
SHARE AN IDEA: AI AUGMENTED URBAN NARRATIVE

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ABSTRACT

Many lessons were learnt from Christchurch City Council's attempt to empower local citizens to co-design the re-development of a city centre following the devastating events of a series of major earthquakes between 2011 and 2012. Running against the grain of national politics, the grass root public consultation exercise was largely overridden by the central government's decision to hand over final responsibility for rebuilding of the city to the Canterbury Earthquake Recovery Authority CERA. Predictably the centrally administered bureaucratic process attracted considerable criticism with studies indicating that CERA was ill equipped and unwilling to engage effectively with the public, which resulted in predictably poor public perceptions. The outcome pointed towards the need for greater clarity about the willingness or otherwise of public agencies or government to share decision making before public engagement to avoid disappointment and disillusionment. Without which, the perception of power sharing becomes an illusion that can quickly turn into public dissatisfaction with public authorities. Furthermore, the problem arose in part due to a focus on solutions rather than prioritising user needs underpinned by shared culture values. To overcome future political impasses between local and national government agencies, an alternative method of collecting and analysing data from public consultation is proposed using AI where large volumes of public data can be readily processed to communicated shared narratives about shared values for future public works such as the rebuild of Christchurch.

1. INTRODUCTION

Public data, contributed by citizens, stakeholders and other affected parties, are increasingly being used to collect the shared ideas of a wider community. Online surveys with questions and answers powered by e-participation tools are being used to identify the public's new ideas, preferences and opinions through public consultation exercises. For example, "The Quality of Life Survey" (Nielsen 2018) undertaken recently in New Zealand asked more than 7000 residents for their opinions on a wide range of different aspects of urban life in four major cities (Tambouris et al. 2013). Likewise, social media, such as Twitter, is another data source to observe public response to news events, such as an earthquake or presidential election, and collect public opinions (Enli 2017; Sakaki et al. 2010; Wang et al. 2012). Once ideas are collected from public data, the policy formulation process is undertaken to map the individual ideas of self-interests to the shared values of public interests, and then translate into action plans (Dalton et al. 2020: 243; Fischer 2003; Sam 2003). However, large format data from public consultation exercises are often organised and analysed manually for reporting to relevant parties or published online for public access.

This was the case for the "Share an Idea" public consultation exercise undertaken by the Christchurch City Council after the 2011 earthquake. The public consultation was carried out in response to The New Zealand Government's Canterbury Earthquake Recovery Act 2011 (CER Act) that required Christchurch City Council (CCC) to develop a draft recovery plan for the central city, in nine months (including public consultation), whilst CERA separately developed a recovery strategy for the Christchurch metropolitan area. The 'Share an Idea' website generated 58,000 hits and engaged the public in four key areas: move (transportation), market (business), space (public place and recreation) and life (mixed uses). The campaign also used traditional and other social media networks to gather public contributions. The unprecedented level of public participation generated 106,000 ideas over six weeks and these informed the development of the Draft CCP (Brand and Nicholson 2016). Of which, 2,740 quotes (58,100 words) from the original texts were published in the Christchurch Common Themes (CCT) report (Christchurch City Council 2011), which has been used in this study.

The public engagement initiative show that online public consultation was readily supported by the community, albeit under emergency conditions following the devastating earthquakes. The grassroots process proposed several important design preferences for the rebuild such as limiting the building height in the Central City to six stories. However as explained by Brand and Nicholson (2016), many of the grassroots ideas fell afoul of top down Central Government bureaucracy. In this case, CERA took complete control for the Recovery Plan through a top

down exercise conducted behind closed doors (Gjerde 2017). The bureaucratic process attracted considerable criticism with subsequent research revealing that CERA was both incapable and unwilling to engage effectively with the public (Simons 2016). Not surprisingly, public perceptions of the way the recovery was managed were perceived as being very poor, with up to 80% of the people living in Christchurch holding a negative view (Simons 2016). Reasons for this are many and are likely to reference a person's experiences of dealing with their own circumstances. So, what went wrong and what lessons can be learnt from the otherwise leading example of public engagement for reconstruction after a series of major earthquakes.

In marked contrast to the relatively short-term strategy deployed by New Zealand Government's Canterbury Earthquake Recovery Act (CERA) for public consultation, the longer term strategies adopted by the Scandinavian cities of Växjö and Sønderborg emphasised the importance of ongoing public consultation and engagement to reinforce community narratives based on core values that underpinned one of the pillars of sustainable development (Dyer and Ögmundardóttir 2018). In particular, ethnographic studies undertaken for the Scandinavian cities of Växjö and Sønderborg transition towards becoming fossil-fuel free economies, highlight the importance of identifying common narratives to transcend political cycles (Dyer and Ögmundardóttir 2018). In the case of Växjö, the common narrative was one of protecting the environment and restoring damaged ecosystems. In comparison, the successful transition for Sønderborg was built on a narrative of combining job creation with movement towards zero carbon emissions based on renewable energy, deployment of district heating systems and generation, retrofitting of homes, all of which was funded by a public-private partnership between local government, industry and banks. In summary, the lessons learnt from transformation of cities towards becoming fossil fuel free societies points to the need for 'bottom-up' conversations based on shared cultural values and interests that motivate change.

2. ELEMENTS OF SUCCESSFUL PUBLIC ENGAGEMENT

Having recognised the importance of public engagement, it is critical to understand the elements that led to successful engagement. The seminal works by Fung (2003, 2006) characterises public participation as having three distinct elements (or dimensions), namely who are the participants, how the participants communicate and what is the impact of the participation exercise. The approach is developed further as a three dimensional 'Democracy Cube'. In a similar vein, the later work by Nabatchi (2012) advocated a framework for designing public participation comprising eight elements (or propositions). The main characteristics of both frameworks for public participation can be summarised as follows:

- Deliberative modes of communication that avoid one-way communication
- Collaborative processes focussed on common interests (values) as opposed to fixed positions
- Shared decision making to resolve values-based policy conflict
- Provision of information to better inform participants and aid good quality decision making
- Recruitment strategies that are representative of diverse stakeholders and avoid bias

Yet as recognised by Fung (2003, 2006), Nabatchi (2012), Gleeson and Dyer (2017), one of the major challenges with participatory mechanisms is the creation of collaborative two-way processes for representative groups of participants to critically define and identify possible solutions whether it be in the public policy arena or design of a new product. Traditionally the scale of the deliberative process is a controlling factor. As observed by Nabatchi (*loc cit*), large format processes typically take place in townhall style meetings that tended to foster one-way communication.

This is where AI based on NLP (Natural Language Processing) can provide rapid analysis of public consultation to communicate real time narratives based on shared 'interests' based on shared cultural values to help formulate public policy and design of new services, products and infrastructure.

Coincidentally, the study by Dyer et al. (2017) explored similar issues when attempting to implement a Triple Zero waste strategy for NATO military camps. Again, the study identified poor engagement by military personnel as the principal obstacles to reducing waste generation, water and energy consumption at military operations, not a lack of technology. The study offered a practical framework, as set out below, for implementing a Triple Zero approach by raising awareness and engagement of participants in the following areas. However the NATO study did not provide a means of using latest AI technology to process large format data into telling or retelling stories to motivate change, which is the purpose of this paper.

(a) **Create Identities.** By creating identities of sustainability, where all of the elements involving society, environment, and economy are present and intertwined; communities begin to recognise sustainability as a concept that affects everyone's lives, families, children, future, and happiness and which needs to be communicated in simple language that everyone can understand.

(b) **Tell Stories.** By listening, telling and retelling stories about how change can happen and has successfully happened, shared narratives can become powerful human motivators for action. There are countless examples about how communities have succeeded in making a positive change, by reducing carbon consumption and climate gas emissions when dealing more imaginatively with energy, waste and water or other issues that protect the environment in a wider sense.

(c) **Empower Individuals.** Empowering individuals who already feel passionate and committed to the issue. These champions are invaluable co-workers in making change happen, who are often having hard time being heard and obtaining support for their efforts.

Hence, without adequate sharing of authority, the public are potentially excluded from the design process and all the knowledge and insight that they can bring. As mentioned earlier, the renowned political scientists Dewey (1981) remarked that 'the man who wears the shoe, not the shoemaker, knows best where it pinches'. This insightful comment goes to the heart of participatory design. To be successful, it requires sharing of authority as illustrated in Figure 1 and recognition that a design process is iterative. In practice, this means devising feedback systems to facilitate a two-way dialogue that is both valid, respectful and representative of the community, whilst at the same time creating a less static and more dynamic environment to trial prototypes before selecting more permanent solutions.

INSERT Figure 1. International Association for Public Participation (IAP2) Spectrum of Public Participation.

3. AI AIDED PUBLIC CONSULTATION

Taking inspiration from the success of Växjö and Sønderborg transitions towards becoming fossil-fuel free economies, the authors investigated the use of Natural Language Processing (NLP) tools to compose 'common narratives' from large format data sets such as the Christchurch 'Share an Idea' initiative. At the same time, it was recognized that there was the added opportunity to align large-scale public engagement with participatory design techniques to address major societal challenges by co-designing new services, products and infrastructure for CE transition that respond to 'user needs'. With these ambitious goals in mind, a digital platform called 'Urban Narrative' was developed using Stanford NLP toolkits. The platform extracts key messages that contribute towards an overall narrative about shared interests. The concept has been demonstrated using published data from Christchurch 'Share an Idea'.

At the same time, the convergence of public participation techniques with participatory design methods offers the prospects of upscaling public consultation as a two way process to create common narratives based on 'shared interests' using Natural Language Processing (NLP) tools (Eisenstein 2019). Examples already exist of NLP being used on popular social network platforms to analyze comments on products, movie reviews or restaurant ratings for

marketing purposes. More recently NLP has made rapid advances using deep learning techniques to develop automatic learning procedures (Hinton, Osindero, and Teh 2006; Manning 2015) and in particular neural networks including word embeddings to capture semantic properties of words or semantic role labelling (such as an agent, goal, or result) to words or phrases to find the meaning of the sentence (Gildea and Jurafsky 2002; Kalchbrenner and Blunsom 2013).

For this study, Stanford NLP Core toolkits (Manning et al. 2014) were employed for several reasons. Firstly, the individual modules were developed using neural language models that gave reliable language analysis results. Secondly, the toolkits use common and uniform APIs that reduce the workloads of system integration. Lastly, central language processing analyses are supported by the toolkits that both identify phrases from a sentence and capture compositional structure of phrases, e.g. the parser extracts the noun phrase “buildings that are accessible to all”, in addition to a single noun word “buildings”, to give more sensible meanings (Socher, Bauer, Manning, and Ng 2013).

4. METHODOLOGY AND RESULTS

4.1 General

With the aim of creating data stories from NLP analysis of large public format data, a digital platform ‘Urban Narrative’ was developed using systems architecture comprising 4 phases as illustrated in Figure 2.

INSERT Figure 2. Systems Architecture for ‘Urban Narrative’

4.2 Phase 1 - Data Storage and Cleaning

Phase 1 extracts text from various file types (e.g. word documents, pdfs and web pages) and encodes each public quote as a single text, and all the texts are collectively stored as a dataset in a repository or Cloud storage. Since the raw texts may well contain irregularities that would cause NLP toolkits to produce inaccurate result, a series of text cleaning and corrections are conducted that include

- Replacing tabs and duplicated spaces with a single white space, to ensure every word is separated by one space.
- Replacing abnormal quote marks, such as back quote and double quotes, with the regular quote mark, to ensure every mark remains the same across the entire text.
- Replacing hyphen (-) with commas to unify the symbols.

4.3 Phase 2 - Linguistic Augmentation

Phase 2 applies Stanford NLP Core toolkit to parse the individual sentences into structured linguistic data (Manning et al. 2014), where each sentence is divided into words and each word tagged with part-of-speech label to classify the word as a noun, verb, object etc. In particular, the process involves three steps. **Step 1** splits the texts into individual sentences. The text “*I want composting toilets in most homes so the sewerage will not be a problem in the next earthquake.*” becomes two sentences “*I want composting toilets.*” and “*So the sewerage will not be a problem in the next earthquake.*” **Step 2** tokenizes each sentence and assigns Part-Of-Speech (POS) tags to words in a sentence. Figure 3 shows the tagged version of the sentence “*I want composting toilets.*” with POS tags at the top where ‘PRP’ stands for personal pronoun, likewise ‘VBP’ for verb, ‘VBG’ for gerund verb that acts like noun and ‘NNS’ for plural noun

INSERT Figure 3. Part-Of-Speech tagged sentence

Subsequently, **Step 3** extracts four types of linguistic data as follows.

1. **Verbs and Nouns** (e.g. *want* as a verb and *toilets* as a noun respectively) are identified based on the POS tags associated with each word.
2. **Noun and verb phrases** are extracted using Stanford Constituency parser (Socher, Bauer, Manning, and Ng 2013; Socher et al. 2013).

A noun phrase must have at least one central noun word (e.g. *toilets*) that is sometimes modified by other words (e.g. *composting*). Two or more noun phrases can be merged into a single noun phrase, the following sentence contains two noun phrases “*recycling bins*” and “*more trees*”. To capture a broad semantic meaning, “*recycling bins and more trees*” is treated as one noun phrase.

*“I want **recycling bins and more trees**”*

A verb phrase constitutes a main verb (e.g. *want*) followed by noun phrases (e.g. *green spaces*) or sentence segments. For example, the sentence segment “*to see more rainwater reused for irrigating green spaces*” in turn contains another verb phrase (e.g. *reused for irrigating green space*) in the following sentence.

*“I want **to see more rainwater reused for irrigating green spaces**”*

3. **Subject, object, and their relations** are extracted by the Stanford NLP Open Information Extractor. The dependency graph indicates “I” as the subject and “electric car charging stations” as the object, and the verb “want” connects the subject and object, as shown in Figure 4.
4. **Named entities** are the names of things, detected by Stanford NLP Named Entity Recognizer (NER) in a text. Entities are labelled with entity types such as Person (e.g. Jacinda Ardern), Title (e.g. prime minister), or country (e.g. New Zealand).

INSERT Figure 4. A Dependency Graph for “*I want electric car charging stations*”

4.4 Phase 3 - Thematic Interpretation

Phase 3 provides a thematic interpretation of the augmented text data by attempting to differentiate between expressions of shared ‘interests’ compared with ‘fixed positions’ linked to thematic topics pertinent to CE.

4.4.1 Differentiating between ‘Interests’ and ‘Fixed Positions’

To differentiate between participants’ ‘interests’ compared to ‘fixed positions’, all the sentences were examined for phrases beginning with the phrases “*I want*”, “*I like/love*” or “*I believe/think*”. The verb ‘want’ was interpreted as stating a ‘fixed position’ compared with the verbs ‘like/love/believe/think’ labelled as expressing an ‘interest’. The work by Nabatchi (loc cit) deemed it important to differentiate between these two standpoints because ‘fixed positions’ commonly lead to adversarial environments, whereas expressions of ‘interest’ foster collaborative work. The following example sentences from Christchurch ‘Share an Idea’ data illustrated ‘fixed positions’.

“I want *recycling bins and more trees.*”

“I want *to see more rainwater reused for irrigating green spaces.*”

Whereas shared ‘interests’ expressed using the phrases “*I + like/love*” or “*I + believe/think*” plus an object clause are shown below.

“I would like *to use some of the bricks and material from buildings lost in the quake in new buildings.*”

“I would love to see the inner city car free with a lot of cycle ways, bus lanes and pedestrian only areas.”

“I think that wind and solar generators should be installed on ALL CBD buildings.”

“I believe that more green alternatives should be utilised to improve essential services e.g. power and sewerage.”

4.4.2 Exploring Thematic Topics.

Next, sentences were examined in relation to a predetermined glossary of terms used to characterise functions of urban infrastructures. The glossary of terms were generated using ‘word embedding’ techniques to represent words as vectors to calculate surrounding words with the similar meaning or similar vector score. For each two seed terms fed into the ‘word embedding’ model, ten similar or related words were output. For example [train and rail] were combined to search for the similar words and produce a collection of representative terms of public transport, comprising express, tram, freight, railway, intercity. Three popular word embedding models were trialled, namely: Wikipedia Word2Vec (Fares et al. 2017), Google News and Twitter Wikipedia Word2Vec was found to produce the best results.

4.5 Phase 4 – Communication and Visualisation

Phase 4 visualises the results from Phase 3 using a combination of chord charts, word trees, design personas and design briefs that together can compose a common narrative using data storytelling techniques. The first two techniques are illustrated in the following case study for Christchurch ‘Share an Idea’. Examples of design personas and design briefs for use in collaborative urban design are presented in Dyer et al. (2019).

5. RESULTS

5.1 Identify Shared ‘Interests’ or ‘Fixed Positions’

Having extracted and ‘cleaned’ the data set, the linguistically augmented data set was used to identify shared ‘interests’ or ‘fixed positions’ about topics relevant to rebuilding of Christchurch that included waste, water, transportation and energy. Individual contributions were extracted using automated glossary of terms together with personal pronouns and verbs that expressed personal “interests” in the form of “I love/like ...” and “I think/believe ...” compared with ‘fixed positions’ in terms of “I want ...”. A selected set of contributions are shown in Table 1 and 2. The information provides a useful insight into topics of interest for the Christchurch community as well as proposed solutions. In terms of waste minimisation, Table 1 reveals a wide interest in alternative ways of decentralising treatment of sewage using composting methods or collecting rainwater for household consumption. Likewise, suggestions were made about reusing demolition materials for rebuilding of the central city.

INSERT Table 1. Christchurch ‘Share an Idea’ selected public contributions on topic of waste management

Similarly, Table 2 shows a public appetite for more public transport, cycling, pedestrianisation and provision of electric vehicles together with sharing of vehicles. However, listing individual contributions in this way provides only a fragmented view of the community engagement, well removed from the conversation proposed by Christchurch City Council when launching ‘Share an Idea’. To examine how a two-way conversation could be facilitated, the study explored the use of ‘Word Trees’ and ‘Chord Charts’ to visualize future community conversations.

INSERT Table 2. Christchurch ‘Share an Idea’ selected public contributions on modes of transportation

5.2 Christchurch ‘Word Tree’ for CE

To explore community conversations from Christchurch ‘Share an Idea’ about future management of waste, water and transportation for the Central City Centre, ‘Word Trees’ were constructed using Google Chart. The diagrams were plotted using sentences comprising expressions of ‘interests’ in the form of “I like/love ...” or “I think/believe ...” compared with ‘fixed positions’ conveyed as “I want ...”. The resulting Word Trees are illustrated in Figure 5 and 6 for waste management and transportation respectively. Even though the public consultation was centred around the broad topic of rebuilding the city centre after major earthquakes, the topics of interests were very pertinent to future sustainable development of the city. In the case of waste management, the Word Tree in Figure 5, indicates a strong level of feeling towards “wanting’ change with an emphasis on sewage and composting. In comparison, Figure 6 indicates an interest in replacing cars with more cycling, walking and public transport that is ideally electric driven. Furthermore, there were comments on more efficient use of space, especially for car parking. All of these suggestions for waste minimisation and alternative modes of transport align with opportunities to increase sustainable development.

INSERT Figure 5 Word Tree for Christchurch ‘Share an Idea’ that displays fixed positions expressed as “I want ...” compared with shared interests conveyed as “I like/love...” or “I think/believe ...” about waste minimisation and reuse.

INSERT Figure 6 Word Tree for Christchurch ‘Share an Idea’ displaying fixed positions expressed as “I want ...” compared with shared interests conveyed as “I like/love...” or “I think/believe ...” about alternative modes of transportation in the central city.

5.3 Christchurch ‘Chord Chart’

The second approach used to interpret key messages from Christchurch ‘Share an Idea’ involved constructing Chord Charts. The images were plotted using D3.js open source library to illustrate inter-relationships between different aspects of urban infrastructures that impact on sustainable development. The terms ‘Soft and Hard Urban Infrastructures’ were introduced by Dyer et al. (2019) to represent the physical utilities, buildings and spaces as ‘Hard Infrastructure’ compared with administrative, social and personal characterised categorised as ‘Soft Infrastructure’. The approach was adopted because an initial examination of ‘Share an Idea’ data set showed a public awareness of connections or disconnections between ‘Soft and Hard Urban Infrastructures’ that affected livability and liveability, such as night shift workers needing to travel home or single parents with children needing easy access to recreation facilities and schooling.

The resulting Chord Charts from Christchurch ‘Share an Idea’ are displayed in Figure 7. The main Chord Chart on the left-hand side illustrates the multiplicity of views expressed connecting different aspects of ‘Soft and Hard Urban Infrastructures’. The width of the chord indicates the relative proportion of contributions received for that particular combination of ‘Soft and Hard Urban Infrastructure’. For example, there is a noticeably wide chord representing participant views about connections between People as ‘Soft Infrastructure’ and transport/buildings as ‘Hard Infrastructure’. The online application allows the individual contributions to be viewed by clicking on the relevant chord. For example, the Chord connecting People and Transport captured views and preferences about different modes of transportation as documented in Tables 2. Ultimately, both graphical techniques allow public contributions to be processed and displayed in real time as part of a dynamic deliberative process.

Figure (a) All Categories

Figure (b) “People” Categories

INSERT Figure 7 Chord Chart displaying perceived connections between ‘Soft and Hard Urban Infrastructures’ expressed in public contributions for Christchurch ‘Share an Idea’

6. DISCUSSION

6.1 Framework for using AI NLP Tools to Enhance Public Consultation

The study has demonstrated some of the capabilities of AI Natural Language Processing tools to enhance the interpretation of large format text data from public consultation but also revealed technological and political limitations that should be discussed in more detail.

On a positive note, the AI NLP toolkit called Urban Narrative, offers a quick and easy means of reagggregating individual Parts-of-Speech (POS) and clauses from original text, whether collected online or in person, into a coherent set of a statements based on preferred combinations of nouns, verbs and adverbs that reflect Shared Interests, such as personal noun (*I or we*), common noun (*waste or transportation*), proper nouns (*Christchurch*), verbs (*love, hate*), adverbs (*must have*). The approach enables a common narrative to develop around Shared Interests or Fixed Positions, which in the Case Study concerns the rebuilding of Christchurch City Centre. From previous studies by the author (Dyer et al 2017) and others (Nabatchi 2012, Fung 2006), the creation of a common dialogue about Shared Interests was found to be an essential ingredient for successful public consultation that helps define a common understanding of the issue at hand rather than jumping to early solutions that might not be relevant but instead cause conflict and misunderstanding.

Likewise, the case study revealed the importance of framing the issue at hand for Public Consultation into a suitable question that encourages discussion about Shared Interests instead of asking for preferred solutions that lead to Fixed Positions. In this instance, the phrase ‘Share an Idea’ used in the Case Study encourages people to propose their personal solution rather than share ideas or thoughts about abstract ideas that could otherwise be known as Shared Values. Instead, the Case Study unwittingly encouraged the public to take up ‘fixed positions’ on topics using the phrase “I want” compared with shared ‘interested’ expressed using phrases “I love/like ...” or “I think/believe ...”. At the same time, it was intriguing to observe that phrases “I want ...” commonly related to objects, whereas the phrases “I think/believe ...” or “I love/like ...” often related to less tangible issues such as environment or aesthetics. The result indicate a need for careful design of public consultation to encourage greater expressing of Shared Interests rather than Fixed Positions. With hindsight, it would have been more valuable to seek the public's cultural values and beliefs first and then encourage ideas or solutions about desired qualities for sustainable reconstruction. This would provide designers (e.g. architects, urban planners, engineers or product designers) with more accurate information and knowledge about ‘users’ needs to enable them to ideate people-centred solutions.

As an inspiration for using Cultural Values in Urban Design, New Zealand’s Maori community of urban designers have recently embraced indigenous cultural values to establish a set of core Urban Design Principles as shown in Table 3. Entitled *Te Aranga Seven Māori Design Principles* (Awatere et al 2010), the design principles are embedded in Maori Cultural Values and implicitly lead to discussions about society’s core values before identifying associated design solutions that turn Values into Qualities. By that, I mean for example that emphasis on the principle Kaitiakitanga would imply that protection of the environment and ecology is a major Value that needs to be addressed in any design solutions such as promoting ecological diversity in suitably design greenspaces or avoiding pollution of groundwater. Likewise, the principle Manakitanga would imply that urban design solutions would embrace hospitality for residents and visitors to those neighbourhoods such as providing meeting places. The issues might appear to be nebulous or abstract principles but earlier studies by the author have shown that core values can act as key motivators for significant change, such as the transition of two Scandinavian Cities of Vaxjo and Sonderborg towards becoming low carbon societies (Dyer and Ögmundardóttir 2018). Likewise for the Case Study, a focus on Shared Values would have shown that participants prioritised the environment and outdoor exercise as principles first before deciding on creation of large green spaces for walking, cycling and exercise as a design solutions. Hence,

AI NLP can be seen as a vehicle for promoting a more nuanced discussion about Shared Values before selecting design solutions as part of a Collaborative Design Framework.

INSERT Table 3. Te Aranga Māori Urban Design Principles (after Awatere et al 2010)

<p>Rangatiratanga (Ownership) The right to exercise authority and self-determination within one's own Iwi / Hapū (Tribe/Sub-Tribe).</p>	<p>Kaitiakitanga (Guardianship) Managing and conserving the environment as part of a reciprocal relationship, based on the Māori world view that we as humans are part of the natural world</p>
<p>Manakitanga (Hospitality) The ethic of holistic hospitality where by mana whenua have inherited obligations to be the best hosts they can be</p>	<p>Wairuatang (Spirituality) The immutable spiritual connection between people and their environments</p>
<p>Kotahitanga (Unity) Unity, cohesion and collaboration</p>	<p>Whanaungatanga (Relationships) A relationship through shared experiences and working together which provides people with a sense of belonging</p>
<p>Mātauranga (Knowledge) Māori / mana whenua knowledge and understanding</p>	

Furthermore, the Case Study shows the importance of establishing guidelines for share decision making from the outset. Otherwise, public participants can become disillusioned when their ideas and recommendations are not given proper consideration when decisions are taking by a remote governing body. This might seem an obvious point to raise but it is fundamental to the success and authenticity of public engagement. The reluctance to shared decision making also loses the opportunity to share knowledge and wisdom beyond the narrow confines of officialdom and professional bodies that can be prone to group think as witnessed by some disastrous mistaken in urban design since mid-twentieth century (Jacobs 1961). Lessons learnt from Christchurch 'Share an Idea' show that the online public consultation was readily supported by the community, albeit under emergency conditions following the devastating earthquakes. The grassroots process proposed several important design preferences for the rebuild such as limiting the building height in the Central City to six stories. However as explained by Brand and Nicholson (2016), many of the grassroot ideas stemming from the grassroots initiative fell afoul of a top down Central Government bureaucracy. In this case, CERA took complete control for the Recovery Plan through a top down exercise conducted behind closed doors (Gjerde 2017). The bureaucratic process attracted considerable criticism with subsequent research revealing that CERA was both incapable and unwilling to engage effectively with the public (Simons 2016). Not surprisingly, public perceptions of the way the recovery was managed were perceived as being very poor, with up to 80% of the people living in Christchurch holding a negative view (Simons 2016). Reasons for this are many and are likely to reference a person's experiences of dealing with their own circumstances. But overall, Christchurch 'Share an Idea' appears to have been a lost opportunity to facilitate a genuine collaborative process for the rebuild that could readily embrace many of the underlying concepts of CE embedded in the public consultation as documented in Tables 1 and 2.

In marked contrast, the strategies adopted by the cities of Växjö and Sønderborg emphasised the importance of ongoing public consultation and engagement to reinforce community narratives based on core values that underpinned one of the pillars of sustainable development. Based on these lessons learnt, in each case the convergence of Public Consultation with Participatory Design to motivate a change in public mindset needs a transparent sharing of power between 'top and bottom up' processes to facilitate ongoing two-way deliberative discussion supported by willingness to trial and modify novel solutions. This is where AI NLP driven real time public consultation provides a means to create ongoing community narratives based on shared 'interests' to aid design of public policy and design of new services, products and infrastructure.

Lastly, there is a need to recruit representative stakeholders to embrace diversity and avoid bias. Of course, the level and diversity of engagement for public consultation exercises can vary considerably ranging from state-based

participants (e.g., expert administrators and elected representatives), to mini-publics (e.g., professional or lay stakeholders, or randomly selected, self-selected, or recruited individuals) to diffuse members of the public (Fung 2006). The use of NPL implies an online recruitment which can influence the type of participants. In the case of Christchurch 'Share an Idea', online engagement was supplemented by in person engagement (via town hall meetings, interviews and written submissions) to broaden the range of participants. Attracting engagement from a broad range of participants is crucial to foster transformational change at scale. It becomes even more important when attempting to construct design personas that represent different socio-demographic groupings. Partly for that reason, it would be valuable where possible to connect this type of public consultation exercise with census data subject to ethical and privacy approval.

In summary, a framework for successful implementation of AI powered Public Consultation require the following key elements based on the results of the Case Study, ie

- Framing of question(s) to encourage discussion about Shared Interests and Common Values instead of asking for preferred solutions that can lead to Fixed Positions
- Ensuring diverse Public Engagement with representative stakeholders to avoid bias, particularly when relying more on online engagement vis-à-vis in person consultation.
- Agreeing from the outset the degree to which Shared Decision making is permitted to avoid future disillusionment
- Creating a coherent dialogue by selecting a preferred set of nouns, verbs and adverbs that can reaggregate POS into a coherent discussion about Shared Interests

6.2 AI Powered Public Participation as a vehicle for Large-Scale Participatory Design

Viewing the study from another perspective, the information gathered on 'Shared Interests' can be seen as an unique opportunity for the public to be involved in large scale participatory design processes where the public as 'users' are considered as a full design partner. Depending on the extent of sharing decision making, this approach as the potential to empower the 'users' to be active participants in an innovative design process. Hence the designer would become a facilitator or what Ehn (2008) describes as a responsive designer, one who alternates the leadership roles in a project depending on whose skills are most relevant, while at the same time keeping all participants involved.

Intriguingly, Dewey (1981), as twentieth century thought leader for public participation, implicitly recognised the overlap between public participation mechanisms and participatory design by once remarking that "the man who wears the shoe, not the shoemaker, knows best where it pinches". Consequently, there is a great deal of potential commonality between Public Participation and Participatory Design, especially where the two aim to empower the 'user'. This provides the theoretical foundations to explore ways of integrating both processes to facilitate a paradigm shift towards future sustainable development.

Furthermore, it is worth noting that participatory design is founded on two complementary values, the first being the right to participate in design activities and the second a means of bringing 'tacit' or non-discursive knowledge of users into design thinking. Hence, without adequate sharing of authority the public are potentially excluded from the design process and all the knowledge and insight that they can bring. To be successful Participatory Design requires sharing of authority as illustrated in Figure 10 and recognition that a design process is iterative. In practice, this means devising feedback systems to facilitate a two-way dialogue that is both valid, respectful and representative of the community, whilst at the same time creating a less static and more dynamic environment to trial prototypes before selecting more permanent solutions.

At the same time, it is important to recognise that design thinking is an iterative process that starts with understanding the needs of end users (Dyer, Corsini, and Certomà 2017). In participatory design, this is achieved by involving the user directly within the design team as a design partner, where the design partner identifies their needs

in design forum/workshop. The challenge for large scale public initiatives is upscaling engagement beyond traditional numbers of participants from 10s or 100s to 10,000s plus. Taking inspiration from the success experienced by Växjö and Sønderborg, a digital platform(s) has been developed using Natural Language Processing (NLP) toolkits to upscale large format public participation to identify public 'interests' and 'fixed positions' as part of a people centred design process for new products, services and infrastructure to aid sustainable development.

7. CONCLUSIONS

Inspired by Växjö and Sønderborg use of community narratives to transition towards a fossil fuel free cities, this study has demonstrated the potential use of NLP toolkits to upscale public consultation by analysing large format public text data to identify participants individual Shared Interests and Fixed Positions using graphical storytelling tools in the form of Word Trees and Charts. The result is a digital platform called Urban Narrative that can facilitate a community wide discussion about a broad spectrum of complex issues in real-time. Beyond the scope of this study are other opportunities to link the data analytics to socio-demographic information about participants to create design personas that can aid participatory design processes but with the clear proviso of needing ethical guidelines to protect personal privacy.

However, for the digital platform to be effective there are a number of issues that need addressing. The first is sharing of authority for decision making. Governing bodies are often reluctant to share authority for a host of different reasons. Likewise, it is crucial to focus on the public's 'interests' in the form of Shared Interest and Beliefs rather than Fixed Positions. This means designing public consultation processes to guide participants towards firstly identifying interests in terms of underlying values by concentrating on the 'why' not 'what'.

Finally, the study highlighted the potential overlap between public participation processes and participatory design, that can be integrated to engage in large scale public discourse and re-evaluation to rethinking services and built environment amongst other aspects of sustainable development. In this scenario, the identification of participants' interests (values) and even positions (solutions) via NLP analysis provides the core insights about 'users' needs to aid design thinking to re-imagining future tangible and intangible product chains.

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