and learning can flourish and pay respect to those who hold it. Tacit knowledge cannot always be "exchanged" or codified in the usual sense because in the process of its acquisition it may well be changed. As each person interprets it in the way that suits them best, it may become something different from that which was held by the first person.

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Also evident in the men's accounts is the use of symbolic reasoning and, as well, the way that conversation is itself productive work; or, as Sawchuk 2003:7) has described it, "…talk as a means of knowledge storage". The processes they describe also fit with Keller and Keller's two cognitive strategies evident in learning "on the job", and of the way knowledge becomes "sedimented".[176]

> One is the process of generalising schemata from sets of similar experiences. … this is the stock of knowledge held in the mind about the shop, tools, procedures, artefacts, aesthetics, mechanics, and social others.... The second process by which knowledge becomes sedimented is that of the abstraction of defining principles from abundant experience [Greg's "memory bank"] … This process is slower than the building of schemata, often requiring long term experience of a domain (Keller and Keller 1996:177).

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[176] The concept of situated learning usually refers to learning in practice as opposed to learning that is abstracted from the location of its intended use. However, it could be argued that all learning is situated in some way. Perhaps "context based" or, "learning in context" is a more accurate description.

This second form of acquired or, “sedimented”, knowledge is seen in the ease with which a master tradesman such as Evan who has many years of experience, knows in an instant exactly which way to set up any particular piece of work. As he describes it, “…it’s straight through my brain like a computer”.

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Both tacit and explicit knowledge effectively underpin production. As Sigaut (2002:439) has observed of the accumulation of knowledge in general, tacit knowledge “follows its own logic and thus logic alone does not necessarily produce effective solutions”. In many areas of learning, it appears that each learner must assemble his or her own interpretation of information given, of techniques described or demonstrated, or, of ways of doing and being. In assembling one’s own interpretations, answers and solutions and ways of doing or being, the learning is then suited to and belongs to that learner in a form that he or she may use in the future. The engineering tradesman knows from experience that there are many ways to approach a particular job and the tradesman or craftsperson also knows instinctively that words are only one form of explanation and that words may constrain as well as enable.

The many elements which contribute to the experience of the shop floor can be seen to be essential to the experience of good learning and thus to a good apprenticeship. The leading hands’ descriptions of their strategy for gradually increasing the variety and complexity of the jobs assigned to the apprentices (and even to the tradesmen, in some instances) demonstrate incidents of a scaffolded form of learning. However, this is only one of many paths to learning on the shop floor. As can be seen from the men’s stories, different forms of teaching and learning suit different people and even then individual needs will change over time as will the personnel available as teaching, mentoring and modelling resources.

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> Knowledge as a resource for production … governs but does not determine practice; and practices, as they are enacted, may constitute a source of new information and may open prior knowledge to reproduction or transformation with further implications for ensuing practice (Keller and Keller 1996:17).

Keller and Keller's observation describes the emergent nature of the knowledge building that occurs within the processes of production.[177] Keller and Keller (1996:17, 18) note that this "dynamic and constantly emerging set of relations … constitutes the foundation for lifelong learning and human productivity". It also forms the basis of the further observation which Sennett (2008:24, 25) identifies and of which I found ample evidence at Stafford, that the craftsperson or engineer is always looking for a "better way" to practise their craft or profession.

Sigaut also argues that continual improvement, "…to do something better, cheaper, faster … is one of the distinctive features of technical evolution" (Sigaut 2002:435). At the heart of practice lies the importance to the practitioner of finding or discovering techniques and processes that make practice better, more efficient and more economical in terms of the use of materials and time, both his or hers and others. "Finding a better way" could easily have been adopted as a slogan for the company and even the trade as a whole as it is implicit in the work of both professional and trade engineers. The impetus for this was not simply a managerially imposed imperative but resulted from the underlying ethos implicit in craftsmanship itself.

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[177] Biesta (2007) and Edwards (2010) also describe the emergent nature of knowledge construction in education.

The ethnography has demonstrated that successful learning on the shop floor (and in the other examples given) is shown to be the result of a complex amalgam of disparate elements. The learning and teaching are embedded in and arise from the processes of creativity, analysis, manufacture and reflection. They involve not only what takes place at the worksite but also the histories, qualities and dispositions that the participants bring to their work. The learning and teaching are sometimes haphazard and serendipitous. They derive from the work itself and may result from encounters with very differing actors.

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The last five chapters have filled out the picture of the work and the men of Stafford Engineering and the education and learning that occurs there. This picture represents an example of a company where good work is done and the men who work there, are, on the whole, happy to be doing it there. In the following chapter I will reflect on how this research relates to and may extend wider discussions of learning. I consider the relationship of formal learning to apprenticeship; the focus on assessment and “competence”; and the individual and complex nature of practice and skill development. Finally, I return to a wider consideration of the notion of apprenticeship itself.

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Chapter Nine

Conclusions: Education, Skill and Apprenticeship

I set out originally to find out about the nature of skill, about the nature of skilled practice, about what those who were “skilled” thought about it, and how they had learned to do the things they do. I had in mind something like the description provided by Matthew Crawford (2009) in his similar aim of highlighting the value inherent in the “work of the hands”. He states:

> For this a new anthropology is called for, one which is adequate to our experience of agency. Such an account might illuminate the appeal of manual work in a way that is neither romantic or nostalgic, but rather simply gives credit to the practice of building things, fixing things, and routinely tending to things, as an element of human flourishing (Crawford 2009:64).

In looking at the practices of apprentices and skilled craftsmen and women I also wanted to understand better the elements and conditions that best contributed to learning in their areas of expertise.

The learning and work of the artist participants was to provide a comparison to that which the engineers undertook. The artist/maker individuals worked independently, decided what they wanted to make, and when, where and how they would do it. The engineers, by comparison, worked semi-autonomously; they made what was required of them largely when it was required and in what would be considered a reasonable amount of time. However, the decisions about how they would proceed on any given project were mostly theirs to make.

Apart from those elements their stories are remarkably similar in many ways. Where there are other differences, they are generally related more to the opportunities that have been available to the different individuals of both groups, the ways different individuals have chosen to put their knowledge and talents to use, and the wider social milieu in which these have evolved.

A number of discussions in chapter two identified issues relating to education, apprenticeship and skill; the following builds on these discussions, based on what I learned at Stafford Engineering and from the artist/makers. In this concluding chapter I also critique the notion of “community of practice” as it has been applied in workplace learning discussions.

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My earlier discussion of skills policies shows that while extensive investments have been made in vocational education and training over many years, insufficient recognition is made of the contemporary structure and state of the labour economy or even of the state of the populations from which those who are to acquire the skills will be drawn. Likewise, the knowledge that some forms of formal education are not always the best training ground for many in the workforce has been pointed out by a number of authors (Apple 1981; Becker 1972; Berg 1970; Illich 1999; Neill 1962; Sidorkin 2009; Willis 1977; Wolff (2006). These commentators criticise mainstream education for a number of reasons.

However, Basil Bernstein describes a fundamental problem evident in contemporary education systems and one which relates directly to my discussions of the fragmentation of knowledge. Bernstein argues that where education was once devoted more to debate and the production and creation of new knowledge, educational institutions must now largely serve as the handmaiden to the market economy with education policy being managed and driven increasingly by market ideology.

> This can be seen in the stress on basic measurable skills at the primary level [in New Zealand this has manifested in the system of National Standards testing], vocational courses and specialisations at the secondary level, spurious decentralisation, and the new instruments of state control over higher education and research (Bernstein 2000:86).

Importantly, Bernstein has identified (in a similar way to Hart's arguments about skill noted earlier) the way contemporary discourse surrounding education separates knowledge from the knower so that it becomes "dehumanised": "Today perhaps there is not so much a contradiction as a crisis, and what is at stake is the very concept of education itself" (Bernstein 2000:86).

Bernstein's observations can be seen to accurately describe the underlying fault-lines which manifest in many different ways within current education policy. They echo the concerns of Hart whose discussion of skill and education traces a similar path. They are evident in the current emphasis on standards and assessment, and policy which reflects the valuing of a narrow range of subject areas, in the early years in particular. My findings suggest that an emphasis in this direction will be detrimental to the goal of creating knowledgeable, creative and innovative citizens and at odds with what educationalists themselves consider "good" education and sound pedagogical practice.

The brief discussion above has focussed on education in general, even while its arguments can be seen to affect, to varying degrees, all areas of education and training. Evident in the earlier discussions is the way that claims about *how* learning occurs have emphasised different elements of the process at different times. The following continues the discussion of learning and builds on a number of the findings which have been outlined in the ethnographic chapters to emphasise the strength and value of the forms of learning experienced by the participants.

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Biography, Culture and Education

My findings support the argument noted in chapter one that the apprentice (or learner) should not be considered simply as a blank slate on which the workplace effects a transformation. Rather, I emphasise the importance of earlier and other learning and experiences, i.e. what the apprentice brings to the job or learning situation. This includes a consideration of socio-cultural environments and of both formal and informal education. This insight arose originally from the stories of the artist/maker group whose backgrounds were enriched by a wide variety of learning opportunities. This led me to consider more closely the histories of the tradesmen and apprentices and to realise that their backgrounds had been equally enabling to their current occupation.

Of importance in the discussions of the participants' biographies, "capital" in its various guises can be seen to provide the best chances for success in the institutions of learning, in the places where people may find work, and, in society in general. Both cultural capital and social capital have been important contributors to the successes of both the Stafford men and the artist/makers. All the participants demonstrate histories of learning and opportunity and experience which have either directly or indirectly supported their later learning.

Briefly, Pierre Bourdieu (1986) identified three main forms of capital: economic, cultural and social. All three may either be inherited by or transmitted to succeeding generations. Economic capital would appear to underlie the best chances of acquiring the other two, which in turn are essential for success in the workplace and valuable as a basis for success in education. As such, they can then be transformed into economic capital. However, Bourdieu argues that it is the least visible and "best hidden" of the three, cultural capital, which

> …receives proportionately greater weight in the system of reproduction strategies, as the direct, visible forms of transmission tend to be more strongly censored and controlled (Bourdieu 1986:49).

Further, he argues that "human capital", as described by Gary Becker (1962), and which can be seen to underpin much of late twentieth century education policy thinking, is a much narrower concept:

> …human capital, despite its humanistic connotations, does not move beyond economism and ignores, *inter alia*, the fact that the scholastic yield from educational action depends on the cultural capital [and, it could be argued, economic capital] previously invested by the family (Bourdieu 1986:48).[178]

The rapid development and rise in computer related work and technologies and concurrent globalisation of the labour force (Brown and Tannock 2009) has seen shifts in ideas about which forms of knowledge are most valued. As they note, raising stocks in human capital became linked to the rhetoric of "high-skills" and "knowledge" economies as

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[178] Savage (2003:539) argues that the education market "is a generative market, in which parents buy into a cluster of practices that allow their children to develop cumulative advantage, many aspects of which are opaque to outsiders". While access to universities in New Zealand is not restricted in the ways assumed by Savage, the "kind of contact" acquired through attending particular schools does apply. I noted a recent example which demonstrated this while travelling past a local private college. A large sign announced a forthcoming "Academic Open Day". However, the sign did not mention such things as education, knowledge, or, quality of teaching. Instead, it offered: "Opportunity **.** Connections **.** Success".

imagined by Leadbeater (2000). This new world of work no longer appeared to require “manual” labour. Rather, as had been pointed out earlier by Ewart Keep:

> …the future development of the labour market and the workplace … promises a neo-utopian world of highly skilled, polyvalent knowledge workers operating in autonomous, self-managed teams and exercising high degrees of discretion within non-hierarchical, high-trust organisations (Keep 2007:20).

However, as is noted in chapter two, this thinking led to a lack of recognition for the knowledge required in the many other forms of work which are necessary to keep society functioning.[179] Also while salaries for those at the top have skyrocketed to unthought-of levels, downward pressure at the lower levels of the market has seen a trend towards a “high-skill, low-wage economy” (Brown et al 2008) and “bad” jobs.[180] As noted earlier, Ewart Keep (2009:21, 2010a) named the “skills narrative” as one of the grand narratives of neo-liberal thought and has pointed out that for vocational education, policy that places skill at the centre as the magic bullet to boost the economy (via human capital accumulation and knowledge stores) and fix social ills, ignores other possible avenues of potentially effective policy.

> Learning to bring about cultural fulfilment; political enlightenment and activism; bolster the enjoyment of sport, hobbies and leisure;[181] or simply

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[179] Supply of those qualified to undertake “good” jobs, exceeds the supply of those jobs: “…even if E&T provision were transformed tomorrow, so that every student entered the labour market with high levels of achievement, and a broad education that embraced both liberal and vocational elements in a sophisticated mix, the poor jobs would still be there and still have to be done by someone” (Keep 2007:22).

[180] In addition to the many British commentators cited, David Livingston (2004) has pointed out that despite the existence of greater numbers of skills within the workforce, the wage gap in the United States is greater than ever. A similar situation has evolved in New Zealand since, in particular, the implementation of the *Employment Contracts Act 1992*.

[181] A friend who is a teacher recently asked her class of eight year olds what hobbies they and their parents participated in at home. In a class of nearly thirty children, the majority answered, “watching television”. She also had to first explain what she meant by hobbies. The word was unfamiliar to the children.

> learning for its own sake, are all relegated to the outer margins of the policy discourse (Keep 2007:16).

With this comment I am reminded of the stories of the artist participants in the way they had access to both time and available classes, to develop their interests and knowledge outside working hours (and even sometimes within, as was the case with a number of this group). The use of “leisure” time in building knowledge is also evident in the stories of the tradesmen and their histories of involvement in family interests and pastimes. In other words, both groups had histories of the inheritance and further building of good stocks of cultural capital. These activities were often important launching pads for later learning and careers.

The stories of the participants demonstrate the way that many elements worked together to enable these individuals to fulfil their potential. Broad and diverse opportunities were sought out by both artist and engineer participants, demonstrating an entwined mix of environment, opportunity and the need to fulfil individual talent. The stories also show that the first choice of occupation may lead in many directions as new opportunities either present themselves or are sought by the individual. A number of the participants can be seen to have searched for and found the teachers they wanted when they wanted them. Apprentice coordinator John also identified the nature of strong, self-driven searching for learning in his description of the young men who, “if you don’t give them an apprenticeship they will find someone else who can”.

Many of the apprentices and tradesmen identified their early teenage years as the time when they believed they already knew many of their strengths and preferences. While some had not known exactly what sort of work they wanted, they had a good idea of the strengths they wanted to work with. Wilson (1999:292) argues that around age ten may be the ideal time for beginning a more structured apprenticeship. During a visit by a group of ten to twelve year olds to the factory, it was clear from their comments, that many of the children already had a sense of whether or not the various forms of work carried out there would suit them. This would indicate that for many children there is a need to begin to focus more specifically on a particular area of learning even at this age. Opportunities to explore their areas of strength may well provide a better basis for other forms of learning. The "basics" of literacy and numeracy would be embedded in these experiences.

Leadbeater (2000) noted above, predicted that the wealth of the future would be created upon "information" and the entrepreneurial uses of the computer, i.e., the "knowledge of the mind". Likewise, in New Zealand Paul Callaghan (2009) argued that this being the case we should be developing our economic activity away from what is produced on the farm. He appeared to argue for a theoretical, technical and scientific emphasis in education.

However, I have shown that in the stories told by those at the engineering company, the knowledge that was most useful to them for further knowledge acquisition, was learned "on the farm" or, in similar places where the theoretical was informed by the manual, by the tactile world that surrounded them; by their engagement with it and with materials and others within it. This embodied experience then provided a solid basis for later forms of learning, both formal and informal.

McWilliam and Haukka (2008) argue that moving creativity, in all its forms, to a central, rather than its current marginal, place in education is also essential to the future of a healthy education system. An improved understanding of the ways in which creativity may be allowed to flourish would then provide "…evidence about the extent to which the creative capacity is being understood to be a powerful economic driver, not simply in the province of the arts and hobbyists" (McWilliam and Haukka 2008:651).

Burnand and White (2008:667) point out the way that the two commonly espoused policy imperatives of performativity (in terms of constant external assessment) and creativity are, in fact, in conflict with each other; the first destructive of the second. Stephen Ball (2003:13) and Craft and Jeffrey (2008:579) note the negative effects of performativity in the way it undermines teacher professionalism. Strathdee (2005a:437; 2011) has also questioned "the ability of new qualifications frameworks and assessment systems to promote innovation and social inclusion". He concludes that in the contemporary labour market, qualifications, while important, are not enough, "…qualifications tend not to measure the qualities employers require … Qualifications do not measure the qualities, knowledge or dispositions associated with innovation" (Strathdee 2005a:453).

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The "Modern" Apprentice

> …the rise of a positivistic vision of knowledge, itself both accountable and (above all) countable, accompanies a brutal elision of embodied forms of knowledge (Herzfeld 2007:93).

Issues of assessment frequently feature in discussions of formal education and also relate to the accrediting of vocational qualifications. I have noted the work of a number of authors who are critical of the way that knowledge is fragmented to serve the instruments of assessment. This is argued to be related to a climate of increasing managerialism in the institutions of education, prevailing market ideology, and judgements based on economics rather than on sound pedagogical principles.

Erica McWilliam (2005) in critiquing the ubiquitous rhetoric of team building that exists in many organisation also notes that despite this rhetoric, assessment has remained “stubbornly individualistic”, leaves little room for non-assessable learning, and the assessed and the assessors are always at a “safe distance” from each other. This “distance” of the assessed from the assessor is also identified in Leesa Wheelahan’s following comment.

> Assessment … becomes a straightforward matter of providing ‘evidence’ that the specified performance criteria have been met. That which can be specified and measured is measured, that which cannot be specified is not measured. The limits of the real thus become defined by the limits of language … the holistic development of the person in the context of their profession is excluded, and this involves forming an identity as part of that profession (Wheelahan 2009:236, 237).

The formal apprenticeship requirements are that processes and techniques performed be recorded in codified form. However these representations of the elements of practices learned are very minimal descriptions of what has truly taken place. These representations eliminate the human elements of the processes of learning: the context, the conditions on the given day. They do not show who has helped, what has hindered, what was easy and what caused struggle. It is essentially a dehumanised representation of what has been in most cases part of a complex experience (Bernstein 2000).

Many aspects of the forms of written assessment required by the new apprentice qualification presented problems for both the business and the apprentices. Some, like apprentice Greg, also seemed to feel distant from the faceless people elsewhere who assessed (or in one instance “lost”) his work. The apprentices appeared instead to be much more comfortable with, and placed much more value on, forms of assessment that were done face to face, with senior tradesmen whom they respected, rather than by someone who "sits in an office" unconnected to their workplace.

> I think a better way of assessing it would be to have someone come in and watch you work. Like – 'make this part' and then you have to make it and get assessed as to how well you have done it. That's what I think. I mean if you can do it on paper, doesn't necessarily mean you'll be good at it in practice… (James, apprentice).

The apprentice coordinator identified the difficulty for apprentices in making sense of some of the documents which describe unit standard requirements – these are highly detailed descriptions of technical processes which were once measured mostly on performance. The apprentice coordinator noted that even he sometimes had difficulty understanding what the authors were getting at and said that he just didn't show those parts to the apprentices but instead provided his own translation of those requirements.

One of the apprentices confirmed this:

> Some of those correspondence questions are just ridiculous. They just word them that funny… like they're not very smart people…..

> *So the paper work could be improved?*

> Just make the questions… make them… not as in simple, so they're easy, but… make them, explain them <u>right</u> as in engineering terms, not a person from university whose got all these… because we're not like that.

I asked who is setting the papers.

> Probably some pen-pusher who's never done engineering in his life, he's just read all these books, and written all these fancy questions that you don't need. You can write it another way… a better way, where people like us can understand it.

Assessment by and of their mentors and peers on the shop floor is already embedded in the processes and practices of their everyday work, not done, as McWilliam (2005:7) notes of assessment, "from a distance".

This distance between what is judged to be known and the knower is what underlies the apprentices' complaint where they wished to be assessed within the context of the work, by their peers or respected others. This illustrates the need for the *person* to be recognised, not simply the task or procedure that they perform but rather the way they have gone about it and the context in which it was done. The apprentices invest much of themselves in the work they do and it is this for which they also wish to gain affirmation and recognition in the same way that professionals are also judged by the human qualities they bring to their work. This illustrates again the very personal nature of learning and of skilled practice.

Kaleb described assessment under the time-served system of apprenticeship and I asked him what he liked about it.

> One thing that worked pretty well was that you were assessed a lot by the people who you were working with on a day to day basis. I mean that can still happen under the new apprenticeship system but it's not really done as well, particularly with say an outside contractor like [the apprentice company] coming in and looking after part of that for you.[182]

[182] Kaleb emphasised the difficulty faced by employers in meeting the institutional requirements of the MA scheme: "It does take the onus away from an employer, to have an outside agency come in and help do all that. Mainly due to the bureaucratic side of things; I mean if we've got to do our own assessments, NZQA accredited bloody unit standards and all that, it would be a crippling cost to us both financially and time wise just to be able to comply with the regulations".

> So I think it was more about actually having the right skills as opposed to going through and trying to tick the boxes – and say yes, I've done a little bit of that – here's a little bit of evidence. You actually … I think you got a better, more rounded sort of tradesperson out of it at the end of the time who had been actually thoroughly assessed throughout the period of their apprenticeship, not just based on the merits of one job but also based on the merits of a lot of jobs and a lot of learning across that period of time.

This form of assessment is in many ways a more complex entity than filling in some spaces on a unit standard form. Missing, but somehow assumed to have been ideal, is the context of the production of this represented, or codified, artefact of "knowledge". In the same way that apprenticeship itself requires relationship building, on-the-job assessment requires that a relationship of some form has been built; that there is willingness on the part of the assessor or assessors to engage in assessment since, like mentoring itself, time spent doing both subtracts from the time the tradesmen have to do their own work. Likewise, at the company level, it takes away from general production time.

The artefact of assessment, the codified unit given at one point in time, however, bears no trace of these "others" who have contributed and in many ways been instrumental in the apprentice's learning. Apprenticeship learning is like the natural growth and development of a human being (Sheets-Johnstone 2000). It is mostly gradual, incremental, and often imperceptible from day to day. But, after a period of time you may become aware that it has occurred. The "snapshot" unit standard, at the lower levels at least, does not recognise such complexity.

However, in New Zealand, engineering apprenticeship itself sits within a more complex system than in the past. There is now what could be called a national overarching "apprenticeship industry" that has been built up around what was once a more localised form of learning. Despite this large bureaucracy of trades training, in the Stafford workplace at least, the manufacture and continuation of knowledge of the trade operates through the traditional practices of time-served master/apprentice teaching and learning, almost completely outside the institutional bureaucracy through which it is audited. The industry is its own judge of the skill levels and knowledge of a tradesman or apprentice. The “standards” of the institutional apprenticeship body appear to be viewed as an inadequate measure within the trade.

In the past an apprentice answered to one master who was not only teacher and owner in his place of artisanal production but also often surrogate parent to the young person in his care. By contrast, the “modern” apprentice has to negotiate relationships with a number of “masters”: the owner of the business where he works (who may also be his employer), the apprentice coordinator (whose organisation may also be his employer), the teachers in the off-site places where he may go for block courses, the external assessment institution whose personnel he may never meet, and those he will meet every day – the men on whom he depends for almost all his learning, those on the shop floor.

During the last twelve or so years, while there has been a renewed emphasis on and appreciation of the value of apprentice-style learning - learning by doing - the emphasis appears to be mostly on the learners. There does not appear to be the same emphasis on the quality of the workplaces where the “doing” will be done, and of the very real need for there to be experienced “others”, doing “good” work.

Given that a large portion of work on the shop floor revolves around working with machinery, learning in that environment entails acquiring technical knowhow as much as acquiring “skill” or “skills”. The young men must already have many of the necessary skills. The learning instead entails building competency, proficiency and then expertise in the use of the machines as they learn “about” them and how to go about making things with them. Success on the shop floor appeared to depend at least initially on what the apprentice brought to the role as much as on what was available on the shop floor. In other words, the qualities necessary for success were often already present within that person before the experience of apprenticeship and were the result of his upbringing and environment, often including school workshop classes, and the social and cultural capital which these supplied.

Importantly, there were also almost always one or more key persons who had had a great influence on the learning experiences of the men at all levels. Some were family members, some “old school” technology teachers. Other important mentors were usually men they had served their time with or worked alongside. Different workplaces were also identified by some as having been influential environments for learning.[183] I could see that the intergenerational makeup of the Stafford workshop was also important to its success as a business and as a place of learning.

Apprenticeship can survive, and does so in many places, without bureaucracy (no matter how helpful it may be) but the bureaucracy of apprenticeship training cannot survive without the goodwill of those already working in the trades, to teach those who will follow. Apprenticeship in precision engineering as it occurs at Stafford is a robust process, based on many of the practices and the ethos of “traditional” forms of apprenticeship learning. The apprentice coordinators, usually themselves ex-tradesmen, also operate within this ethos. Effectively, they are the only representatives of the institutional machinery of modern apprenticeship who actually interact with apprentices at a personal level at the workplace.

[183] Billett (2004), Fuller et al. (2007) and Unwin et al. (2007) have also noted the effects of differing participatory practices on learning in the workplace.

While there are discussions at policy level about skill “shortages” and “gaps”, little mention is made of the capacity of businesses to usefully and productively employ more apprentices even should these be paid for by someone other than the host company. It is obvious from the comments of the CEO and others involved in the training of the apprentices that there is a fine balance to be achieved on the shop floor when it comes to work volume and pressure, to the work that is available for them to do and in the abilities and time available of the tradesmen who will teach and mentor the apprentices. The optimum ratio at Stafford appears to be about one apprentice to seven tradesmen and related staff.

While a number of the artist participants were former teachers and would thus be expected to have strong understanding of learning, the tradesmen demonstrated that they also have clear ideas about how both they themselves have learned and how they may support others’ learning. Important in their pedagogical knowledge was awareness of when to give advice and when to stand back and allow the other to “get on with it” even if it meant leaving them to make some mistakes along the way.

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The perceived value of qualifications, as has been noted elsewhere, is variable. In discussing the current system, CEO Danny Ryan exclaimed that the qualification itself meant “diddly squat” to him and to many other employers of tradesmen. On another occasion, while discussing the wages earned by those at Stafford, one tradesman pointed out that no matter what reputation (or qualifications) a new tradesman brought with him, there would always be a probationary period of employment until he had proven himself in the new setting. Learning may be legitimated within the institution of NZQA but it is recognised, or not, largely only within the industry or company concerned, and specifically, as it presents in this case, on the shop floor. As Master tradesman Phil commented:

> *'I'd rather trust someone I knew could do the job than someone just out of an apprenticeship with papers' (FND 23.9.08).*

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On the positive side, the institutional arrangements of modern apprenticeship do provide a safeguard that was not always available in the past. The negative aspects of time-served apprenticeship have been noted at various points. The modern apprentice coordinator provides a level of protection for both parties and can act as a mediator between the company and the apprentice to circumvent poor practices. In one example, as an apprentice completed his apprenticeship, John (the apprentice coordinator) noted that the young man had not been awarded a suitably higher hourly rate because he was "taking too long" to complete work. John had intervened on his behalf to ask management to reconsider as he felt it was unfair; the fellow had completed his apprenticeship and would no doubt soon pick up speed.

However, those on the shop floor can also act to mediate between young tradesmen and management. In another instance Malcolm had intervened on a young man's behalf so that he could be given the opportunity to operate the Alpha lathe which Malcolm had formerly used. On one of my visits the young fellow was busy at this lathe and said he was really happy with it, and to be working in Malcolm's section of the workshop. Malcolm had also intervened of behalf of a new apprentice who was about to be dismissed because those in management thought that the boy “just didn’t have it”.

Malcolm had said “No, he has, but he’s young, just give him a bit of time” and was told by the shop floor manager, “Okay, you’ve got a couple of weeks to prove me wrong”. On a later visit,

> *…the young man was still happily at work. Malcolm said he remembered back to what it was like when he was a young apprentice – ‘I was just like that; you’ve got to give them time to come right’ (FND 9.12.10).*

These instances, along with a number noted earlier, show that it is the men on the shop floor who often have the best information about how those around them are performing – where there is a need for some “bringing in to line” or when there is need for a little more nurturing, mentoring and patience to allow time for the apprentice to work towards reaching his or her potential.

This is a finely judged call as for management the impetus is for productivity and profit while the master tradesmen on the shop floor remember their own days of learning to do the job. This awareness was strong among most of the tradesmen. Even though they were fully aware of the need for productivity, they also appeared to want to mentor and support the younger men where they could see past the immediate shortcomings.

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Assessment, "Competence" and Learning

A number of authors have noted the negative effects of concentrating on "competency" as a measure of knowledge. However, it is this concept that lies at the heart of unit based assessment. Nigel Norris (1991:4) views this initiative (following Tyler) as cyclical, like other educational movements. As such, he argues that it emerges as a "successful ritual response to a problem". He notes its appeal as an, "El Dorado word with a wealth of meanings and the appropriate connotations for utilitarian times … Words like 'competence' and 'standards' are good words, modern words; everybody is for standards and against incompetence" (Norris 1991:1). He argues that, "Competency-based training theorists typically treat knowledge as static, as information … the concept of competence has been largely stripped of its social content and context" (Norris 1991:3, 4).

Gerard Lum likewise, concludes that competency measures entail "…not only a *quantitative* shortfall in which some capabilities are successfully described but others not, but rather, a *qualitative* discrepancy which cuts across all the capabilities contained within a specification" (Lum 2004:495). Leesa Wheelahan is also critical of the movement, claiming that, "Constructivist discourses around student-centred learning; situated learning and the contextualised nature of knowledge were appropriated and reworked through the prism of instrumentalism" (Wheelahan 2009:227).

Like Bernstein noted above, Wheelahan (2009:227), argues against the way that educational practices, in this case competency based training, work to separate knowledge from the knower. She argues that competency and skills based education is framed in the language of empowerment but fails to problematise the nature of work.

> …the outcomes of education [are defined] as unproblematic ‘descriptions’ of the skills needed by employers … [while] students … can ‘choose’ what, when and how they will study.… In practice, however, the freedom that is entailed is limited to the way in which ‘the tightly prescribed learning objectives are to be achieved’ (Wheelahan 2009:232).

Hugh Lauder (2009), likewise, argues for problematising the relationship between academic knowledge and work if we are to understand the relationship between education and the labour market (and productivity).

David Beckett (2004:500) argues that “knowing how” and “knowing why” are both essential to practice, “Both … are up for constant renegotiation as, anticipatively, actions unfold – amidst a ‘hot action’ workplace”. Alan Brown (2008:9) also argues that competence, as a goal, falls far short of what is needed; instead we must place more emphasis on a “developmental view of expertise”. Jarvis (2009) would agree with this and argues that we should acquire this through experience:

> …we should not expect people to stop learning just because they have achieved a state of competence – it is a low expectation of achievement in education and this should not be an aim in education.… We learn our expertise through experiencing and learning from experience (Jarvis 2009:65).

Despite the many valuable arguments these authors provide, others appear to perceive training and workplace learning (in particular within trades type training) as simply the reception of knowledge or “mindless” acquisition of practical skills. There appears to be a lack of recognition of the analytical elements of the work and of the way that knowledge is also made within the practices of work. This form of knowledge construction is unrecognised within a tightly prescribed qualification system. As Norris above, would argue, like many of the authors cited throughout this thesis, knowledge is not static, or, simply information, but emergent, dynamic and changing.

Another facet of learning is ignored in the competency rhetoric – that of the need for a long time of practice for many forms of learning. Eraut (noted earlier) discusses the work of Patricia Benner (1984) who used the Dreyfus model as a means of analysing the learning experiences of clinical nurses. Competence is the middle level in the Dreyfus model of skill acquisition. Eraut points out that "the Dreyfus definition of competence is based on how people approach their work, not on whether they should be judged as qualified to do it" (2001:112). Benner believed that competence is, "typically acquired by a nurse who has been on the job in the same or a similar situation for two or three years" (Eraut 2001:112).

Shop floor manager Kaleb mentioned the need for apprentices to sometimes move around different jobs to get sufficient variety in the work and that, while some units could get "signed off at Polytech … during the block courses", this did not mean the apprentice was proficient in the use of those processes or techniques in practice.

> …you can't do a whole heap of things in a three week block course at tech. You need to practise them for a three month period to get any where near competent at them.

Given these comments, it could be argued that the system of unit standards based assessment, especially in the lower levels, may not even be measuring competence. It simply records that the learner has been able to perform that technique at that particular time or that he knows a particular group of facts, not that he necessarily knows how to use or apply them well.[184]

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[184] An example of a group of unit standards is provided in appendix iii. Also, as noted earlier, the apprentice coordinator commented that his company could not judge a potential apprentice's maths ability from school-based assessments and always set their own maths test for these applicants.

McWilliam and Haukka (2008:660, 661) also observe that "…when there is an overemphasis on performance goals people are less likely to move out of their zones of competence, and more likely to blame their own lack of ability if things go wrong". As they note, this is the difference between following individual performance goals and individual learning goals. Likewise, while the apprentice engineers were judged competent at various tasks and techniques; in terms of overall practice, the end of apprenticeship was seen as simply a stage in the wider learning which they will continue to do.

Expertise, as both the apprentice coordinator and the shop floor manager noted, is built (not acquired) over many hours and during the years that the apprentice spends in the workshop and related work sites.[185] Additionally, it continues to develop and build, and ebb and flow, during the years of gaining experience and practising their trade as described by many of the men. Thus, the achievement of a Unit Standard, at the level of competence (as evidenced by a verbal description and/or a photograph) is a very limited guide to the knowledge and skill that an apprentice may have acquired.

Apprenticeship style learning resists formal audit and assessment processes but is not immune to them. The degree to which the qualifications resulting from formal assessment processes are valued by business owners and the tradesmen themselves shows that they hold limited currency within the trade. Shop floor assessment of an apprentice's or tradesman's skill, expertise or progress operates independent of formal practices, and, like the building of other forms of knowledge, "follows its

[185] Eraut and Hirsch note the different conditions necessary for proficiency in one area and expertise as represented in expert practice: "This type of expert requires a wider knowledge base, critical analysis and the ability to develop multiple representations of complex problems, as well as being able to work with clients and other people with different types of expertise. The cultivation of such expertise requires a very different learning context from that needed for the development of proficiency" (Eraut and Hirsch 2007:14).

own logic" (Sigaut 2002:439). It is not fixed and immutable but is constantly renegotiated in the processes of everyday work. Even the most experienced tradesman will have days when work does not go so well. Likewise, the new apprentice will have days of struggle and days when he shines. These findings suggest that the current system of assessment while being continually improved still requires further adjustment.

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McWilliam and Haukka (2008:661) point out another negative aspect of the constant awareness of being assessed; that the learner is less likely to risk experimentation and error. "…it is more likely that a student will avoid uncertainty at all costs, rather than embrace it for what it might conceivably offer to fresh understanding and to the strategic search for meaning". McWilliam had argued earlier: "…we should be looking to return to a culture … that respects students enough to challenge them by messing things up with and for them" (McWilliam 2005:10). Learning from mistakes was considered a necessary (albeit occasionally costly) part of the learning that occurred at all levels of the engineering company.

Artist Susan Flight had a similar attitude. I had asked her what she viewed as competence:

> Well I don't know what competent means really because if somebody is working - and I have described this to you – there is always another range of mountains when you get to the top of the one you're walking up. It's a personal thing and it takes a lifetime and it stops when you die. Not much use for training eh?

She also highlighted the negative effects of standardised and heavily audited education systems; in her case in arts teaching.

> …it's a constant battle to keep that creative freedom … I was extremely lucky because I felt the course that I went to was creative and exciting and being a dissident was okay, and it was good. You came out wanting to work and [now] most of the people going into these courses to train them in art or anything of that kind, coming out and not wanting to work … they've had the creative impulse beaten out – through tidy teaching, strict agendas. You've got to have room for your rebels; you've got to have room where people can fail and once they have to pass, that's the end of real education.

I remarked that current education policy in New Zealand appeared to be heading in that direction.

> It's bad news. They're trying to cover up the deficiencies of society with schooling. Tricky.

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Learning in a Community of Practice?

For some time many proponents of workplace learning have invoked the notion of "community of practice" to describe the process by which new entrants are introduced to work. In her ethnographies of the 1970s, Jean Lave focussed on learning at a time when much of the research about learning was conducted in laboratories. Lave quickly developed an awareness of the nature of learning as she observed it in apprenticeship and of how this might be applied more widely. As she describes it, there was a moment when "…apprenticeship turned from a docile example into an unruly object demanding analysis in its own right, it became a key to the theoretical/ ethnographic crafting of a conception of situated practice" (Lave 2011:148).

As Lave explains, ethnographic work is “iterative, open-ended, partial and long term”, and, as such, allows for re-interrogation and explanation in later contexts. Lave notes that some elements of her initial research such as “participation, legitimate participation, and peripheral participation … became much more significant in later readings” (Lave 2011:149). As an extension of her earlier work, she and Etienne Wenger (1991) drew on Vygotsky’s concept of the “zone of proximal development”[186] as the basis for their notions of “legitimate peripheral participation” and “communities of practice”, to emphasise the situated and social aspects of learning.

Anthropologist Cristina Grasseni (2007:208) also notes the long history of philosophical arguments about the individual and social elements of learning and views the notion of communities of practice as “a useful ethnographic grounding of the epistemological notion of ‘form of life’”. However, while Lave and Wenger (1991) sought to refocus attention on the situated and social aspects of learning, their concepts have led in many cases to a “social” theory of learning where all else is downplayed. It appears to have developed into one where there are imagined “communities of practice”, somehow just waiting out there for learners who may penetrate their peripheral boundaries through “legitimate participation” and thus gain access to the knowledge therein; or, even, that such communities may be “willed” into existence (Stamps 1997).

Stephanie Bunn (1999), who studied various types of apprenticeship among the Kyrgyz nomads of Central Asia, also points out a “visible flaw” in the notion of community of practice.

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[186] Vygotsky defined this as: “…the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more able peers” (Vygotsky 1978:85). As such, the “zone” is a conceptual rather than a physical space.

> Kyrgyz apprenticeship does take place in the community, but this community might as well be called the home or the family as the workplace … The importance of 'birth talent' is also overlooked … It is also very useful to look at the nature of learning when the economic imperative is not foremost, to see what other factors play a part. Developing a skill by choice, or developing a 'birth talent', are important features of learning – as is to make for the enjoyment of it, for one's family, or for a gift … One flaw in Lave's argument is that her framework does not allow for the student who studies maths for the love of it … or the place of creativity and intuition in learning (Bunn 1999:84).

In the participants' discussions of learning, the importance of a "zone" as described above can be seen to vary for different learners. Some learn better alone, trying, failing, trying again, while others require and ask for closer mentoring. Likewise, some can learn from books, while for others this is less useful. In the rush to emphasise the social and situated aspects of learning, individual agency and individual talent appear to have been forgotten.

Authors such as Engestrom (1987) adopted a "transformatory perspective on the zone of proximal development" (Guile and Young 1999). In other words, they identified how the processes of work have the ability to generate new knowledge. But this is already evident in Lave's early work and is well demonstrated by the work of authors such as Smith (2004) and Roberts et al. (2007) whose research on historical artisanal knowledge is noted in chapter four.

Michael Eraut (2002) has also critiqued the usefulness of the concept of communities of practice. In an email to me he further explained that "…in modern conditions situated learning does not lead to communities of practice, because each person has acquired a different sequence of jobs" (pers. comm. 1.12.2009). It is also likely that recent trends in labour practices, such as individual employment contracts, contracting out, and part time work, work against the formation of communities within workplaces. Eraut (2002:10) cites McKee who studied junior hospital doctors and found that new working practices "resulted in significantly reduced learning opportunities", with the net result being, "a non-community of partial practice" (Eraut 2002:10).[187]

Eraut (2002:5) also points out that while learning may take the form of learning from others, it may also result "through overcoming challenges posed by the work itself". He argues that there are many variables involved in whether or not "mutual engagement" occurs and instead favours a framework which "treats learning as an integral part of working [using] four structuring dimensions" of activity within the learning context by way of analysis. These dimensions are very context specific, indicating that each workplace must be assessed on its own merits (or deficiencies). They involve:

1. The nature, range and structure of work activities.
2. The distribution of work activities between people and over time and space.
3. The structures and patterns of social relations in the workplace.
4. The outcomes of work, their evaluation and the attribution of credit/praise or blame (Eraut 2002:5).

In the cases considered by Eraut, "mutual trust and regard" were shown to be important variables in relation to successful learning environments. These were not easily solved through new forms of communications technology but rather depended on relationships within the immediate context of the work and respect for each other's perspectives and expertise. They were also "greatly facilitated by informal contact" (Eraut 2002:6). In a related study of clinical nurse training it was found that for newcomers, willingness to learn and "to do things and help out in a crisis" were strongly related to the opportunities subsequently afforded them. The

[187] "Changed working practices not only affected opportunities for mutual engagement, but also fragmented the doctors' experience of patient care. When patient contact is limited to short episodes rather than sequences of events, the consequences of earlier decisions may never come to the doctor's attention, thus reducing the value of case experience on which much of a doctor's professional knowledge is constructed" (Eraut 2002:10).

nurses' "stages of acceptance into a clinical team were related to their ability to ask questions and to seek opportunities for learning" (Eraut 2002:7).

Similar elements are visible in the many comments of the Stafford tradesmen in relation to the attitudes and learning strategies they would expect of an apprentice. An apprenticeship in engineering, as I have observed it, is not simply "learning at the edge of the work" (Bunn 1999:75) or in any way peripheral. From the very first, the apprentice is engaged "in the work", as he must be productive from the beginning, albeit at a lower rate than his more experienced colleagues. Many of the instances noted in the chapters seven and eight, as well as those in the artist/makers stories, support Eraut's claim that learning also results from the challenges of the work itself.

While much has been claimed in recent years for the value of regarding workplaces as communities of practice, Thompson et al. (2001:928) have also identified a similarity missed by many. They argue (following McKinlay), that "arguments about knowledge and communities of practice echo classic Taylorism". They also argue that attempts to "'reconfigure the knowing of experts … relies predominantly on attempts to convert what is tacit and ephemeral into that which is formal and explicit" (Thompson et al 2001:927, 928). This trend of breaking down the constituent qualities of communities of practice is similar to the way in which Frederick Winslow Taylor (1911) fragmented tasks to improve manufacturing efficiency, and is visible in the works of Göranzen et al. (2006) and Wenger et al. (2002), albeit in different areas of work. It also mirrors my earlier discussions of the fragmentation of other forms of knowledge.

Eraut's reservations about the usefulness of the notion of communities of practice noted above, along with those noted by Fuller, Hodkinson,

Hodkinson and Unwin (2005) reflect my own conclusions on the topic in relation to what I observed at Stafford. Every person on that shop floor was doing different work, had a different history and was at a different stage in their career. They are collectively perceived as “the shop floor” but this belies the differences in the personalities and the expertise which they may exhibit. While Lave’s work provides valuable insights, it is more useful in this instance to consider the engineering company as a “field of practice” (Marchand 2010a; Wheelahan 2009) with those who work there as both individual and social actors within it.

While some power relations do exist in this particular field, the concept of a “field” allows for the description of a more open and much more dynamic and ever shifting location for learning and one in which the various actors may play different parts at different times. Pairs of workers or small groups would form for brief periods to answer a question or to solve a particular problem, but quickly dissolve as the work continued. There was a continual flow of such exchanges but each person in the end was responsible for a different workstation and often very different forms of work. In addition, the assumption that apprentices only ever learned from their master is shown to be false, and is likely an incorrect one in the first place (Guile and Young 1999:12; Lave 2011:72).

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Descriptions of manufacture and artisanal production, such as those of Smith (2004), along with more recent works, provide an opportunity to rethink apprenticeship and artisanal learning with renewed interest: the workshop (or workplace) has always been a site of knowledge production. It has always been a place in which to either individually or collectively produce new knowledge and (noting Guile and Young 1999:117) new meanings; otherwise, material production would never have changed. As Marchand has also observed:

> Conclusively, knowledge and practice are not fixed; nor are they hostage to unconscious reproduction. Rather … our human knowledge, like our physical bodies, is constantly reconfigured in the activities and negotiations of everyday work and life (Marchand 2010a:Siv).

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Skill

In chapter two I noted the contemporary definition of skill, i.e., “the ability to do something well”. It is now obvious that we must also consider the earlier origins of the word. Evolved from the Old English *scele* meaning “knowledge”, it was in turn derived from the old Norse word *skil* which meant “knowledge and discernment” (Soanes and Stevenson 2003:1658). These earlier understandings of the word remind us to consider skill in a more holistic manner. The problems with the word skill noted earlier arise when it is used simply to describe things that people *do* rather than to describe people’s ability to *think* and ignores the closely intertwined nature of both.

Stout (2002:179) argues that “skilled behaviours … emerge through the effortful co-ordination of perception and action”. Skilled practice is a complex reality and its acquisition cannot be easily packaged into convenient components. When I wrote my final proposal for this research I suggested that the acquisition of skill was a *transaction of multiple complexities*. I had arrived at this initial thesis/conclusion as a result of my engagement with extant literature and of my own and others’ experiences of learning. Stout (2002) provides a useful summary of the nature of skill acquisition which may be applied generally:

> …manufacture requires well-developed skills ranging from basic motor co-ordination and movement accuracy to higher-level strategic planning and conceptualisation. Acquisition of these skills is a lengthy and labour intensive process that is inextricably linked with the broader social and economic context in which … manufacture takes place ... [these] are defining components of the human adaptation (Stout 2002:715).

In addition to this summary of the process of how crafting skill is acquired, I now offer my own expanded understanding of what skill itself may be:

Skill is achieved and exists on a number of levels. It may be comprehended as a particular type of knowledge or intelligence. We may talk of a skill or multiple skills as both representing “skill” so it can be argued that any one skill or “technique” is in fact made up of many other skills. At a basic level of acquisition skilled practice presents as competence. At more developed levels it presents as a quietly powerful embodied reality that inheres within the person who possesses it and becomes a part of their identity. At the highest levels it allows the person to act instinctively and perform in a dexterous, expert and “automatic” manner.

The ability to acquire skills continues throughout life. For some, skill develops best communally, within a social milieu. For others, skill may be developed on a more individual basis. In addition, it may also derive from somewhat more innate sources already within a person and from a drive within that person to acquire that skill as a means to achieve a particular end. Not only does this inner drive require that a person become competent in that field, it also appears to require that person to aim to be the best they possibly can. In this case the acquisition of skill (or likely multiple skills) is their means of attaining this goal. In this case we may argue that high quality skills are the components of high quality practice, the practice of experts. Skills are the building blocks of both expert practice and of becoming a “person in the world” (Jarvis 2009), both process and material of the construction of personhood.

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The Apprenticeship of Life

In chapter two, I provided a brief history of apprenticeship learning and of some of the ways it has operated over time and place, noting in particular a number of valuable ethnographic and historical descriptions and analyses of the institution. However, a more nuanced notion of apprenticeship has been explored by a number of other authors. In this conception of the word, apprenticeship is considered from the point of view of human development. Drawing on her work in Western Africa, Esther Goody (1989) recognised the similarities of childhood learning with those of apprenticeship.

She questioned why there were so few accounts of children learning from their parents and which framed that learning in terms of apprenticeship: “…for most of human history, virtually all learning has been of this kind: learning from same-sex parent or older siblings” (Goody 1989:234). Goody concludes that as production was taken out of households, where kinship roles were also economic roles, much of what needed to be learned for production, along with the source of that learning, went with it, leaving only general or “basic” skills to be learned from other family members.

> …it seems probable that the cultural splitting of the child’s world from that of adults … has been a consequence of the differentiation of the adult world itself through the division of labour (Goody1989:236).

Stephanie Bunn (1999) also draws on Goody's work, along with those of Lave and Coy, in her recognition of our early learning experiences: "Most learning, of course, happens in the way that most humans learn their first language – on the job – in the process of living itself. As an apprenticeship in living" (Bunn 1999:74).

Kaplan (2007:204, 205) also argues that, in relation to the historical study of apprenticeship, "We need to reproblematise 'upbringing' as a crucial aspect of apprenticeship because it covers the whole range of learning *off* the shop floor". While Kaplan is referring largely to the historical model of *ganze Haus* apprenticeship,[188] recognition of this comment is important in a general sense. It parallels my own argument, resulting from my findings, that policy relating to training and apprenticeship should consider the upbringing and early experiences of the potential participants as significant factors in predicting and assessing the potential value of such policies.

Recent research and knowledge of cognitive development supports this argument. The *Cambridge Primary Review* resulted from an enquiry into primary education in England. As a part of this review, Alexander (2010) and Goswami and Bryant (2007), reported on the current thinking on human cognitive development and its implications for education policy. In particular they noted overwhelmingly the importance of focussing on the early years of learning.

Likewise, philosopher Maxine Sheets-Johnstone (2000) draws our attention to the importance of recognising our first experiences of learning

[188] The *ganze Haus* (whole house) model was one where the apprentice (and sometimes journeymen as well) lived "in the house of the master [who acted effectively] *in loco parentis* and raised his apprentice as he would his own son" (or the mistress, her daughter) (Kaplan 2007:20, 21). Both Kaplan and Reinhold Reith (2007) in the same volume, give fascinating insights into the system. In particular while emphasising the contractual nature of the arrangement, they note its important role in the socialisation of apprentices, the many different and often changing conditions of contract, the areas of conflict, and the way considerations of class, gender and location contributed to the various arrangements.

in our lives and the way these may inform later learning. Sheets-Johnstone argues that our very first apprenticeship in life is that (as newborn infants) of learning our bodies. In effect, all the elements of later learning are active from that time onwards. Sheets-Johnston (2000:344) argues that “the roots of our wide ranging and epistemologically significant capacity for apprenticeship learning” lie within our experiences of these first years of life.

> The … infant social relationships that develop on the ground of our original corporeal-kinetic apprenticeship … [including] … joint attention, imitation, and turn-taking … are the foundation of apprenticeship in later adult life … Both consequent on, and in tandem, with this corporeal-kinetic apprenticeship, we developed understandings of the bodies and movements of others (Sheets-Johnston 2000:343, 344).

If, as Sheets-Johnston argues, our first apprenticeship occurs at the beginning of our lives, then it is of the greatest importance that this apprenticeship be the best it can. “Whatever the particular adult skill-learning situation … it is a compound of experiences sedimented with skills and concepts accruing from our history” (Sheets-Johnstone 2000:359). This is born out in the stories of the participants of this research.

Sheets-Johnstone, like Crawford (2009) and Harper (1987) noted above, describes what she terms “a *felt sense of rightness* in doing what one does, the rightness playing out along the lines of a sensed ease in one’s movement and in the ready flow of one’s response” (360, 361), and that the basis of this is kinaesthetic memory: “Knowledge is enfolded in movement” (Sheets-Johnstone 2000:362).

Grasseni (2007:209, 210), in her study of cattle raising and breeding in Italy, also highlights the importance of the early learning experiences of children in gaining knowledge of the work and activities of those around them. These early experiences of involvement in the everyday practices of their parents or other adults' occupations and activities can be seen as important, if not essential, building blocks for later learning.

Experiences while growing up are shown to be strong enablers for both groups of participants. Both the artist/makers and the engineers have long histories of interaction with tools, materials and knowledgeable others. Danny Ryan was brought up by a father who was a tradesman and a "tinkerer". In addition, he draws on his own history of making, engineering and design to craft an "ideal life" where he is able to work as he wishes, enable the careers of others, enjoy the excitement of invention, the satisfaction and pleasure that comes with the restoration of his classic cars, and the satisfaction and pleasure of having created a landscaped space like no other, in which to do it all.

The artist/maker group recounted histories rich in opportunities within the education system to explore and develop their talents and lead productive lives. The apprentices and the tradesmen acquired some of their knowledge through formal education. Working in tandem with this they had also grown up in environments rich in the tools, mechanisms and other artefacts of mechanical engineering within an equally rich associated socio-cultural milieu. While watching fathers, uncles or older brothers work around machinery or vehicles and using tools, listening to their commentaries, and learning the language of the men, of the tools and of machines, as young people they learned not only about those things but also about the ways of participating in these practices (Forrester 1999; Webb 1999).

These resource-rich environments have supplied them with a body of knowledge (cultural capital) which enables them in multiple ways to continue their work of knowledge construction. An analogy would be that having had experiences in building knowledge they are then able to continue the work of construction, or manufacture, of knowledge, secure in a strong embodied cognitive base. At the company level a degree of openness and informality and freedom for creativity and experimentation must be allowed to remain for this knowledge construction to continue. This will ensure that the company remains a dynamic one where new techniques and ideas may be tried, mistakes learned from, and ideas allowed to emerge; otherwise, as Kaleb remarked, "…you end up with robots, not people".

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If as Sheets-Johnstone argues, the first apprenticeship in life is in learning our bodies then the next apprenticeships entail learning to live in our families and learning to live in the wider communities, environments and worlds that we encounter as we progress through life. The quality of later learning is affected most strongly by these first apprenticeships. Thus, making up for deficiencies in these at a later date may require infinitely greater resources than would otherwise be the case. In many instances, the deficit is never made up. These are the young adults who comprise the NEETs (not in education, employment or training) group. In answer to this problem researchers such as Peter Gluckman (2011) argue vehemently for greater consideration of the importance of the early years of life as this is the time when development trajectories are established.

In an equally focussed manner Frank Wilson (1999) demonstrates the importance of the hand in developing speech and building intellect and the person as a whole.

> The hand is as much at the core of human life as the brain itself…. The hand *is* involved in human learning. How does, or should, the education system accommodate the fact that the hand is not merely a metaphor or an icon for humanness, but often the real life focal point – the lever or the launching pad – of a successful and genuinely fulfilling life (Wilson 1999:277, emphasis in original).[189]

Wilson has also noted the effects of early learning on later youth and argues that "the most powerful tactic available to any parent or teacher who hopes to awaken the curiosity of a child, and who seeks to join the child who is ready to learn, is simply to 'head for the hands'" (Wilson 1999:296). This would indicate that concentrating education on abstract learning alone will not lead to effective learning for all students. Experience of and in the world through all the senses provides a valuable pathway for many areas of learning.

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In a speech to the New Zealand Educational Institute in 1974 Clarence Beeby outlined the following challenge to teachers. The challenge could equally be aimed at those who form education policy:

> …education for development, both national and personal, is more than training in which button to press, which lever to pull, which figure to add to which. It is also more than training the next generation to be adaptable in their thinking, to swing like weathercocks to face the winds of change. It is all these things, and something more. It's helping them to distinguish between GNP and a fuller life for all, between the clean, uncluttered world and sumptuous pollution, between hate and tolerance, between war and peace. It's teaching them to accept some changes skilfully and gladly, but to hold fast to immutable human values that are the measure of all acceptable change. And who knows for sure the educational recipe for producing that kind of man or woman, what mixture of mathematics and music, science and art, sport and contemplation, technology and

[189] Following Penfield and Rasmussen, Wilson (1999:320) illustrates the way the hand, like the eyes nose and mouth, requires a disproportionate amount of the human brain's available capacity.

> philosophy? I suggest to you that it is one of your first jobs … to try to find out (Beeby 1974:18).

As noted earlier, Beeby drew much of his inspiration from the work of John Dewey. It is evident among the many authors I have cited that Dewey's work continues to provide for many a sound philosophical basis for thinking about education. Some who fail to consider the breadth and value of Dewey's writing are dismissive of it. However, controversy surrounding his work is not new. Dewey himself was perceived by some as having far too great an emphasis on vocationalism, and that his theories promoted education for "manpower" at the expense of a liberal education for "manhood" (Scott Johnston 2011). This is typical of continuing arguments which pit the classicist or traditional form of education against that which is considered "progressive" or "experimentalist". However, as another author has commented, Dewey and arch rival Maynard Hutchins

> 'did not disagree about whether children needed to read, or needed to understand the past, or needed to experience literature,' but they did disagree over the appropriate means to achieve these common goals (Johnson 1985:270, citing Diane Ravitch 1983).

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Through the fieldwork and the literature combined I have gained a new appreciation of what the concept of apprenticeship may mean in its widest sense. It is at the heart of our learning and life as a whole, in the way we learn to become persons in the world. This recognition of the pervasiveness of apprenticeship confirms the research noted earlier which shows that the greatest predictor of success in formal education is parental background and the availability of enabling role models and abundant resources. The findings suggest that while some of these elements can be provided in schools they will not thrive in a system that demands a narrow curriculum along with constant testing, assessment and judgement of both teachers and learners. As noted earlier, more than adequate assessment is already carried out in those environments, teachers are already able to identify the challenges that different students face.

In this research I have made a strong argument for recognising the importance of experiential learning. I have illustrated the way that learning results as much if not more from experience, practical knowledge and embodied knowledge, as it does from knowledge taught through abstract principles and methods. Rather, it is through experiential activities that many learners are able to construct symbolic and abstract thinking and through which the learner experiences the processes of learning which provide the ability to acquire further knowledge. Such learning requires a curriculum abundant in both material and human resources.

In 1974 Beeby asked what mixture of elements such a curriculum may entail. The question is as relevant today. We can also ask who should make the decisions on such a curriculum, which and whose talents should be promoted and who has the right to decide these things. Through the participants' stories of building their learning through many experiences we may argue that an environment where experiential and experimental learning may take place, and which allows for challenges to be set, and for mistakes to be made, must form a substantial part of any education system if it is to provide an empowering education. Apprenticeship provides us with a valuable model of learning.

The engineers apply their own logic when faced with a problem: "there is always a way to do it"; you start somewhere and even if that does not work, a way of doing it will become apparent. The engineers' trust in this "philosophy of emergence" appears fairly unshakeable. As Peter Jarvis (2009:145) observes, "…if we are to achieve our desires we have to do something about them and we learn in the doing since we will probably not know when we set out"!

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Throughout much of the time of the research I have been aware of my own role as an apprentice anthropologist. Coy (1989) observes that apprenticeship has been seen largely as "learning by doing", that it has lacked a formal theoretical component. He argues instead that in any apprenticeship the learner must continually move "from theory to method and back again". Apprenticeship is equally "mind work". To continue to separate thinking and doing belies the fact that they are simply forms of action and knowledge which have always been used together in practice, with analysis of the various extant elements being the fulcrum through which they are mediated. And analysis itself can be both tacit and explicit.

I have found many parallels with academic learning: processes of analysis are described and demonstrated by lecturers and learned as well by students through the study of related literature. Like other apprentices, having good tools (a range of theories) is important in this process; these tools are used to consider situations and issues through different perspectives. But learning *how* to analyse, *how* to use the tools, comes only through doing it; through trial and error, mentoring, critique; and through receiving feedback from those one wishes to emulate, those who are "further along". It also appears easy to ignore the fact that professions as well as academic careers are "crafted" by the practitioners within their various fields. Knowledge within both academia and the professions is "made" and emerges within the processes of the work being done.

Finally, and perhaps critically for my purpose (and drawing on an observation by David Plath 1998:346), like other forms of apprenticeship, the work of writing a thesis, the producing of a finished artefact, a crafted object, comes down in the end to be not simply about getting a grip on the many individual components (or units) of the work but of the challenge of “getting one’s whole act together”.

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I have now, to paraphrase Bateson (1991), “thought about the parts separately”. In the ethnographic chapters and analysis I have brought those “parts” back together to provide what I set out to achieve in the anthropological sense – an holistic account of what I have observed and learned. While I did not have the physical experience of all the technical processes I have observed, I have sought wherever possible to use my experience of similar situations to inform my understanding of what I was hearing, seeing or perceiving, through “all five senses”. Like the participants I will continue to learn and with this new knowledge I will be able, like them, to use these materials to make new work.

Almost all the participants, both artists and engineers, spoke of the sense of achievement and pleasure they gained from the creativity and challenges of the processes of making. I have also gained these things in the processes of researching and writing. With this in mind, I leave the last words to two Stafford men; to Phil, who among the men had spent longest on that shop floor and when asked why he came to work replied,

> Well, I quite like making things. I’ve always gone to work because I like making things.

…and to James, who had just begun his apprenticeship as I began the research; when I asked him about the things he gained from his job, he replied,

> I've always liked making things – to be able to stand back at the end of the day and say 'I made that'.

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Appendix i

Consent Form

Faculty of Arts and Social Sciences

University of Waikato

Private Bag 3105, Hamilton

Researcher: Gwen Wanigasekera

Contact: [redacted]

gdw4@waikato.ac.nz

[redacted]

Supervisors: Associate Professor Michael Goldsmith 07 8562 889 x 6426

Dr Tom Ryan 07 8562 889

Consent Form

I agree to be interviewed by Gwen Wanigasekera to discuss aspects of my work and ideas about the development of skill in my field of work.

I have read the information sheet and understand my rights in relation to this research. Any questions I have had have been answered to my satisfaction and I am aware that I may choose not to answer any question and may also withdraw from the research within the four weeks following my interview, and have my information returned.

I would like to hear the recording of my interview Yes No

I would like to read the transcript of my interview Yes No

I would like to have: my own name used prefer to have a pseudonym

(please circle your choices and cross out the others)

Participant's name: ___________________________________

Participant signature: _________________________________

Date: ______________

UNDERTAKING OF CONFIDENTIALITY OF RESEARCH

I, Gwen Wanigasekera, am undertaking research for a thesis as a requirement for a PhD in Social Science at the University of Waikato. I am familiar with and have agreed to follow the University of Waikato Human Research Ethics Committee guidelines. I am familiar with and will also follow the code of ethics of the Association of Social Anthropologists of Aotearoa/New Zealand.

I have informed ______________________ about the purpose and nature of the research and any possible Implications for him/her. I have also informed _________________ that he/she may withdraw his/her consent to participate in the research or his/her consent to have information obtained from him/her used in any written reports on this research within a period of four weeks of the interview.

I undertake not to show transcripts of interviews, conversations or field notes made during this project to any person other than the participant or supervisors, unless I have the written permission of the participant.

I undertake to respect the anonymity of ___________________ and not to publish any information gained from these conversations or field notes in a research paper/thesis or in other academic media, except in the form of extracts pseudonymously identified, or in the form of numerical data, unless the participant agrees or asks to be identified.

Signed: ___________________

Date: _____________________

Information Sheet

Faculty of Arts and Social Sciences

University of Waikato

Private Bag 3105, Hamilton

Researcher: Gwen Wanigasekera

Contact: [redacted]

gdw4@waikato.ac.nz

Supervisors: Associate Professor Michael Goldsmith 07 8562 889 x 6426

Dr Tom Ryan 07 8562 889

Dear

Thank you for considering taking part in this research in which I am looking at the development of skill in a number of contexts. I am currently a PhD candidate in the Department of Societies and Cultures (Anthropology) at the University of Waikato. My study is funded through a University of Waikato PhD Scholarship.

My plan for the research is to observe people at work in a number of areas of art and object production and also in an industrial setting. By making comparisons in the ways that skill develops in these two areas I want to find which environments best support the development of skill and also to explain how these skills are then valued by those who possess them.

I would like to carry out a recorded interview with you to find out more about the way you work and how you have developed your skills. This interview will be recorded if possible, of about 1 – 2 hours duration, and would be carried out at a time and place convenient to you.

You will have the option of remaining anonymous if you so choose. In addition, some data will be presented in a collective manner so that individuals are not identified. You will have an opportunity to hear your recording and view your transcript. You have the right to have any information altered or deleted. You also have the right to withdraw from the research by notifying the researcher within the four weeks following the interview, and to have all your data returned.

The findings of the research will be published as my PhD thesis. They may also be published in articles submitted to academic journals and form a part of academic conference presentations. At the completion of the research I will also supply an executive summary of the findings to those who have participated and wish to receive a copy.

The information collected during the research will be stored securely by me either at my home or in my locked office at the University. Until publication of the finished work, only my self and my supervisors will have access to the data. Upon completion of this research I would like to retain the collected data indefinitely as it may provide for further research by me in this area. As noted above, all recordings and transcripts will be stored securely.

This research has been approved by the Human Research Ethics Committee of the Faculty of Arts and Social Sciences. Any questions about the ethical conduct of this research may be sent to this Committee, email fass-ethics@waikato.ac.nz postal address, Faculty of Arts and Social Sciences, Te Kura Kete Aronui, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

Yours sincerely

Gwen Wanigasekera B.Soc.Sci. (Hons), M. Soc. Sci. (Hons)

Department of Societies and Cultures

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Hamilton 3240

Appendix ii

Below are sample question sheets. These varied from interviewee to interviewee and were simply used as a guide rather than a fixed structure. Some interviews progressed with very little reference to the written questions.

Questions Apprentices

Previous experience, training and skills

How long have you been employed in the company?

Tell me about any training you undertook before starting there?

In what ways has that training been of help to you?

What are the ways that you can learn what you need to know in this field from formal study/following manuals? In what ways is that sort of study helpful – or not?

How much of what you do is learned ‘on the job’?

In what ways do you think working with the machinery/your tools, help you to gain a better understanding of what they are capable of doing/what you can achieve with them? i.e. I mean, in comparison to reading about the process of using/making.

What are the situations where you feel you learn the most or that you feel make it easiest for you to learn?

What sort of skills do you think are useful in this job apart from working with the machinery?

Where do you think you have learned those skills?

Which skills do you thing are the most important or necessary – the manual or the mental – like things like maths and knowledge and about how metal behaves?

What sort of work/trades/careers have other members of your family been involved in?

Is this something you always wanted to do or did you come to it for other reasons?

What sort of things do you like doing or making best of all?

What are some of the skills you would like to learn in the future?

The work environment

Who are the people in this workshop who have helped you to develop your skills/learn the job?

When you first arrived who showed you how to do things?

What sorts of things have helped most since you have been working there?

What are some of the things that you particularly like about that workplace?

What are the things that you value most about your workmates?

What are some of the things that you find most difficult?

What sort of things do you think would improve the way things happen?

What makes you want to come to work – like what are some of the things you really enjoy about working there?

What are the things that are important to you that you gain from this job?

Is there anything else you would like to add – any other aspects of the work – any other useful question you think I should ask?

Do you think you might go overseas to do this work?

Apprenticeship systems

How are finding the apprenticeship system that is set up at the moment?

What sorts of things are particularly helpful?

What do you think would improve the system – what could be done better?

How is the set-up with John coming in to give help and advice working for you?

Being watched

General

What are some other aspects of what you do/your work that you would like to add?

Questions Tradesmen

Previous experience, training and skills

How long have you been employed in the company?

Going back to when you trained as an engineer can you tell me about that – how you learned to do all those things?

What were the things you particularly liked or thought were good about that form of apprenticeship/learning?

Things you didn’t like about it?

Are there ways that you can learn what you need to know in this field from formal study/following manuals?

How much of what you do is learned ‘on the job’?

What do you learn from your tools and machinery?

i.e. I mean, in comparison to reading about the process of using/making.

What were the situations where you have felt that you learned the most or that you felt made it easiest for you to learn?

What sort of skills do you think are useful in this job apart from working with the machinery?

Where do you think you learned those skills?

What work did you do before coming to this company?

What sorts of work/trades/careers have other members of your family been involved in?

Is this something you always wanted to do or did you come to it for other reasons?

Are there any other sorts of things would you still like to learn?

Which materials do you prefer to work with – which ones not?

What are the things that you like making best of all?

Are there any things don't you like assembling?

There does seem to still be a lot of working out done right on the shop floor – even with plans – like the engineers often seem to have to be able to work out exactly how a piece could be made – it doesn't always seem to be on the plans?

The work environment

Who are the people in this workshop who are helpful when you need information or do you find that you are mostly helping/advising others?

What are some of the things that you particularly like about the workplace?

What are some of the things that you find most difficult?

What sort of things do you think would improve the way things happen?

What makes you want to come to work?

What are some of the things you really enjoy about working here?

What are the things that you value most about your workmates?

What are the things that are important to you that you gain from this job?

Questions for employer/trainers

What sorts of things would you look for if you were employing/beginning to train new apprentices?

What qualities enable apprentices to fit in to their work role?

What things do you believe most help in developing the skills that the workers need?

Are there things that should be happening at school/high school level to better support/provide training for young people?

What do you see as the best ways for apprentices to learn?

Questions Artists (These were varied according to their area of practice)

Previous experience, training and skills

Tell me about your earlier training and how you came to be working in etching.

In what ways has this training been of help to you?

What are the situations where you feel you learn the most or that you feel made it easiest for you to learn?

Who are the people who have helped you to develop your skills/learn about this?

What sorts of things do you believe help most.

How much of what you do is learned as you go?

In what ways does working alongside others help with learning the skills you need to do this?

In what ways do you think working with the materials helps you to gain a better understanding of what they are capable of doing/what you can achieve with them? i.e. I mean, in comparison to reading about the process of using/making.

How much of what you do is instinctive, and how much has resulted from your training?

Are there ways that you can learn what you need to know in this field from formal study/following manuals/following how-to books?

How long did it take for you to feel competent to create what you wanted with the skills you had at the time?

What sort of work/trades/careers have other members of your family been involved in?

Is this something you always wanted to do or did you come to it for other reasons?

The work environment

What are some of the things that you particularly like about your workspace?

What are the things that are important to you that you gain from this?

Teaching Others

Have you worked as a teacher or tutor in this area?

What sorts of things do you believe most help in developing the skills that the artists need?

What sorts of things do you think could be happening at school/high school level and other areas of training to better support/provide training for both young people and all other ages?

What sorts of things happened in the past that were particularly helpful?

When teaching others what do you see as the gains they make from working creatively?

What do you see as an average amount of time that it takes for a person to become competent in this field?

Any other aspects that you would like to add?

Appendix iii

Unit Standards do not necessarily describe skills as such. It is more likely that they describe a technique or a process, or a part thereof. Below are just a few of the examples from the New Zealand Qualification Authority's documents for engineering

Fitting and Machining Strand Compulsory

The following standards are required

22898 Demonstrate and apply knowledge of machine levelling

and alignment

22899 Demonstrate knowledge of mechanical power

transmission

3 3 Machining and Engineering and Technology > Mechanical Engineering > Engineering Toolmaking

2714 Produce components by performing engineering turning

operations

3 15

2715 Produce components by performing engineering milling

operations

22909 Demonstrate and apply knowledge of setting and operating CNC engineering machines

22910 Demonstrate and apply knowledge of programming

CNC engineering machines

Engineering and Technology > Mechanical Engineering > Maintenance and Diagnostics in

2403 Select and replace static seals in machines and

equipment

2406 Dismantle, inspect, assemble and test components 4 6

22901 Demonstrate knowledge of pumps, fans, and valves

used in engineering

22914 Assemble and fit precision components 3 10

22906 Demonstrate and apply knowledge of welding low

carbon steel

22907 Demonstrate and apply knowledge of welding

aluminium and stainless steel

(New Zealand Qualifications Authority 2008)