Resistance to Change:
An Effect of Differential Reinforcement on Persistence of Behaviour

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Abstract

Six (Experiment 1) and five (Experiment 2) *Gallus domesticus* hens responded under on a concurrent procedure which contained two independent keys. Two concurrent keys were made available to the subjects on VI schedules 24 reinforces/hr for the right key and 96 reinforces/hr on the left key. The study was designed to assess the effect of training an alternative and a target response in the same context compared to the effect of training these responses separately on the persistency of the target response. Behavioural Momentum theory explained an increase in persistence of the target response as an outcome of enriching the context with the alternative reinforcement and by enhancing Pavlovian relationships between the target response and the stimulus context.

The first experiment aimed to replicate Podlesnik's (2015) findings demonstrating that reinforcing a target response in the same context as the alternative response (analog of the DRA procedure) reduced the target responding while increasing resistance to extinction of this responding compared to training target responding on its own. The results replicated Podlesnik's (2015) findings, demonstrating a lower rate of responding and higher resistance to change of target responding in the DRA-like procedure relative to target responding training on its own.

The second experiment aimed to equalize reinforcement rates for the target and alternative responding to assess resistance to change of the target behaviour in DRA-like and Combined procedure. The results showed a lower rate of responding and higher resistance to change of target responding in the DRA-like procedure compared to target responding in the Combined procedure.

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Introduction

Behaviour in Applied Behaviour Analysis

Psychology looks at an organism's behaviours as an interaction between the organism and its context (Cooper, Heron & Heward, 2014; Skinner, 1938). Behavioural scientists and clinicians agree that behaviour is a natural phenomenon which is distinct, fluid and dynamic, occurs at particular point in time, and is determined by functional relationships between individuals and their environments (Cooper et al., 2014). In some cases, the environment causes the development of a varied range of challenging and antisocial behaviours that may require an intervention to reduce the negative outcomes of these behaviours (Cole & Levinson, 2000).

Applied behaviour analysis (ABA) is known world-wide for its remarkable success in the area of behavioural modification across a wide range of populations, some of them with various disabilities (Ferster, (1961); Matson & Dixon, 2005). The goal of ABA is to achieve observable and measurable changes in behaviours of concern and improve socially significant behaviours by using principles of behavioural analysis through working on different aspects of the individual's environment (Skinner, 1953).

Operant Treatments

ABA primarily examines the occurrence, frequency or duration of the behaviours as the results of the past history of reinforcement. These behaviours are defined as 'operant behaviours,' (Cooper et al., 2014). They are directly affected by the stimulus change that happens as an outcome of the behaviour in close temporal proximity to the action. This stimulus change dictates whether or not, and to what extent, this given behaviour will appear in the future.

Behaviour analysis uses a wide variety of operant treatments for decreasing frequency of, or even eliminating, behaviours of concern (Cooper et al., 2014; Matson et al. 1993). Some of them are based on providing contingent delivery of aversive stimulation or removal of individuals from the environment for unwanted behaviours. The other procedures are known as reinforcement-based methods (Vollmer & Iwata, 1991). These methods are focused on building new, socially acceptable alternative behaviours. These are new behaviours perceived as less intrusive and better accepted by individuals from the different populations (Bell, & Williams, (2002). Cooper, Heron & Heward, 2007).

Differential reinforcement (DR) is one of the fundamental principles of behaviour analysis, (Cooper et al., 2014). During DR, consequences are provided only for the form of responses that belong to a specific class; meet specific criteria such as regularity, topography or duration; or occur under one condition but not another (Cooper et al., 2007; Vollmer & Iwata ,1992). It is the most frequently used operant treatment (Cooper et al., 2007; Ferster, 1961; Lennox, Miltenberger, Spengler & Efanian, 1988).

Differential Reinforcement of Alternative Behaviour

Numerous studies have noted that differential reinforcement of alternative behaviour (DRA) is the most researched and commonly used variation of differential reinforcement procedures. This method targets dual results. It is designed to weaken or extinguish problem behaviour while simultaneously reinforcing acceptable appropriate behaviour.

During DRA, reinforcement is provided for a response which is topographically distinct from the maladaptive behaviour (Roane, Fisher, Sgro, Falcomata, Pabicio, 2004; Sweeney & Shahan, 2013). This new, more appropriate, functionally equivalent behaviour is rewarded with the same reinforcer as the target behaviour. The reinforcer is usually withheld for the problem behaviour (Vollmer et al., 1992).

For example, Functional Communication Training (FCT) is well known as one of the most commonly and widely used by clinicians, variations of DRA (Volker, Lerman, Call, Trosclair-Lasserre, 2009a, 2009 b). During FCT, a socially unacceptable behaviour that was used in the past to attain reinforcement is ignored and the same reinforcement, such as attention, is delivered contingent on an appropriate communicative response (Carr & Durand, 1985). The reinforcement for the appropriate response is usually delivered at a higher rate compared to the rate of reinforcement for the socially unacceptable behaviour. Under this arrangement it is expected that the communicative response should eventually occur at a higher rate than the maladaptive behaviour (Hagopian, Contrucci Kuhh, Long, Rush, 2005).

Over the last three decades a large body of research has reported positive outcomes from implementation of the DRA procedures (Dweyer-Moore & Dixon, 2007). Petscher & Bailey (2008) in their meta-analysis, described the results of a large number of studies that used DRA procedures. The studies were conducted among individuals with a wide variety of behavioural problems. The majority of the participants in these studies had developmental disabilities. A comprehensive review of 116 articles analysed the effect of training individuals to engage in an appropriate, functionally equivalent response for reinforcement. It was summarised that in the majority of cases the results of DRA treatment were due to the intervention, rather than being a reaction to novelty or reactivity. The review suggests that DRA is an established treatment which achieves substantial sufficient practical change for destructive behaviours among adults and children (Wider, Masada, O'Connor & Baham, 2001).

A study conducted by Dwyer-Moore and Dixon (2007) showed an effective reduction in the rate of disruptive vocalization that was maintained by attention among three older adult participants after FCT was introduced. A significant reduction was recorded for each participant after attention was provided for an appropriate vocalization.

A case study by Borrero and Vollmer (2006) examined the outcomes of differential reinforcement used for aggressive behaviour exhibited by a boy with severe developmental delay. DRA and non-contingent attention were used during the sessions. Over the course of treatment, DRA resulted in significant increases in the compliant behaviour and reduction in the participant's multiple-controlled aggressive behaviours. Carr and Durand (1985) also found that the participant's escape-maintained aggression was reduced through learning non-aggressive alternatives reinforced through DRA treatment. Other studies reveal that DRA is an effective method for reducing a wide range of behaviours of concern such as self-injury (Roberts, 1995) and food refusal (LaRue, 1984).

Worsdell, Iwata, Conners, Kahng, and Thompson, (2000) designed their study to find out whether or not there is a relationship between reinforcement rate and response rate. The study was conducted amongst five individuals with developmental delay. It was established that participants' behaviours of concern were reinforced by socially positive reinforcement such as attention. Newly introduced communication responses were used as the alternative behaviour. In the baseline condition, both participants' problem behaviour and appropriate behaviour were reinforced on fixed-ratio (FR) schedules. During the treatment, condition reinforcement for the problem behaviour was gradually reduced. The reinforcement rate for the alternative behaviour continued under the initial schedule. The results of the studies showed that four out of five participants shifted the responses to the alternative behaviour when the schedule for the target behaviour became more intermittent.

This effect has also been demonstrated with animals. In their studies, Mace, McComas, Mauro, Progar, Taylor, Ervin and Zangrillo (2010) and Nevin and Grace (2000) used the animal model to investigate the effect of introducing an alternative response into the same context as a target response. In the initial phase the subject was placed into an operant chamber and was trained to obtain a reward by producing a "target" response. The target response was defined as pressing a lever in Nevin and Grace's study (2000) and pecking on a key in Mace et al.'s study (2010). After the target behaviour had been mastered, the alternative source of food reinforcement was introduced into the context. The delivery of reinforcements was arranged on a concurrent schedule and was signalled with different stimuli such as a visual stimulation that was provided with flicking or steady illumination in Nevin and Grace's study (2000) and different coloured lights in Mace's et al. study (2010). A comparatively high level of reinforcement was delivered for responding to the alternative key. As expected, Mace's et.al.(2010) and Nevin and Grace's study (2000) results showed higher response rates for the alternative behaviour compared to the response rates of the target behaviour.

Over a long period of time using variations of DR procedures in educational environments, clinical treatments and everyday social life practices; teachers, parents and practitioners confirm that DRA procedures are the easiest variations of DR to implement (Volkert et al., 2009). It is also recorded that differential reinforcement of alternative behaviour (DRA) is most commonly used by specialists, and is the most empirically validated intervention applied to decrease behaviours of concern (Vollmer & Iwata, 1992). Professional approval of this approach is related to the fact that DRA procedures not only focus on a reduction in the rate of behaviours of concern, they also report an increase in appropriate behaviours when the procedures are applied with a high level of treatment integrity (Wacker, Harding, Berg, Lee, Schieltz, Padilla, Nevin & Shahan 2011). However, despite the recognition and positive outcomes, there are some serious concerns around using the DRA procedure in applied settings (Volkert et al., 2009).

Implications of using the DRA procedure

When implementing DRA, one of the main worries about using this procedure is that even though extinction is an effective and powerful component of the DRA, it is not always possible to use it in a real-life setting. For example, often it is not possible or realistic for a caregiver to provide zero consideration for the attention-seeking behaviour if it is presented in a physical form that requires protection of the individual who exhibits the behaviour or other people around him (Athens & Vollmer, 2010). Therefore, in some cases it is crucial to keep providing reinforcement for the problem behaviour while introducing and training a functionally equal alternative behaviour.

The other consideration is related to the fact that the DRA procedure uses extinction to reduce the frequency of the behaviour of concern. A large body of research reports a high probability of side effects associated with the procedures that provide extinction such as extinction (Cooper at el., 2014). For example, higher than usual rates of responding of the behaviour of concern, extinction burst and adverse emotional reactions to the procedures such as aggression are frequently recorded when the problem behaviour is punished or placed under extinction. Strong potential for legal and ethical violations during using unpleasant consequences also may raise concerns about using these methods.

DRA without Extinction

Thus, if there are any obstacles or concerns with using extinction, the other set of DRA procedures known as a DRA without extinction is used as treatment for problem behaviour. During this procedure, two or more schedules are active at the same time. Each schedule independently arranges reinforcement for the responses (Petscher, 2008). Therefore, according to the Matching Law, the response rate on one schedule will co-vary with the rate of reinforcement on this schedule (Cooper et al., 2007). Consequently, allocation of the response is expected to be relatively proportional to the rate of reinforcement that is provided for this response (Herrnstein, 1961).

During DRA without extinction, the rate of reinforcement for an alternative behaviour is usually higher than the rate of reinforcement that is provided for the target behaviour. Consistent with the Matching Law, under this condition it is expected that over a period of time this schedule should maximize the probability of appropriate responding and minimize the probability of inappropriate responding (Cooper et al., 2007). Previous research supports this suggestion (Athens & Vollmer, 2010; Cooper et al., 2007).

There are different principles that may be used while designing DRA without extinction. These mechanisms are relatively easy to apply and can be adapted to real-life settings. For instance, it is known that individuals may be sensitive to a more immediate delivery of reinforcement compared with reinforcement that is delivered with a delay (Mace et al., 1994). Several studies have found that behavioural change may be affected by the quality of the reinforcement. The response rate will be in favour of the alternative which is associated with a greater quality of reward (Hoch, Spofford, Dimian, Tervo & Symons, 2016; Pizza, 1997) or a greater size of reward (Hoch et al., 2016).

Piazza (1997) reported that two out of three participants showed an increase in compliance after the quality of reinforcement for compliant behaviour had been increased comparative to the level of reinforcement for the problem behaviour. Break from the task, tangible items or attention were used as reinforcement in this study. During the procedure, participants' behavioural outcomes were measured after the positive alternatives resulted in one, two, or three reinforcing consequences. The consequences included attention, tangible items or breaks. The results showed a decrease in the rate of a problem behaviour that was producing 30-s breaks plus tangible items, compared to inappropriate behaviour that was rewarded with 30-s breaks for only two out of three clients. After the schedule of reinforcement for compliance was faded for all clients, the rate of destructive behaviour was lower when the alternative behaviour produced multiple reinforces such as breaks plus tangible items or attention.

This effect has also been demonstrated in the more recent study conducted by Athens and Vollmer (2010) who investigated an effect of manipulating reinforcement for problem behaviours while reinforcing alternative appropriate behaviours by using a DRA without an extinction component with seven children diagnosed with a moderate to severe intellectual disability. Four experiments were conducted in this study. In the first three experiments, different dimensions of reinforcement were manipulated. Longer duration, higher quality of reinforcement or immediate access to reinforcement after appropriate behaviours to demonstrate the effect of manipulating reinforcement, were introduced for all participants. Shorter duration, lower qualities of reinforcement or delayed access to reinforcement were provided for problem behaviours. In Experiment 4, all these dimensions were combined. The results showed that participants' behaviours were sensitive to the manipulations of duration, quality of reinforcement and delay in delivery of reinforcement. Athens's study (2010) also showed that expected behavioural changes were more significant and more consistent when several reinforcement qualities were combined.

As shown with previous differential reinforcement research, exercising different dimensions of reinforcement results in a decrease in the rate of problem behaviours for all participants. Therefore, in a setting when extinction is not possible, DRA without extinction can be used to reduce behaviours of concern and increase appropriate behaviours.

In the above studies, it was shown that desirable change in behaviour can be achieved by providing a longer duration or higher quality of reinforcement. It also can be achieved by providing immediate reinforcement following appropriate behaviour and delayed reinforcement following problem behaviour. However, despite the theoretical support and empirical statements and findings, a number of studies suggest that DRA without extinction is less effective and does not always provide a reduction in the rate of the target behaviour (Volkert et. al., 2009). A study conducted by Fisher et al. (2000) among three participants with challenging behaviours found that when FCT was used without extinction, only one participant achieved a significant reduction in the challenging behaviours. The FCT method was significantly more effective when punishment for the target behaviour was included.

This effect was also noted by Hagopian et al. (1998). Based on Fisher's et al. (1998) findings, they hypothesised that DRA without extinction would not lead to the anticipated decrease in the rate of problematic behaviours among developmentally delayed individuals. Hagopian tested his hypothesis in a laboratory setting (Hagopian et al., 1998). He was looking at the effect of FCT on the problem behaviour of 21 inpatients aged from 2 years and 9 months to 16 years and 6 months. Ninety-one percent of the participants exhibited property damage, 100% of the participants showed aggressive behaviour and 67% of the participants were engaged in self-injury. Initial analyses of the function of the behaviours showed that the participants' problem behaviours were maintained by social reinforcement. During a training session, backward-chaining was used to train the individuals to produce a communication response to obtain reinforcement. Appropriate communication responses were selected for each client. During FCT without extinction, the reinforcement was provided for both problem behaviour and for the communication response. During FCT with extinction, conditioning of the reinforcement was provided when the participant emitted the required communication response. During FCT with punishment, the reinforcement was provided only for the appropriate communication response and a punishment procedure, such as time out, was implemented as a consequence of problem behaviour.

The results of the Hagopian et al., (1998) study showed that FCT without extinction did not bring an expected decrease in the disruptive behaviours; moreover, there was an increase in the rate of the target behaviours for 10 out of 11 participants. At the same time, there was a significant reduction (up to 70 percent on average) in the level of the target behaviour among participants who experienced extinction or punishment. These findings suggested that FCT in combination with another operant procedure is an effective treatment among individuals with developmental delay.

The other study conducted by McCord, Thomson & Iwata (2001) also found that DRA without extinction did not produce the expected reduction in the rate of the self-injury behaviours reinforced by avoidance of transition and avoidance of task initiation. However, there was a significant reduction in the rate of self-injuries when DRA with extinction and a response blocking procedure were applied. Therefore, it can be suggested that in some cases the only way to reduce unwanted behaviours in the DRA procedure is by adding other unpleasant or costly consequences to the environment or by decreasing discontinuing reinforcement (extinction) (Cooper at el., 2014). However, as mentioned previously, this approach has serious limitations and side effects. These limitations can compromise public belief in the effectiveness of the differential reinforcement procedure.

Concerns Around DRA

There is another, and arguably more alarming, concern around using DRA procedures with and without extinction. Recent data suggests that effects of DRA may not be retained shortly after the therapy is completed (Volker et al., 2009) and the problem behaviour might reoccur (Mace & Roberts, 1993; Volker et al., 2009).

One of the potential explanations of reoccurrance of the behaviour that was successfully extinguished during DRA treatment comes from the well-recorded fact that in many cases, newly learned alternative behaviours are not sustained in the natural environment when the procedures are implemented and maintained by primary caregivers (Mace et al., 1993; Volker et al., 2009). According to Athens (1999), in many cases caregivers and caretakers have a long history of reinforcing problem behaviours. This history may seriously interfere with the effect of DRA treatment and minimize the final outcomes caused by integrity failures.

Athens and Vollmer (2010) also pointed out that, in some cases, caregivers may not be able to implement reinforcement and extinction procedures accurately. When working with families with individuals with intellectual disabilities, the individual's characteristics and limitations often create difficulties in implementing differential reinforcement of an alternative behaviour procedure outside a treatment context. Due to ease of dealing with the challenging behaviours by providing a reinforcer for these behaviours, encouraging and reinforcing the alternative behaviour are often relented by caregivers.

It can be summarised that despite strong theoretical support and significant practical outcomes it might be found that, in addition to the fact that the DRA procedure could be difficult to apply in the real-life settings, it is may not always have a lasting effect (Sweeney, 2013).

Re-Establishment of Behaviour

The phenomenon, where under a range of circumstances, previously extinguished behaviours are reoccurring when the level of reinforcement for the newly learned alternative behaviour is reduced or discontinued, is known as a treatment relapse or resurgence (Nevin, Tota, Torquato & Shull, 1990). Reoccurring extinguished behaviour may raise questions about the long term maintenance of behavioural treatment.

Re-establishment of behaviour that was previously successfully reduced or eliminated is well known by professionals who use DRA in their practice. For example, Sweeney (2013) in his study mentioned that re-establishing of the eliminated behaviour is often observed when reinforcement is discontinued during FCT treatment.

Resistance of the Behaviour to Change

Nevin et al., (1990) believes that re-establishment of behaviour that was reduced or eliminated during DRA may be caused by some factors that are related to the treatment procedure. He suggested that when planning to use the DRA treatment, it is important to bear in mind that there are different variables that contribute to the effectiveness of DRA.

For example, a number of recent studies focused on the theoretical analysis of the internal processes during the DRA procedure. The results found that, while DRA intervention reduced the rate of the unwanted behaviour, it can also be responsible for increasing the persistence of this behaviour (Podlesnik, Bai, & Elliffe, 2012). Persistence is described as the resistance of behaviour to change during interruption by events such as extinction or alternative sources of reinforcement (Podlesnik & Shahan., 2009).

The rate of the response and resistance of the behaviour to change are seen as two separate aspects of operant behaviour (Nevin et al., 1990). These two characteristics are directly related to the theoretical concept of response strength (Nevin et al., 1990). Resistance to change and rate of response both vary as a function of the rate of reinforcement (Catania et al., 1968). However, in the majority of studies, only response rate is used as a measure of behavioural change (Skinner, 1938, as cited in Nevin et al., 1990). The idea that, over a period of time, positive behavioural changes may disappear and problem target behaviour reoccurs, suggests that it might not be enough to focus only on the reduction in the rate of response of the target behaviour as a result of the intervention, but also requires thought about resistance of this behaviour to change.

Nevin, Mandell &Yarensky (1989) used an operant approach to exploring factors that influence resistance of behaviour to change during DR procedures. In his study Nevin et al., (1989) added extra reinforcement to the experimental context. In the first experiment, a pigeon's key pecking was reinforced according to a variable-interval schedule. In addition, extra reinforcement was delivered according to a variable-time schedule. The results showed that the rate of response was negatively related to the level of added reinforcement. At the same time, the resistance to change evoked by extinction and satiation were positively related to the overall rate of reinforcement in the context.

The second experiment in Nevin's (1989) study was designed to measure the effect of alternative reinforcement that was contingent on a specific alternative response. Food was delivered for the target responding according to VI schedules. In addition, concurrently available response-dependent reinforcement was available for pecking an alternative key. This experiment was an analogue of the DRA treatment that is used in a clinical population. Once again, the results of the study showed that the rate of the target response was a function of the reinforcement but the resistance to change was related to the overall level of reinforcement presented in the context. Nevin et al. (1989) concluded that the rate of response was a product of the operant contingency which is functionally related to the level of reinforcement. At the same time, the stimulus-reinforcement contingency which can be described as a Pavlovian contingency, determined the resistance to change. There was no difference between contingent/non-contingent alternative reinforcement that was recorded (Nevin et al., 1990). Based on these results, Nevin et al. (1990) suggested that using reinforcement for alternative behaviour reduces the rate of the original behaviour but makes this behaviour more persistent.

Nevin et al. (1990) proposed that persistence of the behaviour to change better corresponds with the concept of response strength. Nevin et al. (1998) proposed an integrative framework for evaluating the strength of a response and the factors that influence this strength when a disruptor is applied. He termed this framework Behavioural Momentum Theory.

Behavioural Momentum Model

Over the last two decades, the Behavioural Momentum model has received significant attention. The theory takes a quantitative approach to understanding treatment relapse and conditions that influence behavioural renewals (Podlesnik & Shahan 2008., 2010; Mace et al., 2010). It considers behaviour as a natural force that has internal mass which is directly related to the history of building this behavioural repertoire. In turn, Behavioural Momentum Theory comes with a theoretical framework that explains the relationships between past exposure to reward and resistance of the behaviour to change. It suggests that this resistance to change is a function of the total rate of reinforcement associated with the context in which the behaviour occurs (Podlesnik et al., 2010).

In the light of Behavioural Momentum Theory, adding reinforcement for an alternative behaviour during a DRA procedure in the same context in which the target behaviour is reinforced might increase Pavlovian stimulus-reinforcer relationships. As Nevin et al., (1990) suggested, there are two independent features of behaviour. One of them is an ongoing response rate which is a function of operant response-reinforcement contingency (relationship between responding and its consequence). At the same time, resistance of the baseline response rate to extinction is seen to be a function of the history of reinforcement (Nevin & Shahan., 2011).

Extensive research across a range of different populations, from goldfish to humans, reveals that the baseline response rate is more resistant to change in the discriminative-stimuli context of two or more multiple-schedule components which might be associated with higher rates or have been presented with a large magnitude of reinforcement in the past (Nevin et al., 1990). For example, Nevin (2009) showed a significant reduction in response rate on the target key by reinforcing responses on a concurrently available alternative key (analogous to DRA treatment). At the same time, the study also reported that the target behaviour became more resistant to change (Nevin et al., 1990). It suggested that the stimulus context associated with reinforcement might strengthen the targeted behaviour.

Nevin et al.'s (1990) findings have practical implications for the behavioural treatments that are designed to permanently decrease original problem behaviour and increase desirable alternative behaviour. Nevin's study, which was designed as an analogue of DRA treatment in clinical populations engaging in problem behaviour, shows that reducing a rate of response on the target key by reinforcing (with the same reinforcer) a response rate on the alternative key, produces a lower rate but higher persistence of responding on the target key. Therefore, according to Behavioural Momentum Theory, contrary to the purpose of DRA that was widely used over the last three decades by clinical researchers and practitioners, new findings suggest that using the DRA procedure in the same context in which problem behaviour occurs, may actually enhance persistence of this behaviour by enriching the Pavlovian stimulus-reinforcer relations. Therefore, over time, as a result of this enrichment, the target behaviour has a higher chance of reoccurring, than an alternative behaviour, when the DRA treatment has finished.

Hidden Force, Avoiding Enhancing Persistence of Unwanted Behaviour

Mace et al., (2010) and Podlesnik et al., (2010) formulated an approach to avoid enhancing persistence of unwanted behaviour as a result of the DRA procedure. They suggested that rewarding an alternative behaviour in a different context before this behaviour was introduced to the context with the target behaviour, might reduce the effect of having an extra reinforcement. Mace et al. (2010) and Podlesnik et al. (2012) proposed to train an alternative response in the presence of discriminative stimuli that were different from that in the target context.

Mace et al. (2010) used a three-component multiple schedule with different rates of lights flashing over each lever. Rats were trained to press levers to get food reinforcement. The availability of reinforcement was signalled by lights flashing over each lever and its delivery was arranged according to a single VI 30-s schedule. The food was distributed between two levers with different probabilities in each component. Response on the left key was designated as an alternative behaviour while response on the right key was designated as target behaviour. The DRA condition is analogous to a typical DRA arrangement without extinction in which reinforcement for target and alternative behaviours was provided in the same context. A higher level of reinforcement was provided for an alternative response. The Combined condition represents an arrangement in which target and alternative responding were trained separately and the contexts combined during testing.

In the first component, the DRA procedure was arranging a concurrent schedule with 24 reinforcers per hr on the target response (yellow light; right lever) and 96 reinforcers per hr reinforces on the alternative response (yellow light; left lever). In the second component, an alternative response (green light; left lever) was trained in a separate stimulus context. During this phase, the alternative response was active and reinforcement was provided on the 96 reinforcers per hr schedule. In the third component, while the alternative response was inactive, the reinforcement was provided on the 24 reinforcers per hr on the target response only (blue light; right lever). The overall rate of reinforcement in DRA conditions was equal to the sum of the reinforment rate for the alternative and target responses trained separately. The results of the study showed that in DRA schedules, response rates for the target behaviour were lower compared with response rates for the alternative behaviour in the baseline condition. Stimuli from the alternative and target responses trained separately were combined to assess whether there was a difference in resistance to extinction of the target response in the DRA schedule compared with the target response trained separately.

The stimuli in the DRA and Combined components were associated with a reinforcement rate of 120 reinforcements per hr. When the target and alternative stimuli were combined after being presented separately during training, responding on the target lever extinguished quicker compared with responding on the target lever in the DRA component. Resistance to extinction of the target behaviour that was trained separately was roughly equal to resistance to extinction of the target behaviour in the target responses trained separately during the extinction test. The findings supported the Mace's (2010) hypothesis that training an alternative behaviour in the separate stimulus context will not enhance the persistence of the target behaviour to extinction.

However, there was one confound in the Mace et al. (2010) study. During the extinction test, the discriminative stimulus associated with the Only Target component was presented more often than discriminative stimulus associated with the only alternative component. Therefore, Podlesnik et al. (2012) compared the results of extinction conditions with and without exposure to the only target component. They investigated whether the decrease in resistance to change of target responding in the combined component compared to the DRA component was due to combining the stimuli that were trained separately.

The results of the Podlesnik et al. (2012) study suggested that the technique of combining alternative and target stimuli disrupts resistance to change associated with increasing the overall level of reinforcement associated with the typical DRA procedure.

An experimental procedure (Experiment 1, Phase 1 and 2) similar to the procedure conducted by Mace et al. (2010) and Podlesnik et al. (2012) was used to investigate whether or not a target behaviour in a DRA condition will show a higher level of resistance to change in extinction compared to a target behaviour trained separately.

In the above studies, it was shown that training alternative responding separately to target responding before combining them, reduced resistance to change of that target responding. However, in all of the above examples, to establish cause-and-effect relationships, laboratory studies were done in carefully controlled environments where the levels of reinforcement for behaviours were kept constant. As was mentioned above, in the natural, everyday environment it is difficult for caregivers to be consistent with reinforcement. Therefore, studies designed to observe the effects of keeping the levels of reinforcement more flexible are needed.

Experiment 1

The aims of the experiment were to replicate Podlesnik's et al. (2012) study Experiment 1, and extend the findings to another species and to demonstrate that resistance to change of behaviour is a function of the overall rate of reinforcement in a stimulus context during training.

According to Behavioural Momentum Theory, it was hypothesised that resistance to extinction of target responding will be lower in the Combined versus the DRA component. It was also expected that decreased resistance to change of target responding in the Combined component compared to the DRA component was due to combining stimuli rather than to an additional exposure to the discriminative stimulus associated with a target context.

Method

The study design for Experiment 1 (Phase 1 and Phase 2) is presented in Table A1 (see Appendix A). Experiment 1/Phase1 contained 0f six successive sessions of baseline followed by six successive sessions of extinction. Experiment 1/Phase 2 contained six successive sessions of reinstatement followed by successive sessions of extinction.

Subjects

Six *Gallus domesticus* numbered 10.1 to 10.6 were included in the experiment. All birds previously had experience with multiple and concurrent schedules of reinforcement. Hens were individually housed in wire cages. Each cage was 450-mm high, 510-mm wide and 450-mm long. The room with cages had a 12-12-h light-dark cycle. The lights were turned on at 7 am each day.

The hens were maintained at approximately 85% (+/- 5%) of their free-range body weight. The hens were nourished with supplemental feeding of mixed grain commercial laying pellets after sessions as needed. Water and grit were available in the cages at all times. Oyster grit and vitamins were supplied weekly.

Apparatus

Experimental sessions were conducted in an experimental chamber constructed from wood panels. Each chamber measured 550-mm high, 410-mm wide and 550-mm long. The floor was covered with a metal tray (480-mm long and 400-mm wide). A rubber mat (450-mm long and 30-mm wide) was lined inside the tray. There were three circular lighted response keys in the chamber, each 30 mm in diameter. They were made of semi-translucent Perspex and backlit using LED bulbs. The keys were electrically wired together and were centered on the front panel 400-mm above the floor. Only the far left and the far-right keys were used in the experiment; the middle key was inactive. Each key could be lighted blue, yellow or green as illustrated in Figure 1. The operant panel was located on the right wall of the chamber.

In order to record a peck on an illuminated key as an effective response, a force exceeding 0.1 N (10 g) was required to close a micro-switch. Each effective peck to an illuminated key was followed by an electronic beeping sound provided by an electronic beeper, placed behind the keys. The response was recorded by software program. Responses made on unlit keys or the middle key did not produce any scheduled consequences.

The magazine apparatus was positioned 140-mm below the response keys. It measured 100-mm high, 70-mm wide. The hopper with pellets of wheat was positioned behind the magazine. The magazine was manually filled with the wheat when required. While the hopper was active, it was illuminated and all key lights were turned off and the hopper was lifted up in order for the hens to access the food. The reinforcement presentations consisted of 3-s access to pellets of wheat. The reinforcer was illuminated during periods of reinforcement access with a 1-W white bulb. The bulb was positioned 30-mm above the hopper. During reinforcer access periods, all keys became inactive. The experimental chamber did not have any other source of light except the light from the response key and food hopper.

All experimental events were controlled and data recorded by a Dell computer running MED-PC IV software. The computer with software was located in the same room as the experimental camber. The entry to the experimental room was limited for all personnel during the experimental sessions.

Procedure

The sessions were conducted daily, six times a week and always at approximately the same time of the day (from 9 am to 3 pm) .

During the procedure, the experimenter took each hen from its home cage and placed it in the experimental chamber. Then the experimenter initiated the program software. Left key and right key were then illuminated yellow, blue, or green, as shown by Figure 1. All aspects of the experimental procedure remained the same for the baseline and extinction tests. At the end of the daily session the hen was returned to her home cage. Post-session feed was calculated by the computer program according to the hens' current and target weights and was provided if necessary.

Baseline.

During the baseline condition a three-component multiple schedule of food reinforcement was presented. There were four blocks, each of which involved presentation on three components presented in a randomized order. Each component was 60 s in duration followed by a 20-s intercomponent interval (ICI). During the interval, all keys were switched off and pecks on the keys were not reinforced. The session was terminated after 48 minutes or after all the blocks were completed.

In the initial stage food reinforcement was delivered for pecks to illuminated keys in all components. All keys operated on a VI 10-s schedules of food reinforcement. The rates of reinforcement were progressively increased to the baseline values which are specified below in Figure 1. If the hen pecked the key before 10 seconds, the key light was turned off and reinforcement was delivered.

There were approximately 30 baseline training sessions before the hens were moved to the experimental stage. Stability of the baseline response rates were analysed by visual inspection of the data.

Baseline conditions contained a minimum of six sessions and were followed by six sessions of extinction tests. Table 1 shows all experimental conditions in their order.

Reinstatement.

Reinstatement components followed directly after extinction components. They contained six successive sessions. During each session, the objects were presented with the same stimulus arrangement and programed reinforcement rates for each condition as they were presented in the initial baseline condition as illustrated in Figure 2. For the period of these sessions target and alternative responses were trained concurrently in the DRA condition and in the other two conditions.

Baseline component, Experiment 1

Figure 2 shows stimulus arrangement and rates of reinforcement during the baseline condition responding on the left key was designated as alternative behaviour. Responding on the right key was designated as target behaviour. Both the target and the alternative keys were illuminated yellow in the DRA condition. The reinforcement for pecking on the left (Alternative) key and right (Target) key was arranged by two independent VI schedules. Reinforcement was arranged for the Alternative key (yellow light; left key) according to a VI 37.5-s schedule (96 /

hr) and for the Target key (yellow light; right key) according to a VI 150-s schedule (24/ hr).

The left key was illuminated green while the right key was darkened in the only alternative response condition. Correspondingly, reinforcement was arranged only for the Alternative key (green light; left key) according to a VI 37.5-s schedule (96 / hr). The right key was illuminated blue and the left key was darkened in the Only Target response condition. Correspondingly, reinforcement was arranged only for the Target key (blue light; right key) according to a VI 150-s schedule (24 / hr).

Line graphs to demonstrate trends in the outcomes were constructed from the set of data (response rates per minute on each key in each component). The decision to change the conditions was based on the interpretation of the graphs (stability across six sessions). Data that were obtained during sessions in which there was equipment failure or other procedural mistakes were omitted. The extinction test was carried out after baseline responding had stabilized for six successive sessions.

Extinction Component, Experiment 1/Phase 1

Baseline conditions were followed by an extinction component as illustrated in Figure 3. The tests consisted of six successive sessions of extinction. During an extinction test the delivery of reinforcement for pecking on the response keys was discontinued.

The first component of the extinction test involved extinction of reinforcement on the left and the right keys. Both the left key (Alternative DRA) and the right key (Target DRA) were illuminated yellow. The second component of the extinction test involved combined stimulus context involving this

Alternative Only (green light; left key) and the Target Only (blue light ; right key) keys.

Reinstatement

During reinstatement component, the subjects were presented with the same stimulus arrangement and programmed reinforcement rates for each condition as they were presented in the initial baseline component illustrated in Figure 2.

Extinction component, Experiment 1 (Phase 2)

Reinstatement components were followed by extinction phase illustrated in Figure 4. This part of the experiment consisted of six successive sessions of extinction. During an extinction phase the delivery of reinforcement for pecking on the response keys was discontinued.

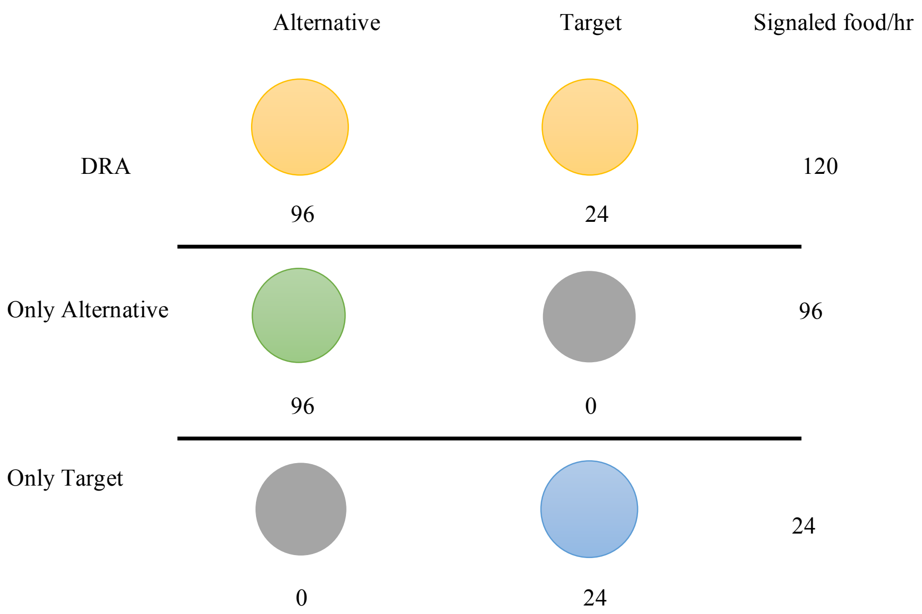
The first component of extinction phase involved elimination of reinforcement for pecking on the Alternative (yellow light; left key) and the Target (yellow light; right key) keys. The second component of this phase involved elimination of reinforcement for pecking the Alternative key (green light, left key) and the Target key (blue light, right key) combined into one stimulus context. The third component of the extinction test involved extinction of reinforcement on the Target key (blue light; right key) and the left key in this component was darkened.

Statistical analysis was performed with IBM SPSS Statistics for Mac, Software. The results of the responses on the alternative and target keys were analyzed by two-way repeated measure ANOVA with “response” and “session” as factors. For all analyses, the significance level was set at $\alpha = 0.05$.

Figure 1. Experimental Set-Up

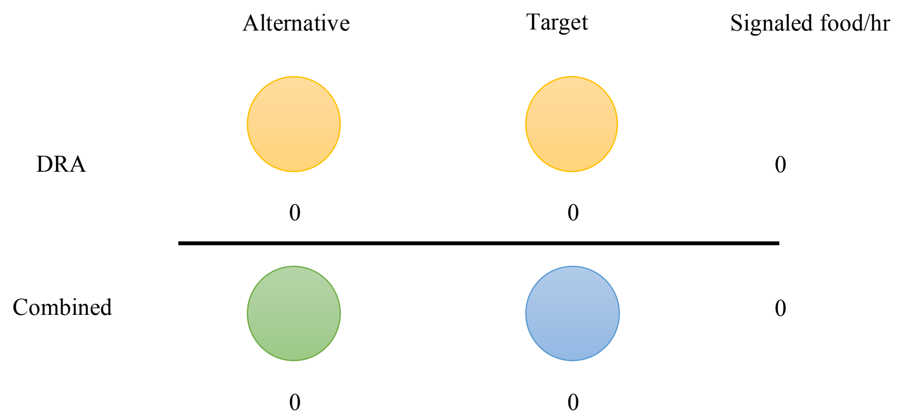
Figure1: Experimental chamber with a hen prior to an experimental procedure.

Figure 2. Baseline component Experiment 1/Phase1



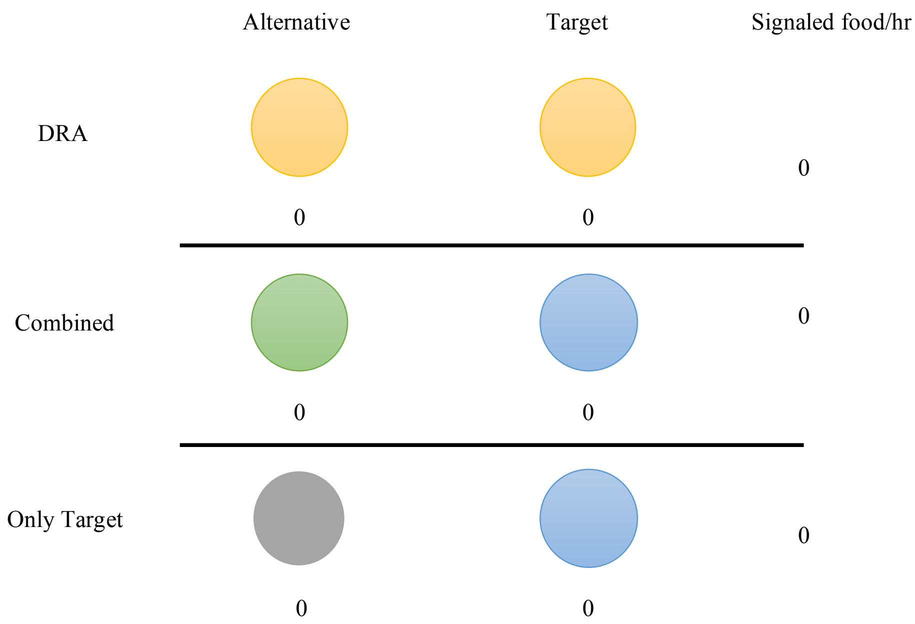
Note: Signaled food presentations available per hr for responding on the target and alternative keys during baseline condition and color assignment. Food presentation availability are presented below each key, with overall food availability presented on the right.

Figure 3. Extinction phase Experiment 1/Phase1



Note: Extinction phase with two components. Signaled food presentations available per hr for responding on the target and alternative keys during extinction condition and color assignment. Food presentation availability are presented below each key, with overall food availability presented on the right.

Figure 4. Extinction phase Experiment 1/Phase 2



Note: Extinction phase with three components. Extinction phase with two components. Signaled food presentations available per hr for responding on the target and alternative keys during extinction condition and color assignment. Food presentation availability are presented below each key, with overall food availability presented on the right.

Results

Tables 1B and (2B (see Appendix B) show individual reinforcement rates in baseline, extinction and reinstatement conditions.

Experiment 1

The primary comparison of Experiment 1 is to evaluate the effect of reinforcing an alternative response in the same and different contexts as the target response. The secondary comparison is to find out whether or not the discriminative stimulus associated with the Only Target component (blue light, right key) being presented twice as often as other stimuli during the extinction (see Figure 4) influences the outcomes of the study.

Experiment 1/Phase 1

A lower rate of target responding in the DRA condition (baseline training) compared to target responding in the Target Only component was expected. A lower rate of target responding in the Combined component (extinction) compared to the target responding form the DRA component was predicted.)

Baseline Component.

Response rates in the DRA (yellow lights; left key and right key), Target Only (blue light; right key) Alternative Only (green light; left key) components are shown on Figure 5.

Data from baseline conditions show a relatively stable rate of responding for all keys across baseline conditions. Target response rates were lower for the DRA components (yellow light; right key) compared to target response rates for the Target Only component (blue light; right key). Baselines for hen 10.1 and hen 10.6 were the exception; target response rates for the DRA (yellow light; left key) were similar to target response rates for the Target Only component (blue light; right key). Data also show that alternative response rates were typically greater compared to target response rates for all hens.

As predicted, and consistent with the purpose of DRA, target responding occurred at a lower rate when trained together with alternative responding. The results are consistent with previous studies by Mace et al., (2010) and Podlesnik et al., (2012). Mauchly's test indicates that that the assumption of sphericity had been met ($p > .05$) (see Table 2). A two-way repeated measures ANOVA revealed that there was a statically significant response*session interaction, F (10, 40) = 4.1, $p < .05$; main effect of responses, F (2, 8) = 12.13, $p < .05$ and main effect of sessions F (10, 40) = 12.63, $p < .05$.

Extinction phase.

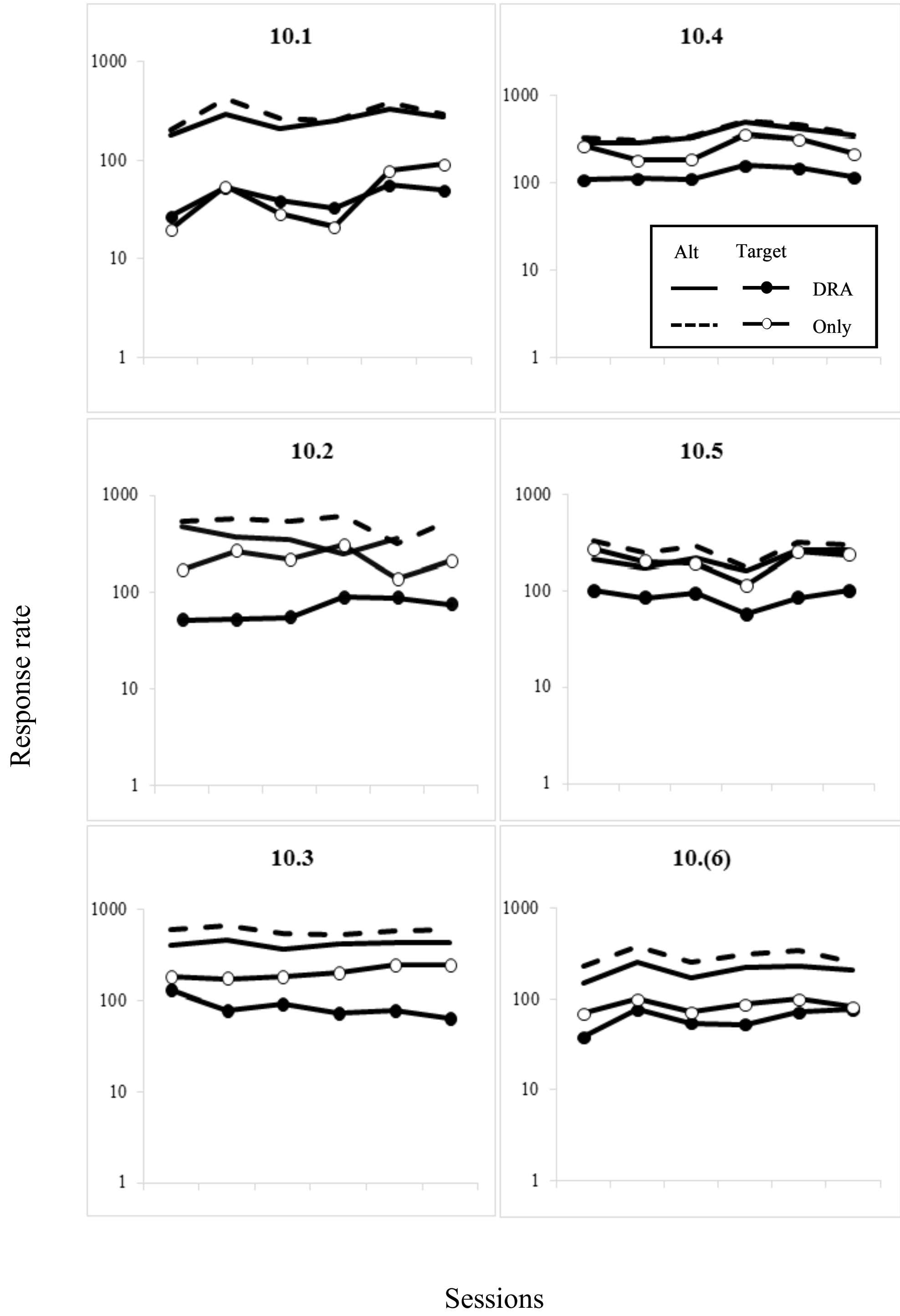
To be consistent with previous studies conducted by Mace et al. (2010); Nevin et al. (1990) and Podlesnik et al. (2012) the main focus of the extinction phases is on target behaviour. Alternative responding is also presented in graphs and is referred to if necessary in order to discuss a specific issue.

Proportion of mean baseline response rates across six successive extinction sessions for Experiment 1/Phase1 is shown on Figure 6. An analysis of the data found a significant difference in responding on the target key in the DRA condition compared to responding on the target key in the Combined condition for all experimental subjects. Within-subject effects are presented in Table 1.

A two-way repeated measures ANOVA showed that there was a statistically significant main effect of components, F (1,5) = 12.5, $p = .000$, main effect of sessions F (5, 20) = 12.2, $p = .004$ and response*session interaction, F (10, 40) = 4.15, $p = .001$.

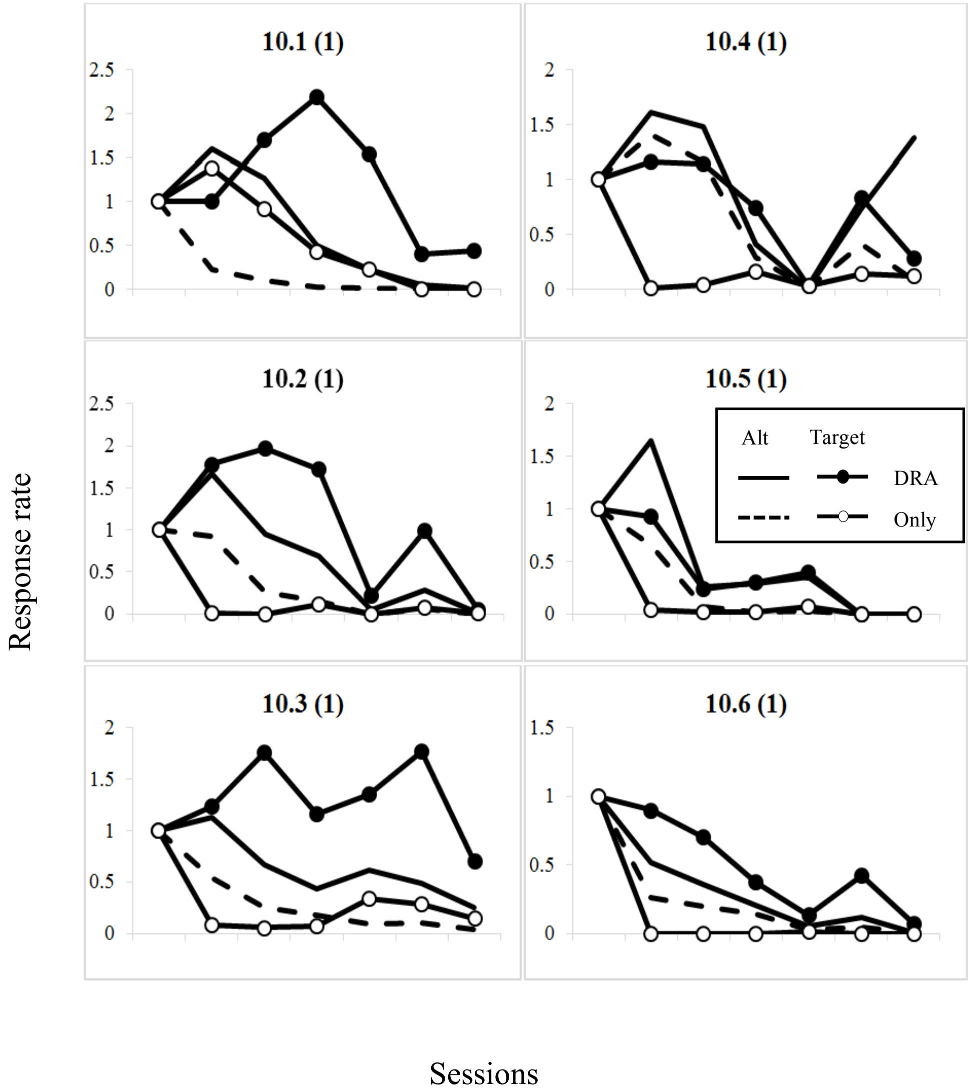
Results reveal that, consistently with the prediction, target response rates in the DRA condition (yellow light; right key) were consistently more resistant to change compared to target response rates in the Combined component (blue light; right key). The results are consistent with previous studies by Mace et al., (2010) and Podlesnik et al., (2012).

Figure 5. Baseline



Note: Baseline response rates from the last six sessions prior to each extinction test. The lines with data points show responding on the target key (black circle-DRA; white circle-Combined), functions without data points show responding on the alternative key (solid line – DRA; dashed line-Combined).

Figure 6. Extinction



Note. Response rates shown as a proportion of reinstatement response rates during the extinction session. The lines with data points show the components' responses on the right key (target responding). The black circles show responding on the DRA Target (yellow light; right key) component and the white circles show responding on the Target Only (blue light; right key) component. The lines without data points show responding on the DRA Alternative (yellow light, left key), the dashed line shows responding on the Alternative (green light; left key) condition.

Table 1. *Summary of Mauchly's test for Baseline Component Experiment 1/Phase 1, Reinstatement Component Experiment 1/ Phase 2 and Extinction Component Experiment 1/ Phase2.*

Experimental condition	**Within Subject Effect**	***Approx. Chi-Square***	***df***	***Sig.***
	Sessions	16.723	14	.408
Experiment 2/Phase1	Responses	7.95	5	.172
	response*session	.	119	.
Experiment 1/Phase2	Sessions	.	14	.
(Reinstatement)	Responses	.58	5	.581
	response*session	.	119	.
Experiment 1/Phase2	Sessions	.	14	.
(Extinction)	Responses	3.06	2	.581
	response*session	.	54	.

Experiment 1/Phase 2

A lower rate of target responding in the DRA condition (reinstatement training) compared to target responding in the target only component was expected. A lower rate of target only responding in the combined component (extinction) compared to target responding form the DRA component was predicted.

Reinstatement Component

Response rates in all three components, DRA (yellow light left and right key), Target Only (blue light; right key) and Alternative Only (green light; left key) components are shown in Figure 7.

Data from the reinstatement component show a relatively stable rate of responding for all keys. Target response rates were lower for the DRA components (yellow light; right key) compared to response rates for the Target Only (blue light; right key) component. Results for hen 10.4 and hen 10.6 were the exception. Target response rates for the DRA were similar to target response rates for the Target Only (blue light; right key) component. Data also show that alternative response rates were typically greater compared to target response rates for all hens.

Mauchly's test indicates that that the assumption of sphericity had been met ($p > .05$) (see Table 2). Two-way measure ANOVA shows that there was a statistically significant main effect of components, F (3, 9) = 12.66, p = .001 but no main effect of sessions F (5,15) = 2.15, p = .12 and response*session interaction, F (10, 40) = 1.4, p = .18

As predicted and consistently with the purpose of the DRA, target responding occurred at a lower rate when trained together with alternative responding. The results are consistent with previous studies by Mace et al. (2010) and Podlesnik et al. (2012).

Once a reinstatement phase was established, responding was disrupted with extinction. Figure 8 shows response rates of the DRA and combined conditions during the extinction phase.

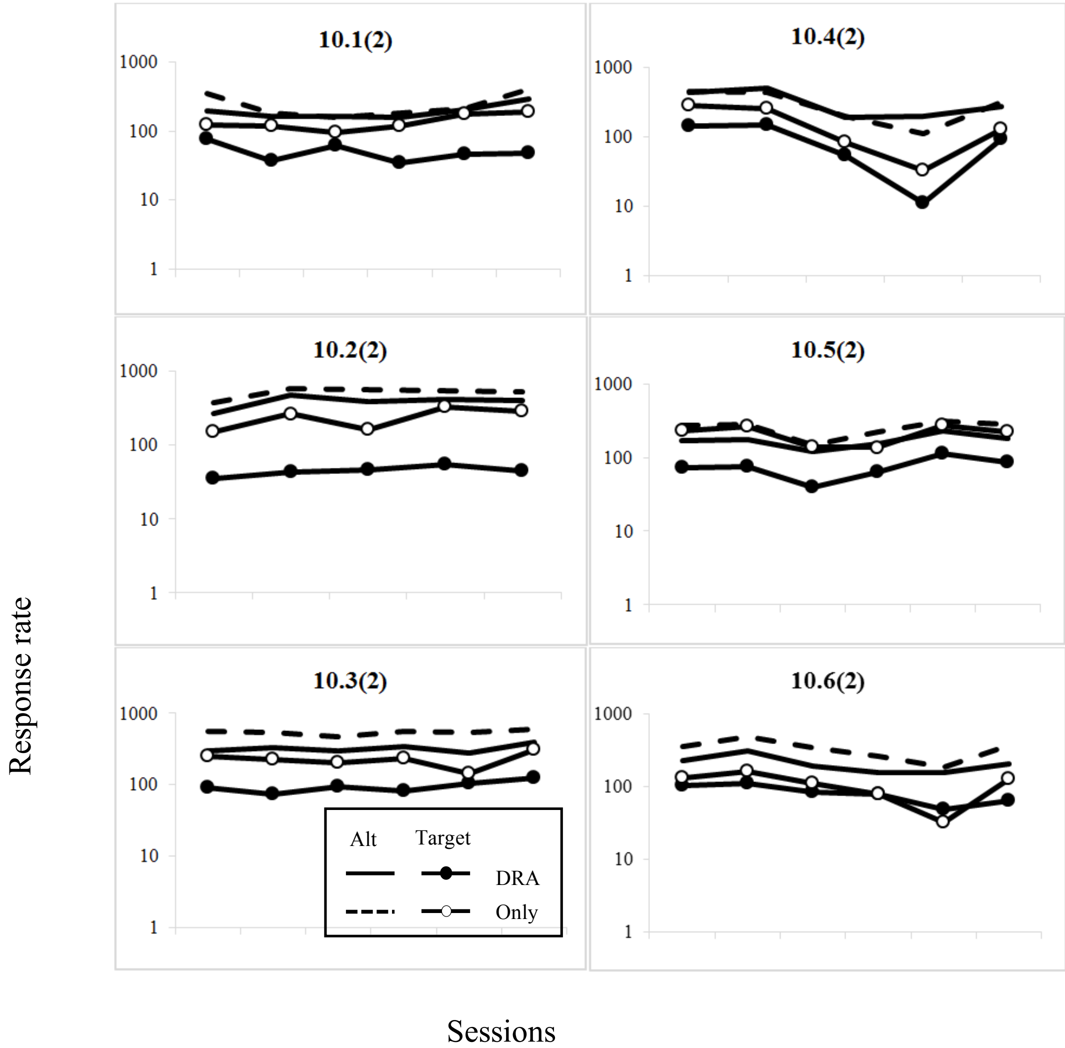
Combined-Stimulus Extinction

Figure 8 shows responding in extinction for the DRA (yellow lights key; left key and right key) and the Combined conditions (green light; left key) and (blue light; right key). It also includes additional Target Only (blue light; right key) component.

Mauchly's test indicates that that the assumption of sphericity had been met (p > .05) (see Table 2). Two-way repeated measure ANOVA showed that there was a statistically significant main effect of components, $F\ (3, 9) = 28.38$, $p < .00$ but no main effect of sessions $F\ (5, 25) = .48$, $p < .79$ and response*session interaction, $F\ (15, 75) = .53$, $p < .91$.

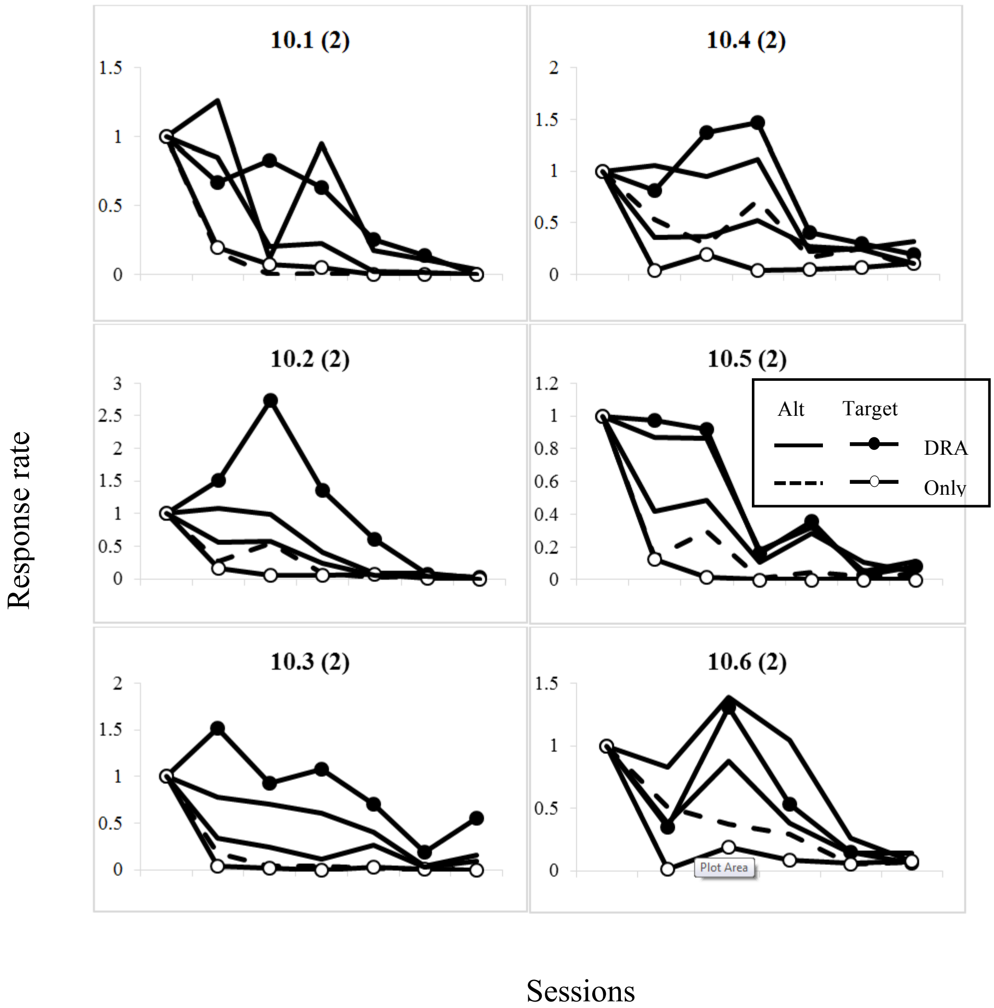
Results revealed that, consistently with predictions, target response rates in the DRA condition (yellow light; right key) were consistently more resistant to change compared to target response rates in the Combined component (blue light; right key). The results are consistent with previous studies by Mace et al. (2010) and Podlesnik et al. (2012).

Figure 7. Reinstatement



Note. Reinstatement response rates from the last six sessions prior to each extinction test.

Figure 8. *Extinction*



Note. Response rates shown as a proportion of reinstatement response rates during the extinction session. The lines with data points show the components' responses on the right key (target responding). The black circles show responding on the DRA target (yellow light; right key) component and the white circles show responding on the target only (blue light; right key) component. The lines without data points show responding on the DRA alternative (yellow light, left key), the dashed line shows responding on the alternative (green light; left key) condition.

Effect of extinction with and without the additional component

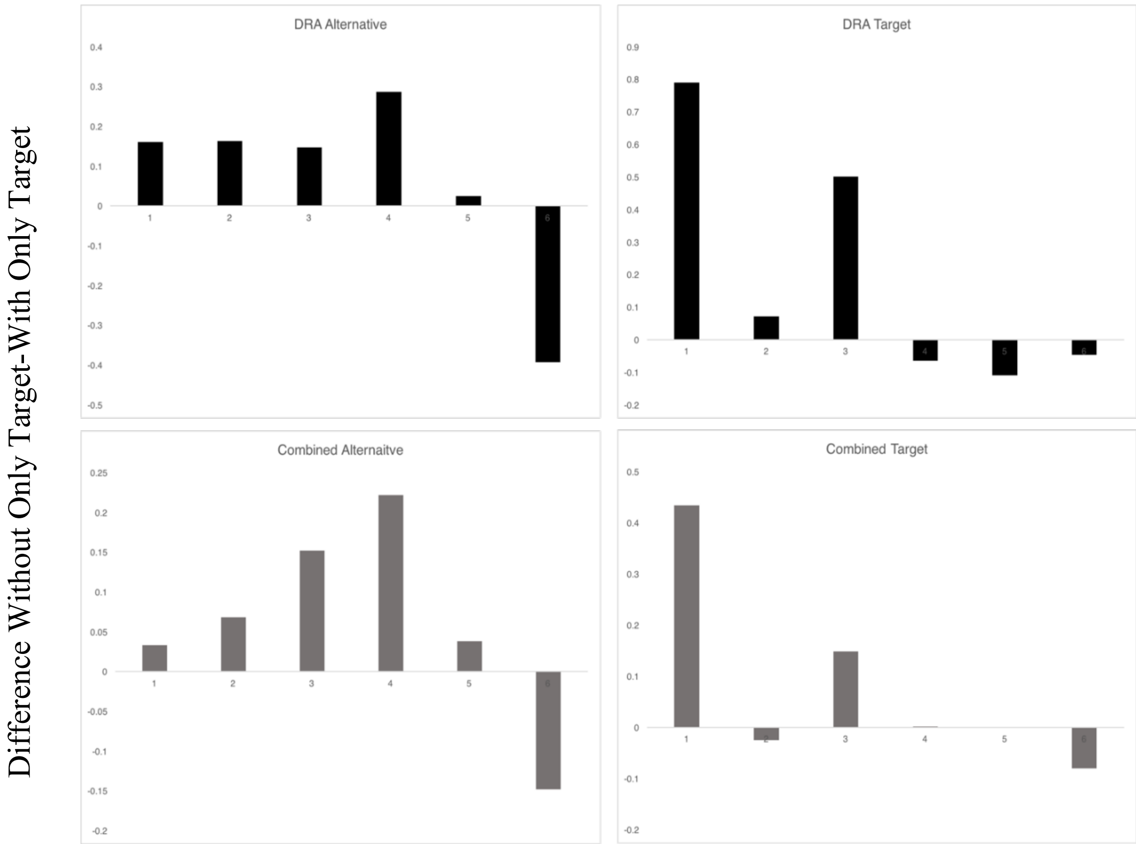
It was expected that decreased resistance to change of target responding in the Combined component compared to the DRA component was due to combining stimuli that were trained separately rather than to greater exposure of that stimulus to extinction.

Figure 9 shows the differences of mean proportion of baseline response rates between the extinction phase with and without the additional Target Only (blue light; right lever) component.

Figure 9 shows general trends that were observed for the majority of subjects. This trend was most evident in the data of Hen 10.1 and Hen 10.3. For these two subjects, target responding in the DRA and Combined components was greater without the additional Target Only (blue; right key) component. No systematic differences were demonstrated for target responding in these components for the other subjects.

For four out of six subjects (differences for Hen 10. 5 and Hen 10.6 were the exception) the differences in the mean proportion of baseline response rates were greater without the additional Target Only (blue; right key). It can be suggested that an additional exposure to the target key had a significant effect on all components for almost all subjects.

Figure 9. Extinction with and without an additional only target responding



Note. Relative resistance to extinction shows as the differences of mean proportion of baseline response rates between the extinction phase with and without the additional target only (blue light, right key) component for alternative and target responding in both the DRA and Combined components.

Discussion

The results of the current study show similar outcomes to Podlesnik et al.'s (2012) study. Data demonstrate the same trend in responding in five out of six subjects.

With an even smaller effect of baseline target responding compared to Podlesnik's et al. (2012) findings, it can be suggested that the first Phase Experiment 1 successfully replicated the observation that reinforcing an alternative response in the same context as a target response achieves a decrease in the rate of occurrence but increases the persistence of that target response.

A closer look at Podlesnik et al.'s (2012) study shows that the subjects who were participating in their research were experimentally naïve. The subjects from the present experiment were previously exposed to different experimental conditions prior to my study. Therefore, it could be suggested that the size of the effect shown in Experiment 1/Phase 1 compared to Podlesnik et al.'s (2012) study could be attributed to the carryover effect from the previous exposure to the different experimental procedures that the participants had prior to the experiment.

Support for the above argument comes from the second phase of Experiment 1 when the delivery of reinforcement for pecking on the response keys had been re-established. Data shows an improvement in performance after the subject experiencing an additional exposure to the training condition (reinstatement), and six out of six subjects responded less in the DRA condition compared to target responding trained separately.

Therefore, in summary, lower response rates for DRA Target responding (yellow light; right key) components are consistent with the Matching Law which explains a degradation of the response-reinforcer relation as a result of adding an alternative source of reinforcement (Nevin et al., 1990). Target responding occurred at a lower rate when it was trained together with an alternative response. It was confirmed that, consistent with the purpose of the DRA treatment, target responding occurred at a lower rate when trained together with an alternative response. By saying that, adding an additional source of reinforcement reduced the rate of target responding but simultaneously increased resistance of this responding to change.

Podlesnik et al., (2012) found that resistance to extinction of target responding was lower in the combined condition compared to the DRA condition for all six subjects. I found the same size of effect in the second Phase of Experiment1. The findings from the first and the second phases of Experiment 1 confirmed that target responding was consistently less resistant to change in the Combined condition than either in the DRA condition or in the context with the target only condition for all subjects.

The positive effect of reinforcing alternative and target responses prior to combining them together on the rate of occurrence and persistence of that target response to change, is demonstrated in the present study. These findings are supported by the previous research. As was mentioned above, Podlesnik et al. (2012) was able to replicate Mace's et al. (2010) results. Therefore, the present study adds to the body of research showing this effect with a new species.

As with Podlesnik's et al. (2012) study, the present experiment tested whether or not a discriminative stimulus associated with Target Only component was presented more often compared to other stimuli during the extinction phase (see Figure 3). Podlesnik compared extinction conditions both with and without an additional exposure to the Target Only (blue light; right key) component. He used an extinction condition with an additional exposure to the Target Only component first, and an extinction without an additional exposure second. Podlesnik found that an additional exposure to the target only component did not have a significant effect on target responding (yellow light; right key) and alternative responding (yellow light; right key) in the DRA condition and alternative responding (green light; left key) in the Combined condition.

However, it can be argued that the order in which the exposure to the additional target only component was arranged in extinction could influence the outcomes. In order to rule out whether or not the order had any effect on Podlesnik's (2012) experimental results, the present experiment used an extinction condition without an additional exposure to the Target Only component (blue light; right key) first and extinction condition with an additional exposure to the Target Only responding second. Inconsistent with Podlesnik's findings, the results showed an additional exposure to the Target Only component had a significant effect on target responding (yellow light; right key) and alternative responding (yellow light; left key) in the DRA condition and alternative responding (green light; left key) in the Combined condition for some subjects.

One of the potential explanations could come from the fact that the experimental subjects experienced an additional exposure to the Target Only component (blue light; right key) in the second phase of Experiment 1, and developed during this exposure a carryover effect that might impact the size of the effect of the second phase of Experiment 1 and influence the results of the comparison.

In summary, it can be suggested that, consistent with Behavioural Momentum Theory, reinstatement of behaviour that was previously eliminated during the treatment procedure depends on the overall rate of reinforcement that was previously obtained in the context. Therefore, the results of Experiment 1 confirm Mace et al.'s (2010) and Podlesnik et al.'s (2012) findings, which suggest that if target responding is trained separately from alternative responding before these two components are combined, the target response is inclined to be less resistant to change.

It might be considered that differences in decreases in responding during the extinction phase could be related to response rates during initial baseline training. To be specific, the baseline response rates of the Target Only (blue light; right key) component were higher compared to the response rates for the DRA Target (yellow light; right key) component for all hens (see Figure 2). Therefore, it can be suggested that, according to Cooper et al. (2009), the more significant reduction in target responding in the Combined component during the extinction phase might be due to a higher level of responding of this behaviour during the baseline phase rather than to the effect of having an alternative reinforcement.

Podlesnik et al. (2012) was trying to rule out this suggestion by noting that the history of reinforcement should affect reinstatement and resistance to change in the same way (Podlesnik & Shahan, 2009). Podlesnik et al. (2012), in the second part of their study measured the relapse of the responses that were trained in the same context or separately before extinction. He was assessing a reinstatement of extinguished operant behaviour by measuring the levels of responding that followed extinction at a point when showed zero or near zero levels of response. Consistent with the results of previous studies (Podlesnik & Shahan, 2009), findings showed that, despite a similarly low level of response rates in extinction, reinstatement for target responding in the DRA condition was greater when compared to reinstatement for target responding in the Combined condition. Podlesnik et al. (2012) concluded that resistance to extinction was most likely influenced by a variety of factors and not exclusively by baseline response rates.

I also wanted to explore whether differences in decreased responding during the extinction phase could be related to response rates during initial baseline training. Because Podlesnik et al. (2012) used relapse of target responding to look at the effect of response rates during initial baseline training on resistance to change; in this next experiment, I decided to examine responding following extinction after target response rates and alternative response rates were reinforced at the same rate during a training procedure.

There is another practical reason for looking at the effect of changing a rate of reinforcement for target and alternative responses during a training procedure. It can be argued that it is rather unrealistic to expect that in a real-life setting each instance of behaviour would be reinforced strictly according to the schedules that are used during a reinforcement-based procedure. Therefore, the present experiment aimed to observe the effect of changing reinforcement schedules for alternative and target responding in the DRA and Combined conditions on the resistance of these responses to change.

The present experiment aimed to look at the effect of increasing the rate of reinforcement for a target response to the rate of reinforcement for an alternative response as is often happening in the natural context after DRA therapy is finished.

It is also intended to assess the effect of reducing the level of reinforcement for the alternative response to the level of reinforcement for the target response on resistance to change of that target response. As has been recorded by Smith (2003), it might appear that over time the level of reinforcement for an alternative response naturally drops by caregivers to the level of reinforcement that was provided for target behaviour in the past.

The third phase of Experiment 2 was designed to assess whether presenting each discriminative stimulus individually in extinction will have an effect on resistance to extinction of the target response.

Experiment 2

The aims of the present experiment were to assess the effect of the past history of reinforcement on the resistance to change of target responding after reinforcement rates for that target responding and alternative responding were equalised.

According to Behavioural Momentum Theory, it was hypothesised that resistance to change of target responding will be lower in the Combined versus DRA component after the rates of reinforcement for the target and alternative responses were equalised. It was expected that target responding in the Combined condition would be less resistant to change compared to target responding in the DRA condition due to the disruptive effect of an alternative source of reinforcement rather than due to baseline response rates.

It was also hypothesised that resistance to extinction of target responding from the DRA component will be higher compared to resistance to extinction of target responding from the Combined component when each stimulus was presented individually in extinction.

Method

The study design for Experiment 2/Phase 1, Experiment 2/Phase 2 and Experiment 2/Phase 3 is presented in Table.2 (see Appendix A).

Subjects

The same subjects (five *Gallus domesticus* hens; hen 10.4 died by the time of Experiment 1) were used in as the previous experiment.

Apparatus

The apparatus was identical to the apparatus in the previous experiment.

Procedure

Reinstatement.

The reinstatement was identical to the reinstatement in the previous experiment (see Figure 2).

Extinction.

Training components were followed by extinction phases. During an extinction phase the delivery of reinforcement for pecking on the response keys was discontinued (see Figure 3).

Incremental Increase. Experiment 2/Phase1.

Reinstatement.

The reinstatement was identical to the reinstatement in the previous experiment (see Figure 2).

Increment phase.

Figure 10 shows stimulus arrangement and rates of reinforcement during the increment phase when reinforcement rates for target responding were increased to the level of reinforcement for alternative responding.

The rates of reinforcement for the target key (yellow, blue lights, right key) were gradually increased over ten sessions from a VI 150-s schedule (24 / hr) to a VI 37.5-s schedule (96 / hr). Six successive sessions when the rates of reward for target and alternative responses were provided on the same VI 37.5-s schedule (96 / hr) were followed by an extinction phase for the DRA and Combined components.

Extinction

The extinction phase was identical to the extinction phase the in Experiment 1. Increment components were followed by extinction phase as illustrated in Figure 3. This part of the experiment consisted of six successive sessions of extinction. During the extinction phases the delivery of reinforcement for pecking on the response keys was discontinued.

Incremental Decline. Experiment 2/ Phase 2.

Reinstatement.

The reinstatement was identical to the reinstatement in the previous experiment (see Figure 2).

Decrement phase.

Figure 11 shows stimulus arrangement and rates of reinforcement during the decrement phase when reinforcement rates for alternative responding were decreased to the level of reinforcement for alternative responding.

The rates of reinforcement for the alternative response on the left key were gradually decreased over ten sessions from VI 37.5-s schedule (96 / hr) to a VI 150-s schedule (24 / hr). Six successive sessions when the rate of reward for target and alternative responses were provided on the same VI 150-s schedule (24 / hr) schedule were followed by an extinction phase for the DRA and Combined components.

Extinction.

The extinction phase was identical to the extinction phase in the Experiment 1. Increment components were followed by extinction phases as illustrated in Figure 3. This part of the experiment consisted of six successive sessions of extinction. During an extinction phase the delivery of reinforcement for pecking on the response keys was discontinued.

Individual Stimuli. Experiment 2/Phase3.

Reinstatement.

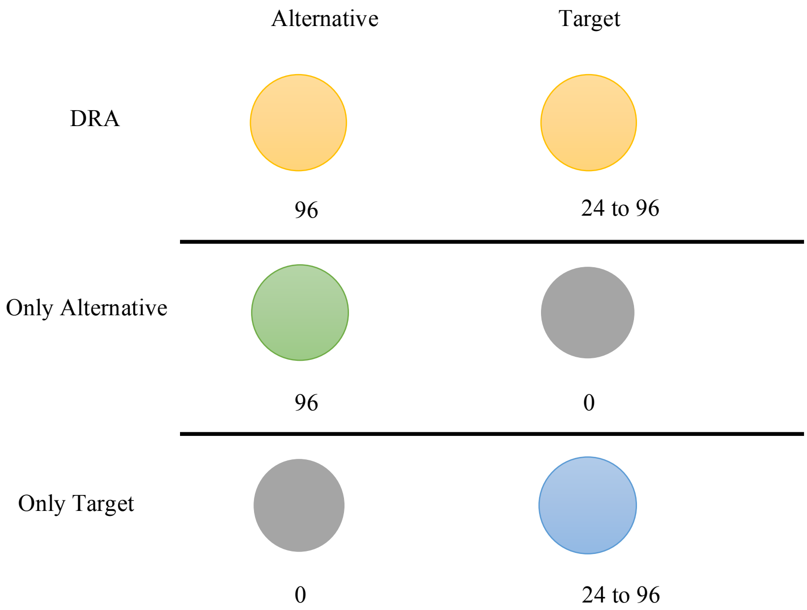
The reinstatement was identical to the reinstatement in the previous experiment (see Figure 2).

Extinction.

Training components were followed by extinction phases as illustrated in Figure 12. This part of the experiment consisted of six successive sessions of extinction. During an extinction phase the delivery of reinforcement for pecking on the response keys was discontinued.

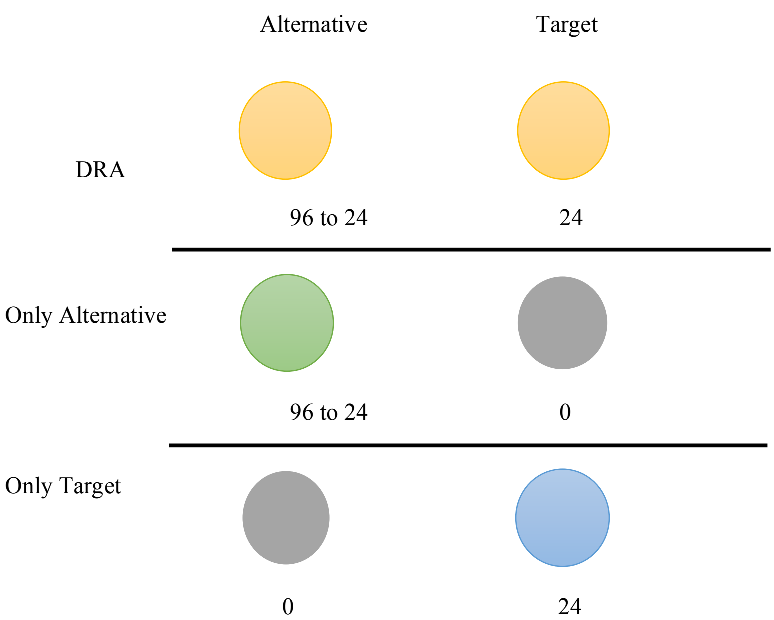
The first component of the extinction test involved eliminating reinforcement on the left key, the right key in this component was darkened. The second component of extinction involved eliminating reinforcement on the right key; the left key in this component was darkened. The third component of this phase involved elimination of reinforcement for pecking on the left key lit green (Alternative Only), the right key in this component was darkened. The fourth component of this phase involved elimination of reinforcement for pecking on the right key lit blue (Target Only), the left key in this component was darkened.

Figure 10. Incremental increase. Experiment 2/Phase 2



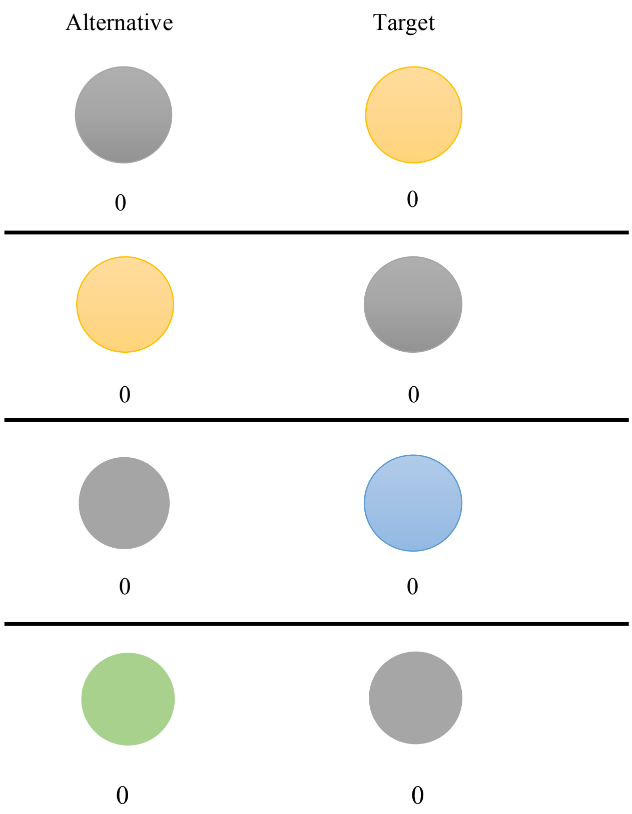
Note: Signaled food presentation per hr and color assignment for responding on the target and alternative keys during increment condition. The rate of reinforcement for the target behaviour was gradually increased to the level of reinforcement for the alternative behaviour.

Figure 11. Incremental decrease. Experiment 2/ Phase 2



Note: Signaled food presentation per hr and color assignment for responding on the target and alternative keys during decries of the rate of reinforcement. The rate of reinforcement for the alternative responding was reduced to the rate of reinforcement for the target responding.

Figure 12. Extinction Independent stimuli. Experiment 2/Phase3



Note: Signaled food presentation per hr and color assignment for responding on the target and alternative keys during extinction.

Results

Extinction Experiment 2

The primary focus of Experiment 2/ Phase 1was to evaluate the effect of incremental increase of the rate of reinforcement for DRA target responding (yellow light, right key) to the rate of reinforcement for DRA alternative responding (yellow light, left key) during training sessions on resistance to change of that target responding. Resistance to extinction of DRA target responding (yellow light, right key) is compared to resistance to change of a Target Only (blue light, right key) component. Lower rates of target only responding in the Combined component (extinction) compared to target responding from the DRA component were predicted.

The secondary comparison of Experiment 2/ Phase 2 is to evaluate the effect of incremental decrease of the rate of reinforcement for DRA alternative responding (yellow light, left key) to the level of reinforcement for DRA target responding (yellow light, right key) during training session on resistance to change of that target responding. Resistance to extinction of DRA target responding (yellow light, right key) is compared to resistance to change of a Target Only (blue light, right key) component. Lower rates of target responding (blue light, right key) in the Combined component (extinction) compared to target responding from the DRA (yellow light, right key) component were predicted.

The third comparison is to evaluate resistance to extinction of DRA target responding (yellow light, right key) compared to Target Only responding (blue light, right key) during extinction when each stimulus (green light, left key; yellow light left key; blue light, right key, yellow light right key) was presented individually. Lower rates of Target Only (blue light, right key) component compared to target responding from the DRA (yellow light, right key) component were predicted.

Extinction Experiment 2/Phase 1.

Response rates during extinction component are shown on Figure 13. Two-way repeated measures ANOVA that shows that there is a statistically significant main effect of components, $F(1,5) = 12.23$, $p = .025$, main effect of sessions, $F(5,20) = 17.83$, $p = .000$ and response*session interaction, $F(5, 25) = 5.79$, $p = .002$.

Results revealed that, consistent with predictions, target response rates in the DRA condition (yellow light; right key) were consistently more resistant to change compared to target response rates in the Combined component (blue light; right key). The results are consistent with previous studies by Mace et al. (2010) and Podlesnik et al. (2012)

Extinction Experiment 2/ Phase2.

Response rates during the extinction component are shown on Figure 14. A two-way repeated measures ANOVA revealed a statistically significant main effect of sessions, $F(5, 20) = 7.41$, $p = .000$, but no main effect of components, $F(1,4) = 21.15$, $p = .692$ and response*session interaction, $F(5, 20) = .79$, $p = .57$.

Results show that, inconsistent with predictions, target response rates in the DRA condition (yellow light; right key) were similar in their resistance to change compared to target response rates in the Combined component (blue light; right key).

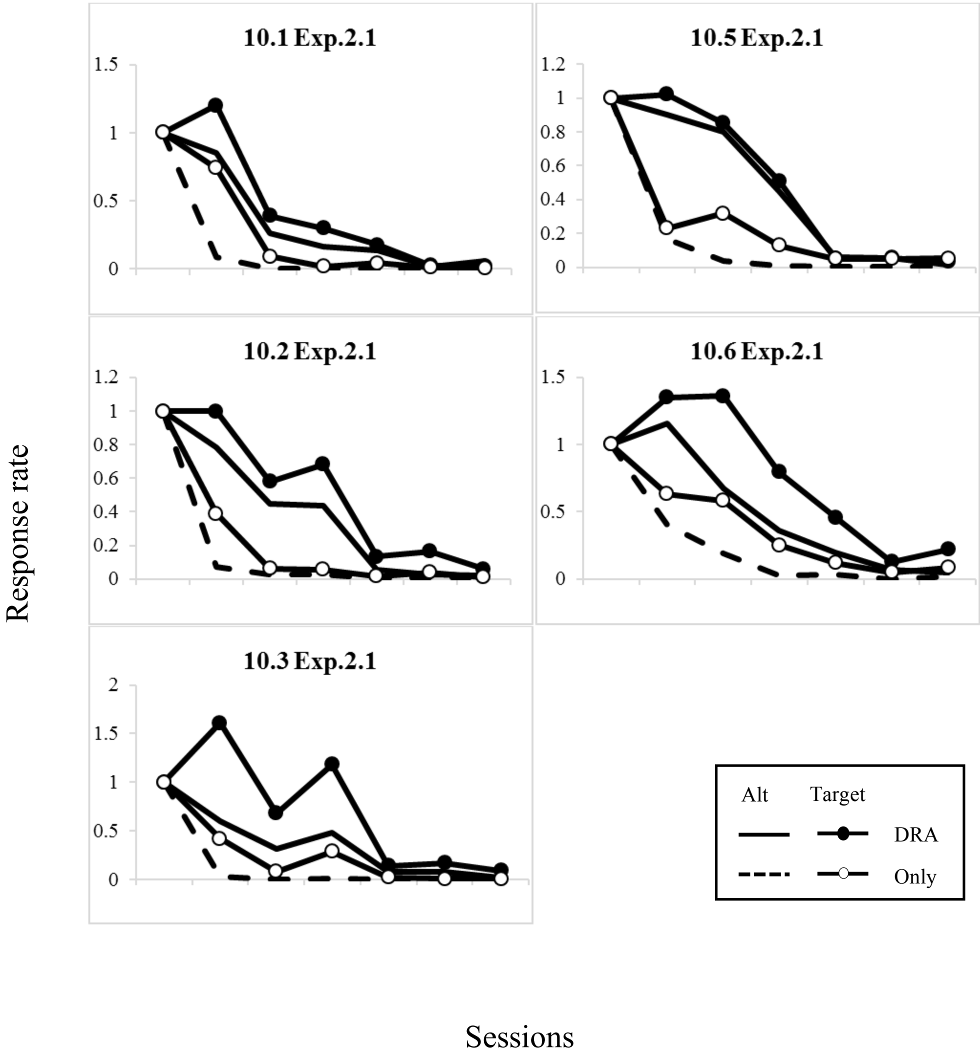
Extinction Independent Stimuli Experiment 2/ Phase 3.

Response rates during extinction component are shown on Figure 15.

A two-way repeated measures ANOVA revealed a statistically significant main effect of components, F (1, 4) = 18.19, p = .013, main effect of sessions F (5,20) = 9.76, p = .000 and response*session interaction, F (5, 25) = 10.75, p= .000.

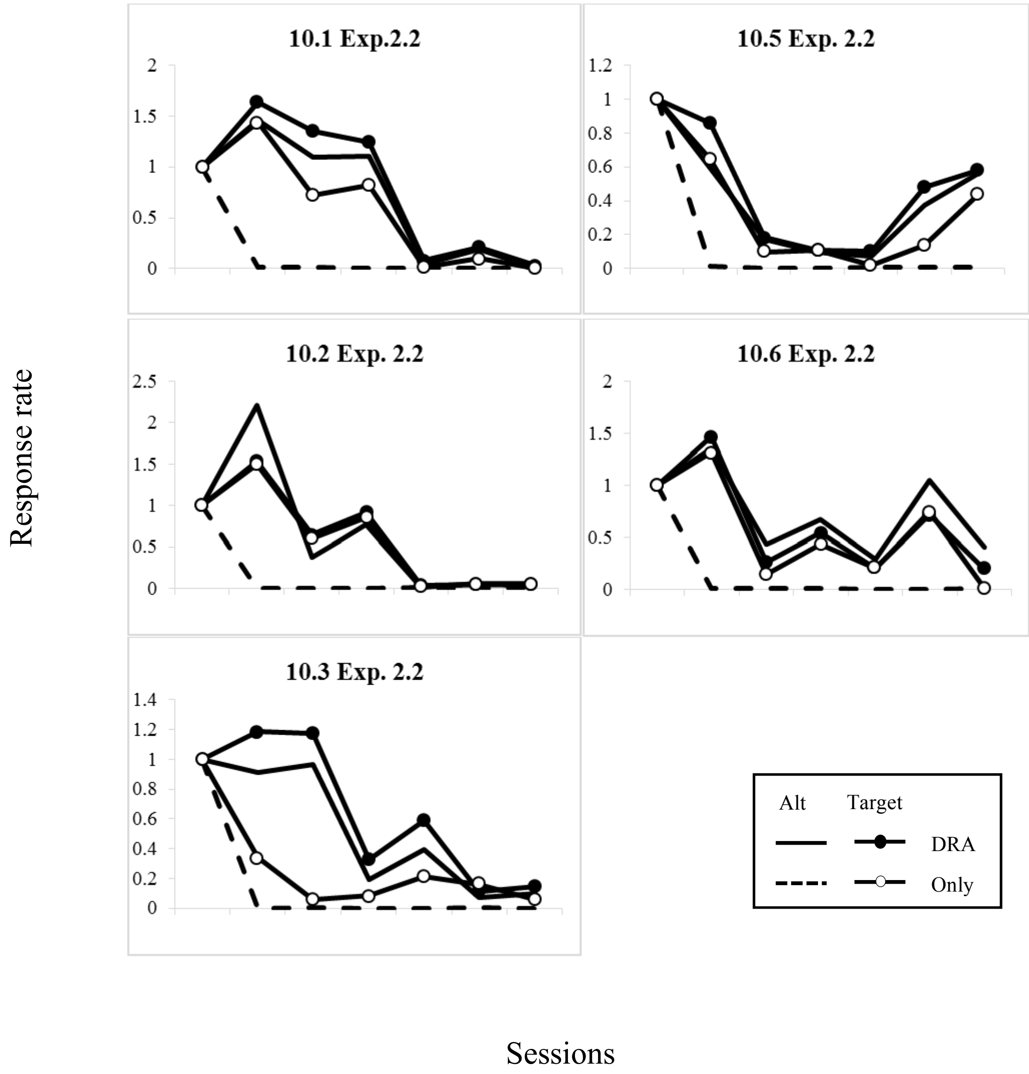
Results revealed that, consistently with predictions, target response rates in the DRA condition (yellow light; right key) were consistently more resistant to change compared to response rates of the Target Only (blue light; right key) component. The results are consistent with previous studies by Mace et al. (2010) and Podlesnik et al. (2012).

Figure 13. Extinction. Experiment 2/Phase 1



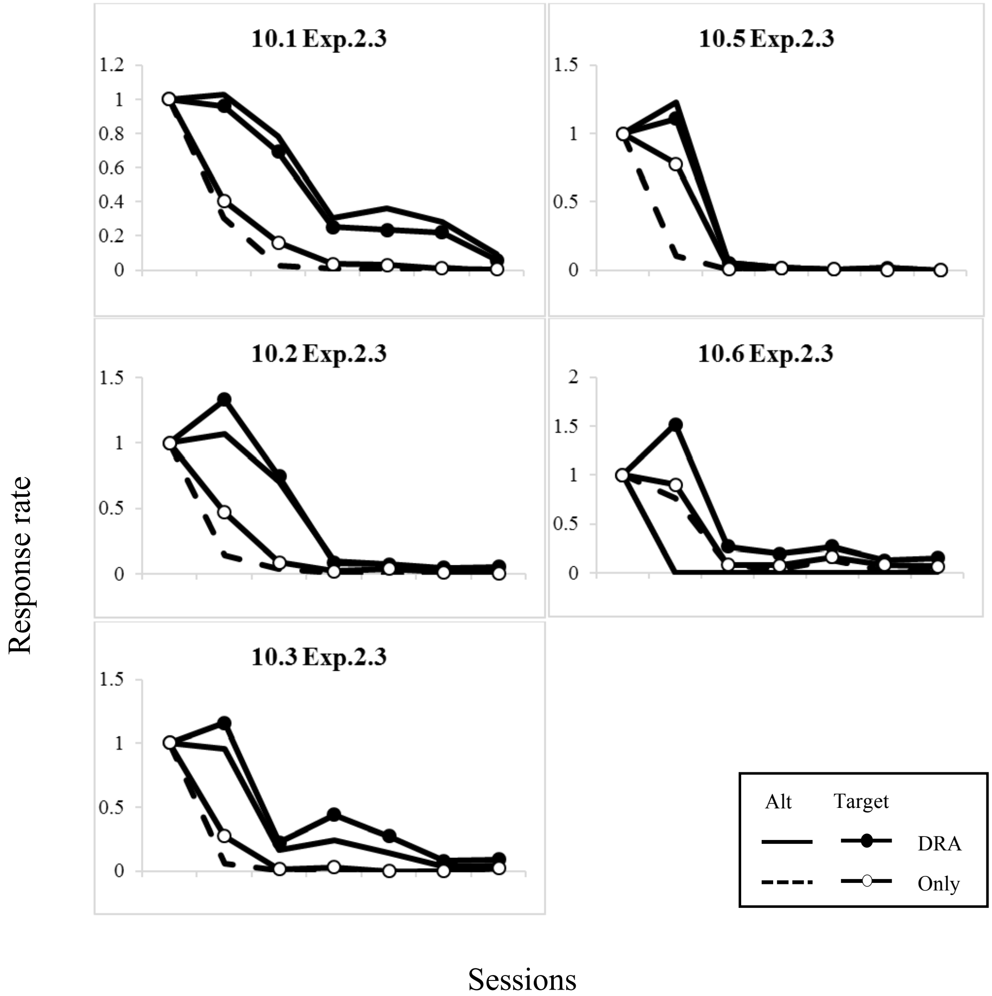
Note. Response rates shown as a proportion of reinstatement response rates during the extinction session. The lines with data points show the components' responses on the right key (target responding). The black circles show responding on the DRA target (yellow light; right key) component and the white circles show responding on the target only (blue light; right key) component. The lines without data points show responding on the DRA alternative (yellow light, left key), the dashed line shows responding on the alternative (green light; left key) condition.

Figure 14. Extinction



Note. Response rates shown as a proportion of reinstatement response rates during the extinction session. The lines with data points show the components' responses on the right key (target responding). The black circles show responding on the DRA target (yellow light; right key) component and the white circles show responding on the target only (blue light; right key) component. The lines without data points show responding on the DRA alternative (yellow light, left key), the dashed line shows responding on the alternative (green light; left key) condition.

Figure 15. Extinction



Note. Response rates shown as a proportion of reinstatement response rates during the extinction session. The lines with data points show the components' responses on the right key (target responding). The black circles show responding on the DRA target (yellow light; right key) component and the white circles show responding on the target only (blue light; right key) component. The lines without data points show responding on the DRA alternative (yellow light, left key), the dashed line shows responding on the alternative (green light; left key) condition.

Discussion

The purpose of Experiment 2 was to observe whether changing the rate of reinforcement of target responding in the DRA component (yellow light; right key) and the Target Only component (blue light; right key) to the level of reinforcement of alternative responding (yellow/ green light; left key) would affect the resistance of this responding to change. It was done to rule out a potential explanation that lower resistance to change of Target Only component (blue light; right key) compared to a target component from the DRA condition (yellow light; right key) is due to a higher rate of this responding in the training condition, rather than to an alternative source of reinforcement which is associated with the training context.

As anticipated, target responding in the DRA condition when alternative only (yellow light; left key) and Target Only (blue light; right key) components were combined in extinction resulted in higher resistance to change of this responding compared to resistance to the change of target responding (blue light; right key) from the Combined condition. This finding supports the result of Podlesnik's (2012) study where he observed a greater relapse in the DRA Target component compared to target responding in the Combined component despite similarly lower rates of the response (zero or close-to-zero rates) in extinction. The results provide support for the hypothesis, suggesting that, according to Behavioural Momentum Theory, resistance to change is an outcome of the enhancing resistance to change effect of having an alternative reinforcement in the same context as a target reinforcement.

In Phase 1 of Experiment 2, we were able to support the idea which was originally suggested by Podlesnik (2012), that resistance to extinction was not influenced solely by the baseline response rate and most likely there are a variety of factors such as the rate of reinforcement in the context that might influence it.

Results from the second Phase of Experiment 2 provide partial support for the hypothesis that baseline response rates do not influence resistance to change (at least not solely). Results indicate that target responding from the DRA component (yellow light; right key) in extinction after the rate of reinforcement for alternative responding (yellow/green light; left key) was decremented to the level of reinforcement of target responding (yellow/ blue light; right key) in the training component was different for two out of five subjects. For three other subjects, they were similar to the level of responding in a target component (blue light; right key) that was trained independently prior to extinction. One potential explanation for the results might be that a carry-over effect from the exposure to the previous experimental conditions had influenced the subjects' responses in the second Phase of Experiment 2. The level of reinforcement of target responding was significantly increased in the previous experiment. As a result, subjects might have an extensive cumulative history of previous learning that affected responding in extinction.

However, the results of the Experiment 2/ Phase3 may challenge this suggestion. Data show that, consistent with Behaviour Momentum Theory, resistance to extinction of target responding from the DRA component was higher compared to resistance to extinction of target responding from the Combined component when each stimulus was presented individually in extinction.

Therefore, it could be suggested that the tendency to attain a lower resistance to change of target responding from the DRA component might be due to the way the training sessions in the Phase 2 Experiment 2 were conducted. Therefore, further studies are required to find out whether or not decrementing the rate of reinforcement for alternative responding to the level of reinforcement for target responding during a training DRA session reduces resistance to change of that target responding.

Results of the last phase of Experiment 2 once again supported our prediction that having an alternative source of reinforcement in the DRA procedure increases resistance of target responding to change.

My Study is a first attempt at a comprehensive evaluation of the consequences of changing the rate of reinforcement during DRA training and when alternative and target responses were trained separately. Consistent with our predictions, response rates of Target Only responding (blue light, right key) was lower when this responding was Combined with Alternative Only responding (green light, left key) in extinction. Unexpectedly, for some experimental subjects, we did not observe an increase in resistance to change of DRA arget responding after it was trained in a condition in which reinforcement for alternative responding was decremented. These findings have promising treatment implications for decreasing the persistence-enhancing effects of DRA schedules.

General Discussion

Over the last three decades, differential reinforcement of alternative responding procedure (DRA), has been widely used by clinicians and practitioners. However, regardless of strong theoretical and empirical support for DRA, this method draws a lot of criticism because of reduced outcomes in achieving outcomes in a long-term and a low level of generalisation of treatment effect. Despite this criticism, not much comprehensive applied research has been dedicated to understanding the circumstances under which extinguished responding reoccurs (Lerman & Iwata, 1996, Podlesnik 2017).

The present study was designed to add to the body of research and examine resistance to change of target responding with multiple schedules of reinforcement. We found that training alternative and target responding in separate contexts prior to combining them in extinction reduced resistance to change of target responding compared to a target responding that was trained simultaneously with alternative responding in the DRA component. Results suggest that the negative outcomes of using DRA might be primarily due to limitations in the treatment strategy and can be avoided by training target and alternative behaviours separately.

There are some limitations to Mace's et al. (2010) extinction tests that were pointed out by Podlsenik et al. (2012). Podlesnik et al. suggested that having an additional exposure to the Target Only component during extinction may have a confounding effect on outcomes. Podlesnik compared the results of an extinction test with and without a target only component. He concluded that there was no systematic effect of having additional target only responding in extinction.

The results of the present study did not support the hypothesis that an additional exposure to a target only component in extinction will not affect another component's response. The findings differ from Podlesnik's et al. (2012) studies. This could be attributed to the order in which exposure of target responding to extinction was introduced. In the present study, we had an additional exposure of target responding in the second phase of Experiment 1 while Podlesnik et al. (2012) had that exposure in the first phase of his experiment. Further research could be used between-subject research design to determine whether or not the order in which an additional exposure of target responding to extinction was introduced, influences the results.

The results reviled that increasing the level of reinforcement for target responding to the level of reinforcement for alternative responding did not have a resistance-enhancing effect on target responding in extinction in the Combined component. The also show that reducing the level of reinforcement for alternative responding to the level of reinforcement for target responding did not have a negative effect on target responding in the Combined component. Moreover, lower resistance to extinction of target responding in the DRA component for some subjects was recorded. This could be attributed to the effect of having the new schedule of reinforcement (low rate of reinforcement for both responses) in the training component when contingency of reinforcement was weakening.

Further research could look exclusively at the effect of reducing the level of reinforcement for alternative responding on resistance to change of target responding prior to extinction, to determine whether or not this reduction had an influence on resistance to change and was not due to a carryover effect from the previous conditions. These findings may have important implications in order to examine whether or not the outcomes of treatment would be compromised while transitioning from an experimental setting to a real-life setting in which levels of reinforcement for alternative behaviour would not necessarily be kept as high as they were during a DRA procedure.

Overall, the results of the study are consistent with the previous findings by Mace et al. (2010) and Podlesnik et al. (2012), who suggested that relationships between resistance to change and relative recovery of behaviour could be explained within a Behavioural Momentum frame work. This framework looks at resistance to change in respect of the underlying behavioural mass of this behaviour formed as a product of the past history of reinforcement. Therefore, together with the studies of Mace et al. (2010) and Podlesnik et al. (2012), it can be suggested that target responding tends to be less resistant to extinction if it is trained separately from alternative responding before these two components are Combined.

It can be pointed out that my study was fully focused on a target behaviour. Further research could look at an alternative behaviour in the light of the current findings knowing that alternative responding may also become more resistant to change if it is trained in the same context as a target responding.

As with the Mace et al. (2010) and Podlesnik et al. (2012) studies, I used a strictly controlled environment to observe fundamental operant processes when adding an additional source of reinforcement to the context. This was done to eliminate other factors rather than to present an alternative reinforcement on a target responding. This experimental procedure provided us with the outcomes that allowed us to conclude that resistance to change is a function of overall level of reinforcement in the context.

However, one of the main arguments against using the DRA procedure is that the treatment effect does not sustain other contexts or therapists (Podlesnik et al., 2017). Therefore, it could be suggested that clearly, despite the fact that a strictly controlled environment could be good for skill acquisition, with humans, the treatment context needs to be more extended rather than built around specific discriminative stimuli when using DRA.

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Appendix A

Table A 1.1. *Baseline and extinction condition for Experement1*

	Conditions		Key color & Schedules		Total session time	Name/Why?
Phase 1	Baseline	comp 1	VI 37.5	VI 150	48 min.	DRA Right key- target behaviour (lean reinforcement) Left key- alternative behaviour (reac reinforcement).
		comp 2	VI 37.5			Alternative behaviour in separate context (reach reinforcement).
		comp 3		VI 150		Target behaviour (lean reinforcement
Phase 1	Disruptor 1	comp 1	0	0	36 min.	DRA. Extinction.
		comp 2	0	0		Combines stimulus context. Extinction.
Phase 2	Reinstatement	comp 1	VI 37.5	VI 150	48 min	Reinstatement phase
		comp 2	VI 37.5			
		comp 3		VI 150		
Phase 2	Disruptor 2	comp 1	0	0	36 min	Extinction. Measure of persistence t each individual stimulus.
		comp 2	0	0		
				0		

Note. Letters within the cells specify the key color (letter Y indicates Yellow color, letter G indicates Green color, and let B indicates blue color). Each cell contains a number that shows a food presentation and changes in the food presentation the target and alternative responses in DRA and Separated condition during baseline and extinction.

Table A 1.2. *Baseline and extinction condition for Experement2*

Conditions			Key color & Schedules		Total session time	Name/Why?
Phase 1	**Increment**	comp 1	VI 37.5	VI 150 to VI 37.5	48 min.	DRA Right key- target behaviour (enriched reinforcement) Left key- alternative behaviour (rich reinforcement).
		comp 2	VI 37.5			Alternative behaviour in separate context.
		comp 3		VI 150 to VI 37.5		Target behaviour.
Phase 1	Disruptor 1	comp 1	0	0	36 min.	DRA. Extinction.
		comp 2	0	0		Combines stimulus context. Extinction.
Phase 2	**Decrement**	comp 1	VI 37.5 to VI 150	VI 150	48 min	DRA Right key- target behaviour Left key- alternative behaviour (decreased reinforcement) Alternative behaviour in separate context. Target behaviour).
		comp 2	VI 37.5 to VI 150			
		comp 3		VI 150		
Phase 2	Disruptor 2	comp 1	0	0	36 min	Extinction. Measure of persistence to each individual stimulus.
		comp 2	0	0		
Phase 3	**Reinstatement**	comp 1	VI 37.5	VI 150	48 min.	DRA Right key- target behaviour (lean reinforcement) Left key- alternative behaviour (rich reinforcement).
		comp 2	VI 37.5			Alternative behaviour in separate context (reach reinforcement).
		comp 3		VI 150		Target behaviour (lean reinforcement).
Phase 3	Disruptor 3	comp 1	0			Extinction for each individual key
		comp 2		0		
		comp 1		0	48 min	
		comp 2	0			

Note. Letters within the cells specify the key color (letter Y indicates Yellow color, letter G indicates Green color, and letter B indicates blue color). Each cell contains a number that shows a food presentation and changes in the food presentation for the target and alternative responses in DRA and Separated condition during baseline and extinct.

Appendix B

Table B.1. *Responses During Baseline, Reinstatement, Extinction Tests for Experiments 1*

	Hen Number	*10.1*	*10.2*	*10.3*	*10.4*	*10.5*	*10.6*
Experiment 1/Phase1	*Condition*						
	Alternative/DRA	181 296 210 249 328 279	482 378 353 249 367 421	301 333 295 338 280 389	282 281 329 485 408 343	261 176 219 163 265 167	147 253 169 220 228 207
	Target/DRA	27 53 39 33 56 50	52 53 55 90 88 75	91 74 95 83 106 126	108 112 110 157 146 117	101 85 95 57 85 100	38 76 54 52 72 76
	Alternative/Ind.	204 425 272 256 391 297	552 576 545 614 325 562	556 537 464 556 545 605	321 302 340 500 463 355	331 248 289 180 326 305	230 383 257 304 342 251

Experiment 1/Phase2	*Target/Ind.*	20 55 29 21 79 93	172 270 218 309 137 216	255 224 203 235 144 308	261 180 184 361 309 214	273 204 289 180 326 305	70 100 71 41 101 82
	Alternative/DRA	196 164 162 155 203 295	266 477 395 421 403 -	301 333 295 338 280 389	434 490 191 194 274 -	171 174 122 153 226 180	226 309 189 155 155 204
	Target DRA	77 37 62 35 46 48	35 43 46 56 45 -	91 74 95 83 106 126	142 146 53 11 91 -	72 76 39 64 112 87	104 110 83 77 48 64
	Alternative/Ind.	349 180 158 181 211 406	385 595 566 550 540 -	556 537 464 556 545 605	440 432 196 109 312 -	274 279 149 223 311 283	358 478 343 257 181 362
		123	151	225	283	333	131

	Target/Ind.	118 96 117 175 188	266 165 330 292 -	224 203 235 144 308	247 83 32 128 -	300 353 70 79 100	163 110 78 32 127

Table B.2. *Responses During Extinction Tests Experiments 2*

	Hen Number	*10.1*	*10.2*	*10.3*	*10.5*	*10.6*
	Condition					
Experiment 1/Phase1	*Alternative/DRA*	235	280	250	137	370
		73	161	130	122	215
		46	157	203	68	116
		37	20	35	9	62
		5	9	35	8	22
		17	8	10	2	15
	Target/DRA	267	185	361	210	334
		87	107	152	176	337
		66	126	264	105	197
		39	25	32	10	114
		6	30	38	11	32
		4	11	21	7	54
Experiment 1/Phase2	*Alternative/Ind.*	32	47	21	61	207
		0	17	3	13	96
		0	15	6	3	15
		0	1	2	2	17
		0	5	0	2	0
		0	7	0	1	9
	Target/Ind.	271	155	104	90	252
		34	25	19	125	233
		7	22	72	50	102
		16	7	6	19	46
		4	15	2	19	18
		1	4	2	20	34

<table>
<tr><td rowspan="5">Experiment 1/Phase3</td><td>Alternative/DRA</td><td>241
180
182
7
32
0</td><td>273
46
95
2
7
8</td><td>305
322
64
131
25
34</td><td>76
22
12
9
48
72</td><td>158
50
78
33
122
47</td></tr>
<tr><td>Target DRA</td><td>335
276
255
16
43
6</td><td>294
124
177
7
10
9</td><td>303
300
83
151
29
37</td><td>173
37
22
21
97
117</td><td>439
77
163
61
214
58</td></tr>
<tr><td>Alternative/Ind.</td><td>5
3
0
0
0
0</td><td>0
0
0
3
0
5</td><td>0
1
0
0
1
0</td><td>4
1
0
3
2
3</td><td>2
3
1
0
0
3</td></tr>
<tr><td>Target/Ind.</td><td>366
183
209
3
25
0</td><td>519
209
297
6
17
14</td><td>69
12
17
44
33
12</td><td>176
27
30
5
38
119</td><td>510
55
167
79
290
2</td></tr>
<tr><td>Alternative/DRA</td><td>261
199
78
92
72
22</td><td>344
226
31
23
4
12</td><td>374
63
94
56
14
17</td><td>322
14
4
2
5
0</td><td>372
182
3
13
3
5</td></tr>
</table>

	Target/DRA	171 124 45 42 39 11	380 212 24 20 12 14	267 52 101 62 18 21	190 9 3 1 3 0	565 146 1 22 6 6
	Alternative/Ind. .	77 6 2 1 4 0	78 22 3 0 1 4	33 2 6 0 0 0	40 1 0 0 1 0	52 0 0 1 0 0
	Target/Ind.	108 43 10 8 3 1	193 36 9 14 6 4	50 2 5 0 0 4	272 3 6 1 0 0	403 127 12 12 6 60