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Sensitivity to Prevailing Contingencies: Downsizing, Restructuring Efforts and Moderating Risk Factors

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"All scientists, whether giants or not, enable those who follow them to begin a little further along" (Skinner, 2000, p. 11).

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A Behavior Analytic Approach to Organizational Downsizing and Restructuring Efforts

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Abstract

Reported accumulated knowledge related to downsizing or restructuring efforts may well be accounted for by the behavior analytic paradigm. It seems paradoxical that while research on aversive control procedures is reduced to a minimum due to animal welfare and ethical considerations within behavioral sciences, corporations throughout the global economy continue the application of large-scale aversive control procedures in the name of economic gains. Adding to the paradox, firms state they downsize for economic reasons, while a vast amount of studies indicates the overall economic outcomes are uncertain, quite often negative, if not detrimental. As downsizers regularly seem to violate the norms of economic rationality, indications are classic economic and organizational theories fail to explain the phenomenon. Known functional effects of aversive control procedures derived through applied scientific method predicts in part the reported adverse human, and subsequent economic consequences. Prediction allows for control, thus estimation and moderation of risk factors. When knowledge is available, why is it not applied?

Keywords: Behavior Analysis, Organizational Behavior Management, Downsizing, Restructuring, Change, Aversive Control, Negative Reinforcement, Avoidance, Extinction

Despite great scholarly interest since the eighties, downsizing remains a populist term with rather bad validity beyond face value. No precise or uniform definition of the concept seems to exist across fields, much less any precise theoretical determination exceeding that of cutting costs to increase performance (Budros, 1999; Cameron, 1994; Cascio, 1993; Gandolfi & Hansson, 2011; Kets de Vries & Balazs, 1997; Ryan & Macky, 1998). For the purpose of this article, downsizing will be defined as a response class constituted of structural measures of behavioral control, administered by formal management, functioning to reduce costs related to the work force, thus allowing for the allocation of freed generalized conditioned reinforcers to improve return on investments related to future operations.

Unquestionably called for at times, companies do reap financial benefits from downsizing (Cascio, 2003; De Meuse & Dai, 2013). However, there are vast support for a productivity paradox, reporting on lacking or inconsistent evidence of improved financial performance. Gandolfi (2008) review 16 major studies (exceeding 2,300 companies) published between 1990 and 2004, finding non-downsized firms consistently financially outperform downsized firms (Gandolfi, 2008). Revealing some positive indicators short-term, long-term financial indicators was found reliably negative (Gandolfi, 2008). Cascio (2003) and colleagues observed 6,418 employment adjustments between 1982 and 2000, finding no consistent significant evidence of downsizing rendering improved financial performance (see also Sheaffer, Carmeli, Steiner-Revivo, & Zionit, 2009). It seems a common expectation of downsizers is a dramatic rise in stock value following downsizing announcements, by some referenced as *the wall street effect* (e.g., Appelbaum, Lavigne-Schmidt, Peytchev, & Shapiro, 1999). Worrell, Davidson, and Sharma (1991) found a significant overall 2% loss in stock value following downsizing announcements of 194 organizations between 1979 and 1987. Reports suggests both employee and asset downsizers are outperformed on stock price development when compared to firms aiming on increasing net value by increased revenues rather than cutting costs (Gandolfi & Hansson, 2011). Lack of financial outcomes in the aftermath are typically attributed poor implementation or unskilled managers (see for instance Appelbaum et al., 1999). People directly affected by downsizing are consistently throughout the literature divided into the groups of survivors, victims and executioners (Appelbaum, Delage, Labib, & Gault, 1997). Survivors keep their jobs, victims waive their jobs involuntarily, while executioners are typically comprised of executives and middle managers to some extent involved in the implementation (Appelbaum et al., 1997). Recurrent, and given quite much attention is the construct of “Survivor Sickness” or “Survivor Syndrome” (Appelbaum & Donia, 2001) describing survivors to exhibit a cluster of behaviors in the aftermath of downsizings. Behaviors referred are numerous, including anger, increased absenteeism, productivity loss, guilt, lower morale, distrust, anxiety, learning disabilities, reduced motivation and willingness to take risks, as well as political behaviors, short-term crisis mentality, lack of leadership and resistance to change (Appelbaum et al., 1999; Gandolfi & Hansson, 2011). Also reported are tendencies to leave the business (Erickson & Roloff, 2007), or feelings of relief to have kept the job followed by "Survivor guilt" in which depression, fear and anxiety can affect the remaining employees (Appelbaum & Donia, 2001; Clair & Dufresne, 2004; Gandolfi, 2008; Gandolfi & Hansson, 2011). Research also reveals a general tendency of increase in production and sales initially following downsizings, however short-lived and followed by discontent (Appelbaum et al., 1997; Espahbodi, John, & Vasudevan, 2000). Bureau of Labour Statistics at U.S. Department of Labour (BLS, 2012) reported that 6.1 million Americans with so-called “long tenure” (employed at least three years) lost their jobs between January 2009 and December 2011. Statistical calculations made by the Confederation of Norwegian Enterprise (NHO) estimates a decline of 11 percent in industrial sector, and 21 percent increase in service related industries over a period of 42 years (1970 to 2012, growth of population mainly consisting of labor immigration). Considering an active workforce of 2.5 million (Statistics Norway, 2013, p. 210), downsizing represents a socially significant phenomenon also in relatively small and stable economies (i.e., Gandolfi & Hansson, 2011). Taking technological development complemented by disruptive innovation into account, it seems likely corporations will continue to downsize in efforts to adapt to complex and instable environments despite a bad risk-reward ratio signaled by literature on the subject.

Given a rationale of increased competitiveness through cost reductions expected produced by survivors and executioners, findings are interesting (Clair & Dufresne, 2004; Gandolfi, 2008; Gandolfi & Hansson, 2011). Known functional effects of aversive control, derived through applied scientific method, seems largely to predict some of the reported human, thus economic consequences of the practice. When knowledge is available, why is it not applied?

Rules

Saving time, and protecting us from undesirable results or unfortunate exposure to contingencies, *rules* supply descriptions of antecedents and consequences of specific behaviors. Consisting of verbal behavior relayed and differentially reinforced by the social community, rules function as *motivational operations* (MOs) if altering functions of stimuli and as *discriminative stimuli* (S^D) if signaling the availability of reinforcing events contingent on specific response. Functioning as MOs rules establish or abolish the reinforcing or punishing effects of some stimulus (value-altering effect), and evoke or repress behaviors related to that event (frequency-altering effect).

As organizational environments has become increasingly complex, amongst other things due to technological innovation, lack of physical and temporal contiguity has complicated prediction of consequences. Thus, relying on contingency specifying verbal events, conveyed by others or generated privately, we may isolate from potential aversive consequences and fast track positively experienced ones operating on our environment. However, what may once have been a "good" practice need not be under changing environmental conditions. In general, imitating what other members of the group are doing or have done previously, renders a greater probability of reinforcement (Skinner, 2000). Most members of verbal communities have extensive individual learning histories related to conditioning of rule following. As such, following culturally conveyed rules may be reinforcing in itself. Thus, cultural practices often pertain long after initial selecting consequences extinguish (Skinner, 2000).

Historically, processes of downsizing have typically been illustrated by across the board cuts, early retirement or severance packages, in addition to delayering and streamlining of operations by the outsourcing or elimination of product lines, divisions and/or entire business units (Appelbaum et al., 1999; Cameron, 1994). While originating as a term referencing downscaling of cars in the American auto industry following the 1973 oil crisis, a generalization followed in the early eighties. The extended use of the term came to include a cross sectional set of organizational behaviors reducing headcounts through layoffs, retrenchment, attrition, hiring freezes, early retirement or severance pay, including parachutes and buyouts (Cameron, 1994). These behaviors were labeled *workforce reduction strategies*. Illustrated first by blue-collar, then across the board cuts, strategies was negatively reinforced, primarily selected as a last ditch effort of effectively cutting costs in times of economic turmoil (Gandolfi & Hansson, 2011). Imitated by other members in the group exposed to the same occasioning contingencies, new variations emerged, again selected by others. Thus, the phenomenon evolved. Uncoupling from economic cycles during the mid- to late-1980s, and referred to as a change management strategy, the term came to incorporate an even broader range of managerial efforts. *Organizational strategies* evolved, and came to be included in everyday language as part of the response class. Organizational behaviors included differential efforts of streamlining organizational structures. Delayering, outsourcing and eliminating product lines, divisions, and/or entire business units became part of the downsizing mantra in addition to the previous attempts to "cut the fat" (i.e., Appelbaum et al., 1999; Cameron, 1994; Cascio, 1993; Gandolfi, 2008). Although frequencies still peek during economic roughs (including but not limited to recessions), generalization and shifts in the reinforcing contingencies (societal structures, workforce fluctuations) has led downsizings to occur in large scale and high frequency irrespective of economic cycles (Budros, 1997; Gandolfi & Hansson, 2010). Adding to this, the concept has further generalized. Previously mainly denoting negatively reinforced, workforce reduction- and organizational strategies, the term has according to literature also come to include implementation of responses denoted *systemic strategies (Cameron, 1994)*. However not operationalized, strategies are reported to entail "systemic targeting" of individual employee values, attitudes and culture (Cameron, 1994; Gandolfi, 2008; Gandolfi & Hansson, 2010). These strategies has been utilized in order to avoid repetitive and continual workforce reduction strategies due to a frequent *productivity paradox*, an increase of costs in the aftermath of downsizings essentially canceling out cost reductions (Appelbaum et al., 1997; Gandolfi, 2008). It seems systemic strategies exemplify selection based on variation in the aftermath of extinction in an exemplary way.

However, emitted responses and administered consequences included in systemic strategies do not appear aimed at reducing work force driven costs, but rather to manipulate the effects of these organizational measures of control. Thus, it cannot be treated as member of the response class of downsizing within a behavior analytic paradigm. Thus, disregarding systemic strategies, downsizing behaviors seem to function in a common way, as *structural measures of behavioral control with the aim of improved return on investments related to future operations.*

The economic value of labor

Employee work related behaviors are principally under economic control. Showing up for work is usually incompatible with engagement in alternative more potently reinforcing activities (opportunity cost in economic terms). The *matching law* states that when two or more alternatives, or *concurrent schedules* of reinforcement are available, the relative amount of time or behavior spent will match the relative rate of reinforcement available on respective alternatives (Pierce & Cheney, 2008; Pierce & Epling, 1983). Hence, a contract is made (written or vocal, but still verbal), and wages are offered contingent on specified behaviors (Skinner, 2000). Thus, money are utilized to manipulate the relative rate of reinforcement of work related behaviors, consequently offsetting the aversive stimuli offered by the work itself or by it preventing engagement in alternative reinforcing activities. As such, both offering and accepting employment involve comparison of positive and negative reinforcing effects (Skinner, 2000). The behavioral product of choices (“altering” behavior) is referred to as *matching* when the distribution of behavior equals the distribution of reinforcement offered by the alternative activities (Pierce & Cheney, 2008). The aspect of economic control thus entails utilizing generalized conditioned reinforcers in the form of money to manipulate matching of behaviors. Employers engage in the, by definition, aversive behavior of giving up money used to reinforce employee behavior (Skinner, 2000). Employees on the other hand, matches the schedule of reinforcement represented by wage against the aversive consequences of giving up alternative reinforcing activities (as staying at home or working for another employer). Thus, the expenses linked to compensations will depend on the economic value of the specified labor given the current economic circumstances of the employer and the employee respectively. The value this economic value may be altered by MO's in the forms of culturally conveyed rules, competition, political contexts, education, media, legislation and designed collaboration models to mention a few (Skinner, 2000). While the monetary system of our culture has attained status as the primary scale of value, money have no intrinsic value apart from the pairing with other stimuli. It is however, exchangeable for goods (the reinforcing products of others behavior) covering the fluctuating continuum from primary to secondary reinforcing events (Skinner, 2000).

In order to secure the coordination of Interlocking Behavioral Contingencies, minimizing input relative to output, *management* is appointed, delegated and defined by, the power to manipulate important variables affecting organizational behaviors (Glenn & Malott, 2006; Skinner, 2000). Defining managers as ones who "*achieves goals through other people*" (Robbins & Judge, 2013, p. 704), leadership may define as *"ability to influence a group toward the achievement of a vision or set of goals"* (Robbins & Judge, 2013, p. 703). Affecting the behavior of others is a function of one's ability to arrange contingencies of reinforcement, thus antecedents and consequences, hence also a function of the resources one controls, typically referenced as power (Goltz & Hietapelto, 2003). Control of resources may be delegated in a direct formal, or acquired in an indirect informal fashion. However, as control of resources are generally reinforcing, individuals will seek to increase and maintain their access (Goltz & Hietapelto, 2003).

1. Signaled Consequences

A reduction of cost increase earnings, escalate stock values, keeping analysts optimistic, yet again increasing values for investors (i.e., shareholders; Cascio, 2003; De Meuse & Dai, 2013). Hence, downsizings are regularly justified on grounds of deregulation and globalization driving competition and financial pressures (Gandolfi, 2008). Reduced profitability calls for consolidations (driving downsizing of redundant employees), technological innovations (disruptive innovation or adjusting needs for in-house competence), and shifting managerial strategies in the hunt for competitive advantages in a co-evolutionary economy (Appelbaum et al., 1997; Gandolfi, 2008).

Anticipated organizational, hence behavioral consequences include increased efficiency derived through organizational benefits or “synergy effects” thus besides lowered costs, one expects less bureaucracy, faster decision making, smoother communication, greater entrepreneurship and an increase in productivity to mention some (Appelbaum et al., 1997; Cascio, 1993). According to economic logic, all things equal, cutting costs by cutting people seems like a safe bet, as future costs are easier to predict than future revenues, not to mention by definition aversive to management. Moreover, overhead costs (salaries, concomitant taxes) are one of the most substantial expenditures in modern organizations, and directly linked to personnel behavior (Cascio, 1993). However, downsizing efforts changes the environment of which future operations, hence organizational performance, is a function. By adjusting cost and facilitating innovation, organizations may achieve increased (or contained) revenues due to competitive advantages in a global economy (Cascio, 1993). Increased revenues represents an increased amount of conditioned generalized reinforcers to offer investors, or skillful (potential) employees representing further competitive advantage for that matter. To illustrate, tendencies toward excess staffing has been rectified through the delayering of middle management ranks

(Appelbaum et al., 1999), ensuing more flexible cultural entities, allowing for rapid adaption in changing environments. While it is obvious that downsizings are expected to yield improved business performance or reposition organizations for future growth and success (Appelbaum et al., 1997; Datta, Guthrie, Basuil, & Pandey, 2010; Gandolfi & Hansson, 2011), a number of different organizational MO's and S^D's are asserted throughout downsizing literature. Often referenced as "causes and driving forces", literature describe diverse correlations of downsizing. The phenomenon, however defined, are regularly described in a structural rather than functional fashion, awarded the title of dependent or independent variable, although usually describing correlations and not causal relations. Structural efforts to sum up complex environments of downsizing represents a seemingly exhausting, at times confusing and often confounding mission. However, those viewing downsizing as the dependent variable, give an impressive picture of what seems to be a rule of downsizing being a "one solution fits all", describing a multitude of diverse natural, operant and cultural contingencies leading up to decisions to downsize. Common to most is the assertion that no one factor can account for the complexity of the phenomenon.

However, analyzing behavior in terms of its products or consequences might be helpful, as the allocation of scarce resources will always include a conflict between reinforcing and punishing stimuli.

While the leader is primarily under the control of external variables, the followers behavior is under control of the leader (Skinner, 2000). Employees represent followers to the top managers, as top managers are followers to the board. Constituting a common environment, individuals are important to one another controlling the one another's reinforcing events, thus emitting *social behaviors* producing the aggregated product. In a system of limited resources, one man's positive reinforce is necessarily another man's negative (Skinner, 2000).

Functional Effects of Downsizing

While *negative punishment* denotes the procedure of removing an ongoing stimulus contingent on a response, thus resulting in decreased rates of this response. *Extinction* denotes the stopped delivery of reinforcement on previously reinforced behaviors, resulting in decreased rates of response due to the discontinuance of the relationship between response and reinforcing event. Whether downsizing constitutes punishment or extinction will depend on context, individual endgame and learning histories. However, termination of employment is usually a consequence one seeks to avoid or escape, announcement thus representing a conditioned aversive stimulus (S^{ave}), implying discontinued monthly paychecks contingent on work behaviors, in addition to isolation from social reinforcers offered by work setting (Pierce & Cheney, 2008). In sum news of downsizing may represent a deteriorated economic situation for the dismissed, possibly having to give up reinforcing stimuli or seeking social benefits, however certainly implying a less predictable economic future and the need for increased efforts finding alternative sources of income. Further, as downsizing is a response class of behaviors with the function of allocating limited resources, a social episode is initiated wherein the behavior of those remaining only can be reinforced at the cost of colleagues let go. Announcing downsizings will as such function as an MO altering the setting of work related behaviors from cooperation to competition for limited resources. Those most likely to experience the downsizing as a punishment are those ultimately shown the door. Although possibly remaining in the organization for some time, and as such afforded the opportunity to affect the work environment, their behaviors have limited influence on future adverse financial results except that of potential lawsuits and affecting external factors to the organization. However, if expected financial yields are not achieved or the expected surplus revised upwards, further downsizings may be expected down the road (Cameron, 1994). If there has been a promise of a one-time hit, this affects correspondence between saying and doing rendering employees continued behavior to be negatively reinforced, as the threat of downsizings seem to become continuant rather than intermittent. Several rounds of job cuts may also affect the reinforcing value of rule following. As the probability of described contingencies on the one hand may be intermittently reinforced and pliance to rules increasingly resistant to extinction, the news may also serve to weaken the potency of social reinforcers delivered by management, seen as their statements tend not to correspond. In sum, what may emerge is rigid, however individually reinforcing behaviors. When this positively reinforced behavior contrast or are incompatible with the IBC's required to produce the aggregated (sub)product, this implies financial losses, or in different terms; disconnects in the IBC's.

Aversive Control

An *aversive stimulus* is effective either as a negative *reinforcer* or a *punisher*. Denoting an event the organism seeks to escape (terminate) or avoid, the term aversive typically comes to use if neither the punisher or negative reinforcer is readily defined (Catania, 2013; Pierce & Cheney, 2008). Aversive stimuli by definition produce a rapid decline in targeted behaviors, hence are often administered in order to control what is perceived as the aversive behavior of others (Pierce & Cheney, 2008; Skinner, 2000). Thus, the effective application of aversive events tend to be negatively reinforced. Denoted escape or avoidance behaviors, these are maintained by the immediate effect terminating, avoiding or reducing intensity of an aversive event (Pierce & Cheney, 2008). When an S^D signals a potent reinforcer, stimulus control tend to generalize, rendering people likely to emit functionally equal behaviors in similar situations. Thus, escape and avoidance behaviors is, in effect, the operant conditioning of alternative behaviors resulting in isolation from contexts in which these aversive stimuli have occurred in the past. This complicates possible extinction or de-sensitization of the respondent reactions underlying the conditioned stimulus, as both presupposes the individual to contact the natural contingencies. Thus, operant avoidance behaviors prevents respondent extinction through effective avoidance of actual contingencies or by increasing resistance to extinction through intermittent reinforcement (Pierce & Cheney, 2008). In addition to ethical concerns and the economic aspect of creating what might be conceived as rigid behaviors, the application of aversive control produce or resistance to change as well as a series of additional behavioral products. These are often referred to as side effects or by-products, however this labeling might convey an impression of them being of a lesser magnitude than the target behavior. This will obviously depend on the severity of the target behavior, however should at least be treated as an empirical question, and if possible, include ripple effects in the equation.

Taking a closer look at the function of the practice, the execution of downsizing is an extensive measure of aversive control. The threat of seizing accustomed positive reinforcement is, although not primarily intended to be so in the everyday use of the word, an aversive event to the ones exposed (Skinner, 2000). Announcing a decision to downsize involves not only signaling seize of pay contingent on work related behaviors, but also that employees have no control or possibility to predict future contingent consequences when it comes to work related behaviors. That is, unless they leave on their own initiative. Besides signaling a seize in the schedule of monetary reinforcement, potential victims will face significant temporary or permanent alterations in schedules of social reinforcement. Downsizing signals the withdrawal of several concurrent schedules of reinforcement, like the potentially automatic reinforcing events generated by the work itself in addition to social workplace related reinforcing events, illustrated by collegial approval, as well as intellectual or perhaps academic exchanges (Pierce & Cheney, 2008).

Moreover, due to the aversive consequences of being controlled, thus losing control over limited resources previously controlled within the social system, a manager who initiates control should face the prospect of being *counter-controlled* by the employees he or she seeks to control (Skinner, 2000). Besides functioning as an MO, altering the value and frequency of operant behaviors previously experienced to be aversive to the controller, emotional reactions like anger or frustration may suppress the operant behaviors on which wages is contingent (Pierce & Cheney, 2008; Skinner, 2000). Hence, sub-optimization, further functioning to negatively reinforce managers, may emerge due to the imbalance caused by opposing directions of control causing additional adverse organizational and financial consequences (Skinner, 2000). Goltz and Hietapelto (2003) defines “resistance to change” and “workplace deviant behaviors” in accordance with the accounts of counter-control and long-term aversive control of behaviors made by Skinner (2000). Specifying resistance to change as nonverbal behaviors hindering the change process along with verbal statements not supporting the changes to take place. Resistance to change is illustrated by not performing target behaviors of which wages are contingent or not doing so in a timely manner, committing errors, making it difficult for others to respond according to specifications, or slowing down (Goltz & Hietapelto, 2003). They further define workplace deviant behaviors as “voluntary behaviors that significantly violate organizational norms and threaten the well-being of the organization and its members, such as theft and aggression" (Goltz & Hietapelto, 2003, p. 5). "Voluntary" referring to the responses being operant, hence preceded by a stimulus affecting its probability of occurrence (Skinner, 2000).

As not otherwise operationalized survivor sickness, work-deviant behaviors and resistance to change may rely on the same basis of observation, hence using one, resistance to change, to explain the other, survivor sickness, or vice versa. This may represent a dualistic explanation reliant on a category mistake. Behaviors representing all labels coincide well with what Skinner defined as counter-control, a response to aversive control of behaviors. Not saying that either labels are not useful in everyday speech, it may well serve to save some time. They are merely redundant in any functional account explaining the functional effect of downsizing.

Avoidance

Avoidance behavior is poorly maintained when responses do not reduce the frequencies of aversive stimulation (Pierce & Cheney, 2008). Discriminated avoidance denotes avoidance behavior contingent on a warning stimulus (S^{ave}) after which a negative reinforcer will be presented given some time range. However, if a response is made, the negative reinforcer (S^{r-}) is delayed, strengthening the future occurrence of that same response. Avoidance behavior occurring without a warning stimulus is called nondisicriminated or Sidman avoidance denoting behaviors performed "just in case", like that of taking precautionary backups of a master thesis or being certain to inform management of one's impeccable results during economic downturns, both respectively executed in order to prevent aversive stimuli. However, avoidance behavior is intrinsically cyclic. The response postponing the aversive stimulus may decline due to limited contact with the negative reinforcer, typically in terms of "forgetting" or "being careless", in sum representing the effect of a thinner reinforcement schedule. Contact with the negative reinforcer is reinstated, and the operant avoiding the "shock" is again strengthened. This is a paradox; the less shocks the weaker the avoidance behavior, and the more shocks the stronger and more effective avoidance behavior become (Pierce & Cheney, 2008). While effective avoidance brings failure, positive reinforcement procedures intensify or brings more of the same behavior (Pierce & Cheney, 2008). However, to a degree contrasting escape behaviors, negatively reinforced avoidance behavior eventually leads the organism to contact actual prevailing contingencies, in the end allowing for adaption to changing environments. If the only reason managers downsized were to cut costs in order for their organizations to survive, occasional failures or near failures would be necessary to keep the phenomenon evolving. A manager downsizing to attain positively reinforcing events, quite randomly illustrated by individual economic incentives or the future options for reinforcement that a specific group membership or social status may make available, will stop only if the products of downsizing becomes irrelevant or function as a moderate to intense punisher. However, the latter would depend on somewhat immediate feedback, and an ability to process such an enormous amount of information relating to diverse factors possibly affecting operations, that effective punishment of the actual target behavior seems unlikely in practice, if special contingencies are not arranged. Downsizing behaviors originating as negatively reinforced avoidance behaviors, although probably multiply determined, seems to have shifted to a schedule of predominantly positive reinforcement.

Experimental evidence suggest length of Response-Shocks intervals affect how fast rats acquire avoidance responding (Hineline, 2001). When the response-shock interval is longer than the shock-shock interval, avoidance behaviors is more readily acquired. However, if responding renders the next shock closer in time than not responding, chances are response frequencies would increase. In other words, if applicable to humans, it is conceivable that as costs related to downsizings balance out potential financial benefits, managers will increase frequency of downsizings. Downsizing in other words breed more downsizings, rendering a reinforcement trap.

Punishment

When a stimulus or events follows, and decrease the future probability or intensity of an operant the stimuli or event is denoted a punisher, the procedure or contingency is labeled punishment, having punishing effects. The terms positive or negative denoting whether a stimuli or event is presented or terminated contingent on the response. Being functional accounts, terms are defined by the behavioral effect rather than the individual perception or "intent" denoted in usual language. While punishing contingencies will temporarily suppress or eliminate target behavior, it also elicits reflexive emotional by-products (respondent behavior) initially preventing, or outcompeting, occurrence of appropriate operant behaviors (Hackenberg & Hineline, 1987). Further, administering punishment does not imply any sort of conditioning of alternative response eligible to achieve the reinforcing event maintaining the punished behavior to begin with. Hence, punishment will never contribute to resolving issues related to performance. Moreover, if not followed by any suggestions on alternative responses leading to reinforcement, employers might come to produce inexpedient passivity due to inescapable aversive stimuli, usually summarized under the label of learned helplessness, presumed closely linked to the cluster of behaviors known as depression (Carlson, Miller, Heth, Donahoe, & Martin, 2009; Daniels, 2006). Moreover, application of punishing events may contribute to increased absenteeism, due to avoidance behaviors, bearing resemblance with both survivor syndrome and survivor guilt.

Further, in order to necessarily be effective in producing the defining suppressing effect on behavior, punishing events will be adequately powerful to generate respondent emotional behavior, including aggression, what we label anxiety, hence inclinations to retaliate (Skinner, 2000). Accounted for by phylogenic selection or previous pairings (conditioning) with primary aversive stimuli, these by-products typically take the form of social disruption in groups (Pierce & Cheney, 2008). As such, use of punishment may work to the disadvantage not only to the punished, but also to the punisher or punishing agency becoming a conditioned aversive stimulus hence possibly producing as much trouble as it alleviates (Skinner, 2000). Nonetheless, human behavior is to a large extent regulated by aversive stimuli. Be it as designed methods of control or more unintended or natural circumstances, by definition, the presentation of aversive stimuli (positive punishment) or removal of positive reinforcers (negative punishment) contingent on a response will have punishing effects (Pierce & Cheney, 2008; Skinner, 2000). Research may help reduce prevalence through identification of procedural effects, facilitating prediction, hence the design of environmental events so as to minimize the by-products (Delprato & Midgley, 1992). Complicating the identification of procedural effects, target behaviors are typically maintained on some schedule of positive reinforcement, hence effects may reflect both reinforcing and punishing contingencies. Adding to the picture, values of reinforcing events are typically not absolute, but rather relative to context and availability of alternative reinforcing events (e.g., The Premack Principle, Pierce & Cheney, 2008). Further, in addition to consequences (intended or unintendedly) being contingent, the intensity (size), access (deprivation or satiation) and immediacy of the subsequent stimuli on behavior will determine its relative effect. Analogue to experiments related to abrupt introduction of punishment, survivor reactions to downsizing vary from continued responding to those no longer responding. Some relocate to another employer. Some show suppressed frequency of behaviors included in the response class of work related behaviors, presumably due to increased relative reinforcement of off-task behaviors in the work environment. Some take sick leaves representing cessation of any and all work related behaviors (at least temporarily). The diversity of behavioral effects illustrates diverse individual learning histories affecting the perceived quality and intensity of events in addition to relative differences in access to alternative reinforcement. When responding is eliminated due to contact with intense punishing events, this might not only drag out in time, but also isolate responses from potential subsequent reinforcing consequences as the punishment is withdrawn, due to lack of contact with the contingency.

Long term effects of negative reinforcement.

Hackenberg and Hineline (1987) found disrupted operant responding in rats, in a set up based on positive reinforcement, when avoidance periods either preceded or followed food sessions. In everyday language, long-term aversive consequences affect behavior across species. Signaled aversive events (avoidance) trumps positive reinforcement, and has a *conditioned suppression* effect on behavior irrespective of how rich the schedule of positive reinforcement are. This indicates framing effects may have substantial value in the face of restructuring or downsizing efforts. Further, it seems these anticipatory effect of aversive consequences, may have greater influence (*general disruption*) on behaviors than "ripping of the Band-Aid" and having it done with. Positively reinforced operants have been found less influenced and recovering faster the latency between aversive stimulation being shorter (Hackenberg & Hineline, 1987).

Behavioral contingencies

Used predominantly in efforts to reduce the aversive behavior of someone else, punishing stimuli by definition produce a rapid decline in target behaviors. Thus, effectively employing aversive procedures controlling the behavior of others is negatively reinforced, hence avoidance or escape behaviors. If successful in terminating or avoiding the aversive behavior of others, this would serve to reinforce the controlees' future application of aversive measures of control. Further, besides the conditioned stimulus being likely to generalize, occasioning functionally similar behaviors in similar situations, individuals tend to isolate themselves from contexts in which these aversive stimuli have occurred in the past, complicating possible extinction of the respondent reactions underlying the conditioned stimulus. "Avoidance behavior maintained by operant conditioning prevents respondent extinction" (Pierce & Cheney, 2008, p. 136). As a function of this, due to isolation from the natural contingencies and often being vaguely signaled, the reinforcement schedule typically takes an intermittent form, increasing resistance to extinction. Also, in addition to the above mentioned and ethical concerns of utilizing aversive contingencies in the face of alternative measures controlling behaviors, both punishment and negative reinforcement produce a series of additional behavioral products. These are often referred to as side effects or by-products, however this labeling might convey an impression of them being of a lesser magnitude than the target behavior. This will obviously depend on the severity of the target behavior, however should at least be treated as an empirical question, and if possible, include ripple effects in the equation.

Some Final Remarks

For the purpose of this paper, two literature searches was conducted. The first, using a combination of the key words downsizing and organization was conducted using The Norwegian Electronic Health Library (www.helsebiblioteket.no). The second was conducted using PsycINFO, and specifically related to organizational effects of downsizing. This search applied keywords reorganization, downsizing or rightsizing (5864 results) and behavior analysis, organizational behavior or behavioral assessment (176 results) in conclusion with survivors (20 results). Limited to journals grouped by The Norwegian Electronic Health Library as relevant to behavior, the first search was initially restricted to journals published in Norwegian or English on level two (Norwegian Social Science Data Services, 2014), however the paper also includes literature referenced in articles located in both searches.

Reported accumulated knowledge related to downsizing or restructuring efforts may well be accounted for by the behavior analytic paradigm. It seems paradoxical that while research on aversive control procedures is reduced to a minimum due to animal welfare and ethical considerations within behavioral sciences, corporations throughout the global economy continue the application of large-scale aversive control procedures in the name of economic gains. Adding to the paradox, firms state they downsize for economic reasons, while a vast amount of studies indicates the overall economic outcomes are uncertain, quite often negative, if not detrimental (e.g., Budros, 1997; Cascio, 1993; Gandolfi & Hansson, 2011). As downsizers regularly seem to violate the norms of economic rationality, indications are classic economic and organizational theories fail to explain the phenomenon (Budros, 1997). Known functional effects of aversive control procedures derived through applied scientific method predicts in part the reported adverse human, and subsequent economic consequences. Prediction allows for control, thus estimation and moderation of risk factors.

Emergence and widespread use of terms like “reorganization” may be indicative of a growing tendency to discriminate between strategies, although interchangeably applied along with dozens of other terms like “rationalizing”, “rightsizing”, “leaning-up” or “restructuring”. Variations in vocabulary, are however, reported to elicit speculations among employees on the “real” reasons for change (e.g., Budros, 1999; Gandolfi & Hansson, 2011). While deficient definitions in terms of specified objectives, efforts or strategies, is common to all of the above mentioned, studies show workforce reduction strategies predominate both in stated planned applications (Cameron, 1994; Hallock, 2009) and reports on conducted downsizing efforts (Gandolfi, 2008). Taking a closer look at the function of the practice, the execution of downsizing represent an extensive measure of control.

Downsizing will represent different contingencies to different people. Perceived value of the contingent consequences of behavioral alternatives available will always be individually determined, depending on genetic makeup, individual learning histories, group- and cultural affiliations as well as physical and temporal environment. As such, this approach allows only for a general discussion. However, revealed functional relations between behavior and its environment allows us to assume events to have certain characteristics, rendering different people placed in similar contexts to behave in similar ways (Catania, 2013; Skinner, 2000; Sterman, 2000).

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Verbally Governed Behavior and Sensitivity to Prevailing Contingencies

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Abstract

Fifty-six participants (36 women, 20 men, *M* age = 33.8, age range: 19-63) participated in the experiment investigating the effect of differential verbal instruction on the performance, discrimination, contingency testing and generalized matching equation. Participants in all groups showed overall levels of stimulus control, clicks over sessions generally increased correlated with discriminative stimuli and decreased in its absence. Differential instructions did not produce significant differences in either of the four discrimination indexes across groups. Overall contingency testing rendered no significant differences across groups, tests applied across original scores, scores adjusted for initial baseline differences, per session, per schedule component (RR20 RI10) and across treatment period, individual sessions and total (session two through seven). Differential instructions did, however, produce significant differences pertaining to relative response rates across groups. In the group given general instructions combined with behavioral precursors and information on how to test contingencies, matching explains more than 75% of the behavior of 24% of the participants. None of these had reported any formal knowledge of reinforcement schedules.

Economic phenomena are ultimately expressions of behavior in complex systems. Although neither a natural phenomenon nor a science in its own right, economy is a social construct invented by man, and behavior in itself. Characterized by individuals acting in concert, it represents a pervasive field based on, and characterized by, relations between behavior and its reinforcing events, in sum constituting co-evolutionary systems (Skinner, 2000). Money exchanges for, hence allows access to, a variety of primary and secondary reinforcing events, thus labeled generalized conditioned reinforcers. Conditioned to signal availability of a wide array of reinforcing events, the selection of money has resulted in it evolving into to *the* measurement scale of value in our society, acquiring its reinforcing effect, its value, through the pairing, conditioning, with other events however having no practical value on its own (Skinner, 2000).

Behavior (R) is selected by its consequences. Events or stimuli (S) following behavior, increasing its future probability, labels as reinforcers (S^r), having reinforcing effects. Stimuli or events following behavior, decreasing its future probability, labels as punishers (S^p), having punishing effects (Cooper, Heron, & Heward, 2007). When events previously following behavior is stopped, and the rate of the behavior decrease, we call the procedure extinction, having extinguishing effects on the targeted behavior (Miller, 2006). The extinguishing effect is potentially interrupted by an extinction burst, a temporary upsurge in frequency and variation of responses previously leading to reinforcement, as extinction begins. The partial reinforcement effect (PRE) denotes behavior established by intermittent reinforcement to be more resistant to extinction than behavior established on continuous reinforcement (CRF, Pierce & Cheney, 2008). Extinguished behavior may spontaneously recover, hence again be followed by consequences affecting its future occurrence.

Stimulus Control

Defining a stimulus as any relation or combination of physical events, stimulus control refers to its effect on behavior. The discriminative stimulus (S^D) signals availability of reinforcement contingent on a specific response, while the extinction stimulus (S^Δ, S-delta) signals unavailability, hence non-reinforcement or extinction contingent on a specific response (Pierce & Cheney, 2008). If occasioning change, thus controlling behavior, it is denoted a controlling stimulus. Controlling stimuli thus alters (increase or decrease) the future probability of the operant it controls by its presence (Pierce & Cheney, 2008).

Discrimination and Generalization. Denoting differences in a continuum of precision related to stimulus control, discrimination refers the precise, one to one control of an operant (S_A^D:R_A), contrasted by generalization referring to a less precise, many to one control of an operant (S_{ABCorD}^D:R_A). To illustrate, an individual emitting a specific response in one context, but not in another, discriminates among contexts, while an individual emitting a specific response across different contexts generalize among contexts (Pierce & Cheney, 2008). Generalization occurs when common properties of different stimuli set the occasion for the same operant, probability of the operant (stimulus control) generally increasing with similarity to stimuli previously signaling reinforcement S^D(Pierce & Cheney, 2008).

Matching Law. In addition to consequences having differential effects on probabilities of behavior (*the law of effect*), the density of reinforcers (or punishers) affect the intensity and frequency or the "strength" of behavior. The *matching law* states the relative rate of responses will match the relative rate of reinforcement, two or more concurrent-interval schedules of reinforcement being available (Pierce & Cheney, 2008).

Rules

At times matching of positive and negative reinforcing consequences may be impeded by difficulties predicting consequences. Defining as verbal antecedent contingency-specifying events, verbally (vocal and non-vocal) mediated rules identify what consequence(s) a response will have given a more or less specific future context. Intrinsically useful when consequences are "remote, weak, or thought to maintain undesirable behaviors" (Catania, Shimoff, & Matthews, 1989, p. 119), rules may be conveyed by others or be emitted as self-instructions (Skinner, 2000). Thus, behavior in accordance with these verbal contingency-specifying events are referred to as rule-governed, or alternatively, in order to avoid confusion related to everyday speech, verbally-governed behaviors (Catania, 2013). As such, rules constitute S^Ds bringing current behavior under the control of future consequences, or function as Motivational Operations (MO) momentary affecting the reinforcing value of a given response.

Verbally-governed behaviors are controlled by a double set of contingencies, those specified by the rule, as well as previously experienced contingencies maintaining the operant class of rule-following in itself. This paper will emphasize on the effect of verbal stimuli on operant behaviors, rather than, however presupposing, the conditioning of rule-following as a response class. Thus, if not otherwise specified any reference to contingencies will be to those preceding or following a specified response, rather than those responsible for establishing rule-governed behaviors (Catania et al., 1989).

Obviously less sensitive to contingencies than behaviors by definition being contingency-shaped, verbally-governed behavior is said to be insensitive when the contingencies maintaining rule-following "overrides" the contingencies of an operant, for instance when a rule gains stimulus control altering the probabilities of a specific behavior at the expense of another, isolating the individual from contingencies of which the consequences are aversive. If however, contingencies change, but the rules do not, the rules may become the problem, further postponing a solution (reinforcing events) rather than induce or prompt one (Wulfert, Greenway, Farkas, Hayes, & Dougher, 1994).

The rule being stable, and the relation between operant and consequence identifiable and identified, the rule as well as the behavior it controls may adjust accordingly (Pierce & Cheney, 2008). However, if following the rule is negatively reinforced, it implies the absence of a consequence is reinforcing, thus effective responding prevents contact with and feedback from the prevailing contingencies, isolating both the rule and the behavior under its control from differential reinforcement and potential adaption to the altered environment. Further, as contingencies change, the discriminated operant may itself alter the environment in new ways, rendering unintended or undetected ripple effects affecting the context of future behavior hence possibly increasing the number of inconsistent rules.

This renders the operant either on an intermittent schedule of reinforcement, making discriminated operants more resistant to extinction given the cyclic nature of avoidance behaviors (the response postponing the aversive stimulus may decline due to limited contact with the negative reinforcer) or, potentially occasioning an extinction burst if or when the previously negatively reinforced behavior no longer work or no longer work as planned, as in producing consequences inconsistent or even incompatible with those specified by the rule. If variations in intensity are reinforced we may refer to it as generalization, or new discriminated operants may emerge based on variations in current, collateral or adjunctive behaviors.

Viewing economy as the allocation of scarce resources, economic behaviors within a behavior analytic paradigm ultimately comes down to *matching* of positive and negative reinforcing events, matching describing the equal distribution (measured in percentage or ratio) of behavior relative to alternative sources of reinforcement in choice situations. However, as practices like downsizing seem to exemplify, rules or unknown variables like sensory capabilities, response cost or a history of punishment, arising through natural selection and /or individual learning histories, may factor in affecting the perception and value of, or attention to, reinforcers thus contributing in producing systematic departures from ideal matching in choice situations (Pierce & Cheney, 2008). In business, different financial indices like red numbers, prognoses, descending stock prices, shifts in return requirements, fiercer competition, (hence) lower prices or new technology can all constitute complex S^Ds and S^Δs controlling the encumbrance, degree and manner of which operants in an organizational context, like decisions to downsize, are occasioned. Executives generalize and discriminate between contexts based on the behavioral contingencies in a given context. As such, attention is shaped by an individuals' experience with what has been important in past contingencies, for instance delivering a bold black bottom line to the board, avoiding micromanagement, keeping ones income, attaining a bonus, making that A in grad school, or fitting in in social contexts whether it is constituted by disgruntled colleagues, fellow executives or the friends of a current partner (Skinner, 1976).

B.F. Skinner defines having a problem as lacking a response that will produce potentially reinforcing events, problem solving thus involving "more than *emitting* the response which is the solution; it is a matter of taking steps to make that response more probable, usually by changing the environment" (Skinner, 1976, p. 123). These steps preceding the response, functioning to produce the instigating reinforcer, are constituted by a behavioral chain of operants, denoted precurrent behavior, wherein what constitutes the reinforcer (S^r) for behavior A, also function as the S^D for behavior B (Catania, 2013; Skinner, 2000). Functioning to arrange or construct S^Ds, facilitating stimulus control over subsequent operant behavior, precurrent behaviors are executed covertly ("thinking") or overtly, occasioning the effective behavior colloquially referenced as problem solving, in the end attaining the instigating reinforcer (Catania, 2013; Pierce & Cheney, 2008; Skinner, 2000). Thus, both private and overt precurrent behavior are maintained by a contingency of reinforcement, in which "solving the problem" represents the reinforcing event, attaining the previously unattainable reinforcer (positive reinforcement) or avoiding a potentially aversive consequence (negative reinforcement, Pierce & Cheney, 2008). As such, "making a choice" is the selection of an operant based on the probability of, and functional relation to, its historical consequences, representing distribution of operant behavior among two or more, often incompatible concurrent schedules of reinforcement (Catania, 2013; Pierce & Cheney, 2008). While some strategies are selected based on previous experience with contingencies, our limited lifespans and phylogenetically selected species-specific behavior ("cognitive bias") restricts variation in our behavioral repertoires as well as learning capacity. Hence, we rely on antecedent verbal stimuli, vocal and non-vocal, in forms of rules constituted by advice, threats, warnings or promises, specifying what consequences to expect, given a more or less specific context. Different instructions are typically mediated by different cultures (shaped by differing learning histories), in behavioral terms defined as "all the conditions, events, and stimuli arranged by other people that regulate human action" (Pierce & Cheney, 2008, p. 345), and may as such obviously represent competing reinforcing events in a behavioral chain constituting precurrent behavior (Wulfert et al., 1994).

Nevertheless, whether constructed in the form of overt or covert self-instructions, based on previous contact with contingencies or mediated by others, when rule-following preclude contact with the "raw" contingencies (the ones not constituted by the rule itself) adaption to changing environments may suffer, rendering the behavior ineffective relative to the instigating, typically remote, reinforcing contingencies, yet maintained by (shorter-termed) vicarious or alternative reinforcing events. In short, the contingencies of reinforcement may shift, rendering adverse consequences due to a lack of contact with the raw contingencies. Thus, knowledge of how to induce sensitivity, or rather how to manipulate levels of contingency testing or rule-tracking, becomes of interest. Different settings calls for different rules. While strict adherence, or pliance, to the rule is appropriate in some settings, for instance related to safety procedures, greater variability or testing of the prevailing contingencies might render better adaption to changing contingencies in other contexts, for instance pertaining to innovation, highly knowledge based industries, or continuous change processes in organizations. Instructions may of course vary both in how they are conveyed, their explicitness and completeness (Matthews, Shimoff, Catania, & Sagvolden, 1977), they are, however, always the product of an extensive history of differential reinforcement, as such rendering the effect on human behavior at times astonishing to the observer (see for instance Milgram, 1963).

Several studies, including Shimoff, Catania, and Matthews (1981) and Shimoff et al. (1981) found responding according to shaped rules to be sensitive to changes. Instructed responding (both verbal and demonstrated), although in contact with the contingencies remained on the other hand largely insensitive even to drastic alterations in contingencies, those adapting (three of eight participants in Shimoff et al., 1981) doing so in a relatively postponed manner. Catania et al. (1989) found the sensitivity of a non-verbal performance to depend on the sensitivity of the controlling verbal stimulus, and indicated “instructed verbal behavior will be less sensitive to contingencies than verbal behaviors shaped by contact with contingencies” (p. 146). However, due to restricted time or access, shaping might not always be an alternative conveying critical information about contingencies. Factors have, however, been identified as potential sources affecting sensitivity to contingencies. The application of explicit instructions may instigate a reduction of behavioral variability, in addition to potentially adding competing social contingencies, those previously conditioned governing rule-following, interfering with the sensitivity to scheduled consequences (Wulfert et al., 1994) In accordance with the concluding remarks of Catania et al. (1989, p. 148), studies has implied that “sensitivity to contingencies is likely to be mediated by rules” as the type of rule to seem to affect variability in behaviors and sensitivity to prevailing contingencies, rules specifying responses rather than mere contingencies inducing a greater extent of stimulus control (Hayes, Brownstein, Haas, & Greenway, 1986; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986; Matthews, Catania, & Shimoff, 1985; Matthews et al., 1977; Wulfert et al., 1994). Further, general rules, rules specifying behavioral antecedents determining what cues to look for, how to test contingencies, or rules that precludes 1:1 stimulus control forcing a level of discrimination, seem to produce greater variability and sensitivity than do their opposites (Catania et al., 1989; Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Wulfert et al., 1994). Thus, will different levels of detail in instruction yield differences on group levels when it comes to behavioral variability and testing of contingencies in complex settings?

Hypotheses

H_0: There is no significant differences in performance.

H_1: Differential instructions will produce significant differences in discrimination across groups.

H_2: Differential instructions will produce significant differences pertaining to variability in responses, defined as contingency testing, across groups.

H_3: Differential instructions will produce significant differences in relative response rates across groups.

Method

A quasi-experimental group design dividing subjects into three groups was implemented. All subjects participated individually and was exposed to a design combining elements from reversal and multiple treatment designs. The control group was offered minimal instructions. The general instructions group was offered fairly general instructions. The discriminative instructions group was offered a description on how to test for different contingencies. No further distinctions between conditions were programmed. The experiment was initiated by introductory instructions common for all groups. This was followed by seven three-minute cycles of button-clicking sessions, from now on referred to as sessions, interrupted by a two-minute “guessing-break” between cycles. In sum this tended up as 7 five minute blocks. To assess effects of general and specific instructions on stimulus control, variability and contingency testing, differential instructions followed the first block. This rendered the first block a baseline condition to compare subsequent performance within the respective group, as well as it might uncover potential differences across groups. In order to assess apparent schedule sensitivity related to changing contingencies, a multiple schedule was applied during sessions. The multiple random ratio random interval schedule (MULT RR20 RI10) was reversed (RI10 RR20) after block two, and alternated through block seven, allowing for comparisons of schedule sensitivity contingent on the changing order of components in the multiple RR RI schedule. Random-ratio (RR) and random-interval (RI) schedules are versions of variable-ratio- (VR) and variable-interval (VI) schedules respectively, the ratio in RR schedules specifying the probability of response reinforcement, irrespective of the number of responses emitted since the previous reinforcer (Catania, 2013).

Participants

Fifty-six participants (36 women, 20 men, *M* age = 33.8, age range: 19-63) recruited through social media and personal contacts at Oslo and Akershus University College of Applied Sciences served as subjects. As such this constitutes a quasi-experiment seen as selection is not randomized. All participants reported to be based primarily in the Oslo area. No monetary compensation was offered. A total of three subjects were drawn from the study (P013, P022, P044). Of these, withdrawn from the general instructions group (P022), one repeatedly left the experimental room during sessions asking for additional instructions, thus suppressing behavior relevant to the experiment. Two participants were withdrawn from the discriminative instructions group, one due to personal reasons during block three (P044), the other due to statement during debrief of not having read the instructions (P013).

Procedure and apparatus

Informed consent. Upon arrival all subjects received written information about the experiment, data handling, voluntary participation, and the right to withdraw at any time. The consent form told the experiment would involve playing a simple game on a computer placed in a separate room, earning as many points as possible, during a certain setup taking approximately 45 minutes. Instructions would at all time be provided by the software, the task was not intended to include any discomfort, risks or inconvenience. The study purpose was stated as learning more about behavior related to choice-situations. Participants were informed that more detailed information would not be given before participation in order not to influence results. Immediately after finishing, they would however, be offered a comprehensive debrief with the opportunity to see individual results and ask questions immediately. Apart from a signed consent, no information was gathered in advance, see Appendix A. Participants were told their personal belongings, including phones, would be looked after right outside the experimental room. They were not asked remove clocks, or similar personal items, in order not to give cues related to the experimental setting. During debriefing participants were asked to provide information on age, occupational direction (social, mercantile, creative, other) and previous knowledge of reinforcement schedules. All experiments were overseen by the same researcher. Participants were assigned a participant ID. No information was coupled suitable to identify individual participants. No lists of names, participant number or other additional information were ever matched. For detailed group demographics see Appendix B.

Procedure. After reading and signing the consent form, participants were escorted to one of two possible adjacent private rooms, and asked to retrieve the experimenter when the software informed them the experiment was over. The experiment started on the participants own initiative pressing start. A picture of the participants' experimental condition is provided in Appendix C. The rooms in which experiments were conducted were equipped with identical laptops, a work desk and a chair facing a white wall. Seven three-minute sessions were conducted with two-minute "guessing-breaks" between each. Each session consisted of two 90-second components and one guessing break (two minutes) constituting a block of five minutes. The experiment lasted a total of approximately 35 minutes, dependent on how long the participants used to read the introductory instructions and pressing start.

Apparatus. Systematically replicating experiments conducted by Shimoff et al. (1981), the physical console used in the original studies was substituted by designing the experiment according to published specifications using the software Visual Studio 2010, using C# / .Net (see also Catania, Matthews, & Shimoff, 1982; Catania et al., 1989; Matthews et al., 1985). The experimental setting differed from original studies with the use of laptops with 14 inch display, (HP EliteBook 840) and externally connected mouse, in the color of two buttons (previously red and black), and omitting white noise and audio signals administered through headphones in previous studies intended to mask mechanical clues (Catania et al., 1982; Catania et al., 1989; Matthews et al., 1985; Shimoff et al., 1981).

Participant Interface. For participant software interface, see Figure 1. The interface was at all times full-screen. This consisted of three grey buttons eligible for clicks, placed in a triangle, two buttons in the lower to end of the interface, one in the center. A smaller square were placed right above the two lower left and right buttons respectively. Two larger squares was placed in the upper left and right corner. Small squares over left and right lower buttons turned blue in correlation with the current active component of the multiple random-ratio random-interval schedule (Matthews et al., 1985). Interface background was white, the keyboard deactivated with the exception of a few commands known to the experimenter, offered in Appendix D. Lasting for a total of 180 seconds, the button clicking sessions always started on the left button, and shifted to the right after 90 seconds. The larger squares in upper left and right corners turned green signaling availability of points according to reinforcement schedules, RR20 RI10. Pilots led to the addition of bright blue color to center button, correlated with green lights, prompting point collection.

Multiple schedule of reinforcement. The RR20 schedule made clicks to eligible for reinforcement given a probability of .50 (Catania et al., 1982; Catania et al., 1989). The RI10 schedule determined intervals by the program selecting pulses generated at a rate of one per second with a probability of .10, RI10-s, $t = 1.0$, $p = .10$ (Catania et al., 1982). Reversal of schedules started in session three, alternating through to session seven, sessions always starting with the left button. In practice the RR20 schedule component was assigned to the left button and the RI10-s schedule component to the right, in sessions one (baseline), two, four and six. The RI10-s schedule component was assigned to the left button and RR20 schedule component to the right in sessions three, five and seven.

Guessing-breaks. During guessing-breaks the keyboard was activated and participants were asked to write their best guess to “the way to earn points with the left [right] button is____”. A total of six open fields for submission of answers were offered consecutively on the same screen, three for the left button and three for the right, separated by headings emphasizing the sequence of components (“The first active button”). As this study seeks to explore the effect of differential instructions on behavior, the “non-differential points for guessing” procedure used by Catania et al. (1982) was administered during the guessing breaks. This was done in order not to inadvertently shape specific individual private rules. Participants earned a total of ten points per completed guess sheet (six guesses), and were allowed to finish as many guess sheets they wanted within the two minute time limit between sessions as opposed to one sheet in the study by Catania et al. (1982). As in the original studies (Catania et al., 1982; Catania et al., 1989; Matthews et al., 1985; Matthews et al., 1977; Shimoff et al., 1981), points earned during guessing-breaks and sessions were not shown in the same counter, but rather in two separate ones, each visible to the participants at all times during the current experimental task. Total scores were registered in a separate scorecard automatically shown on screen after finishing the experiment. A clock counting down from 120 seconds was visible in the upper right corner during guessing, and the counter for points earned on guessing was visible at the bottom of the screen. After two minutes guessing-breaks, the interface automatically returned to a new session, irrespective of whether answers had been submitted or not. The primary purpose of guessing-breaks was a) keeping the experiment as similar as possible to the original studies, b) to give the participants a break from relatively static movements using the mouse, thereby avoiding discomfort from repetitive strain, c) attempting to reduce possible confounding variables affecting performance during consecutive button-pressing sessions.

Instructions

Subjects were assigned to one of three groups, differing only in instructional conditions: minimal-instructions (Group 1), moderate-instructions (Group 2) and discriminative-instructions (Group 3). Except trying to keep an equal gender distribution, assignments was random and linked exclusively to a participant ID. Instructions were all slightly merged, adapted and translated to Norwegian from similar study setup by Shimoff et al. (1981), Catania et al. (1982) as well as Experiment 4: Instructing schedule discriminations, referenced in Catania et al. (1989). Corresponding to the research question and conforming to the use of computer software, instructions differ from original studies (Catania et al., 1982; Catania et al., 1989; Matthews et al., 1985; Shimoff et al., 1981) in omitting all references to mechanical apparatus, headphones and white noise, switching between work modes, pencil and stencils, shaping of guesses and the exchange of points for money. Conforming to the use of computer software also implies a certain level of netiquette. Information was conveyed in smaller chunks compared to original studies, allowing participants to set the pace prior to pressing start, however mounting no instructions on the wall in order not to influence participants during the experiment. In translating from English to Norwegian, some of the wording was adjusted, also instructions refers to clicking rather than pushing, and refrains from the use of capitalized headings and key words.

General instructions. Introductory instructions were common for all groups, accompanied by screenshots of the interface and administered over five screens with the possibility to navigate back and forth: (1) “Please read the following instructions carefully. As this is an experiment, there will be given no further instructions nor opportunity to ask questions during the experiment” (Shimoff et al., 1981). (2) “Your task is to earn as many points as you can. Points are shown on the counter at the screen center. At the bottom of the screen there is two gray buttons you may click on. They will never work at the same time. The blue light above the lower gray buttons will tell you which of the buttons works”(Shimoff et al., 1981, p. 208). (3) “If you click in the right way, the green light above the active button will be lit. When the green light is lit, you may collect a point by clicking the gray center button” (Catania et al., 1982). (4) “Every few minutes, the game will pause for about two minutes. In these breaks, you will be asked to finish sentences. You may complete as many forms as you wish. This will earn you ten points per submitted form, no matter what you answer” (Catania et al., 1982). (5) “When you are ready, press start”.

Upon pressing start, all participants initiated baseline; the first three minute multiple RR20 RI10-s session followed by the first two minute guessing break. The two minute guessing-break was always, for all groups, initiated by a reminder stating “Finish the sentences on the next page. Use the keyboard. You have two minutes, and may complete as many forms as you wish. This will give you ten points per form, no matter what your answer is” (Catania et al., 1982). A gray navigation button with the text “Ok! Next →” showed in the lower right corner of the screen during all instructional slides. All experiments concluded with a scorecard containing the following text after seven cycles (including baseline): “Thank you for your efforts! Your total game points: XX. Your total text points: YY. Total score: XY. You may now go get the experimenter". The minimal instructions group (Group 1, *n* = 18) functioned as a control group, and was not provided any further instructions.

Moderate instructions (Group 2, *n* = 18). After the conclusion of the guessing-break of the first cycle (baseline), initiating the session of the second cycle, the following additional instructions were provided: "The program decides whether a click earns a point according to one of two possible rules: 1.The game lets your click earn a point after a **random number of clicks**. The more clicks you make, the more points you earn. The best thing to do is to press fast. 2. The game lets your click earn a point after a **random time interval.** The number of presses does not matter, so there is no reason to press fast. The best thing to do is to press slowly" (Catania et al., 1989, p. 139).

Discriminative-instructions (Group 3, *n* = 17). In addition to general instructions and the instructions offered the moderate-instructions group, this group was offered a consecutive screen with the following text: "**How to figure out which rule the game is applying.** To find out which rule the game is using, you should **wait for a while before clicking.** If your next click makes the green light come on, the button is probably working after random **time intervals**, and there is no reason to press fast. If your next click does **not** make the green lights come on, the button is probably working after random **numbers of clicks**, and the faster you click the more points you will be able to earn" (Catania et al., 1989, p. 140).

Output and variables

Data output related to button-pressing sessions came in the form of one temporary graph (*.gif) allowing participants to view individual results during debrief, in addition to participant specific, comma separated text files with one line of data per .25 seconds (4,050 data points per variable per participant). Output data from sessions included the variables Left Click Enabled, Right Click Enabled, Center Click Enabled, RR20, RI10, Center Click and Points. Text files were imported and processed in Microsoft Excel 2010, generating templates initially, merging input into 10-second intervals (40 lines of data per interval), rendering nine points of data per component of button-pressing, a total of 18 per session and 126 per participant (7 sessions). The data were later imported to IBM SPSS 23 and processed on group levels. Data output related to guessing-breaks came in the form of participant specific text files, separating cycles, and number of entries by numbers. Files generated from guessing-breaks were not further processed in relation to this paper.

Results

All experiments were conducted during the month of May 2015, and the participants (N = 53, $n_1 = 18$, $n_2 = 18$, $n_3 = 17$) were recruited during the same and previous month. Distribution of clicks and points were tested using non-parametric tests in IBM SPSS Statistics 20 and 23, specifically the Kruskal-Wallis test of variance across groups (H), and Friedman's ANOVA across sessions within individual groups ($H\chi^2_F$). Significance level was set to .05. When significant differences were found, the Kruskal-Wallis test was subsequently followed by a *pairwise comparison* analysis, Friedman's test by a Wilcoxon Sign Rank test (Field, 2013). Effect sizes (r) were calculated based on results from post-hoc analyses using Microsoft Excel 2010 (Field, 2013). If not otherwise specified, treatment refers to sessions one through seven. For specific Mechner notations per button, see Figure 1.

Stimulus Control

All included participants showed button clicking behavior during both RR20 and RI10 schedule components in the baseline condition, and all participants increased clicking frequency contingent on earning their first points. Ratio distribution of clicks between and within groups, and across conditions.are offered in Table 1.

Discrimination Indexes. A discrimination index (I_D) portrays the percentage of total presses allocated to respective buttons correlated with discriminative stimuli (Pierce & Cheney, 2008). As the experiment included multiple possible discriminated operants, four I_Ds were calculated per session one through seven, based on group mean response rates per minute in order to assess effects of instructions on stimulus control (Catania, 2013). Discrimination Indexes are presented in Table 2.

The first index (I_{D1}) investigated effects of differential instructions on overall stimulus control and whether participants discriminated between active (S^D_{MULTp}) and inactive ($S^\Delta_{\mathrm{MULTp}}$) lower left and right (MULT), as well as center (p) buttons. Indexes two and three (I_{D2}, I_{D3}) investigate isolated effects of differential instructions on the center button and lower left and right buttons respectively. Index four (I_{D4}) was computed to investigate whether differential instructions affected discrimination between buttons generating points ($S^{\mathrm{D}}_{\mathrm{MULT}}$) versus total responding (all other buttons):

$$I_{D1} = \frac{S^{\mathrm{D}}_{\mathrm{MULT}+p}}{(S^{D}_{\mathrm{MULT+p}}+S^{\Delta}_{\mathrm{MULT+p}})}\, .\; I_{D2} = \frac{S^D_p}{(S^{\mathrm{D}}_{\mathrm{p}}+S^{\Delta}_{\mathrm{p}})}\, .\; I_{D3} = \frac{S^D_{\mathrm{MULT}}}{(S^{\mathrm{D}}_{\mathrm{MULT}}+S^{\Delta}_{\mathrm{MULT}})}.\;\; I_{D4} = \frac{S^{\mathrm{D}}_{\mathrm{MULT}}}{(S^{\mathrm{D}}_{\mathrm{MULT+p}}+S^{\Delta}_{\mathrm{MULT+p}})}.$$

The higher the scores, index ranging from 0 to 1, the more probable groups were to demonstrate strict stimulus control. This entailed distributing clicks to discriminative conditions (defined in the numerator), not testing prevailing contingencies by clicking the non-illuminated, thus signaled inactive, S^Δ buttons.

Clicks to active buttons as a discriminated operant. General stimulus control (I_{D1}) ranged from 93% (Group 2, session 2) to 98% (Group 1, session 7 and Group 3, session 3) during treatment. Group 3 increased the most, comparing average I_{D1} during treatment (sessions two through seven) compared to baseline conditions, up 8.5%, distributing 88.4% of clicks to active buttons during baseline versus 96.8% in average during treatment. Group 1 and Group 2 increased 5.7% and 5.9% respectively comparing average I_{D1} during treatment to the baseline session.

Center clicks as a discriminated operant. Clicks on the center button (I_{D2}), ranged from 53% (Group 3, session 2) correlated with S_p^D, to 93% (Group 2, session 7) during treatment. Group 2 increased the most, comparing average I_{D2} during treatment sessions compared to baseline conditions, with a 30.3% increase, distributing 56.6% of clicks to the center buttons while signaled active (collecting points) during baseline versus 86.9% in average during treatment. Group 1 and Group 3 increased 17.6% and 17.2% respectively.

Clicks to active lower buttons (MULT RR20 RI10) as discriminated operants. Measuring discrimination between lower left and right buttons when signaled active (correlated with blue stimulus in square above, S_{MULT}^D) and not, I_{D3} ranged from 95.0 % (Group 2, session 4) to 99.1 % (Group 3, session 3) during treatment. Group 3 increased the most comparing average I_{D3} during treatment to baseline conditions, with an increase of 7.2 %, distributing 91.1% of clicks to active button during baseline versus 98.3 % in average during treatment. Group 1 and Group 2 increased 5.0% and 2.9% respectively.

Clicks to active lower left and right buttons (S_{MULT}^D) in percentage of total responding, I_{D4}, ranged from 92.9% (Group 3, session 2) to 98.5% (Group 1, session 7) during treatment, see Figure Group 3 increased the most, up 8.8% comparing average I_{D4} during treatment sessions to baseline conditions, distributing 87.9% of clicks to the lower left and right buttons while signaled active (generating points) during baseline, versus 96.7% in average during treatment. Group 1 and Group 2 increased 5.9% and 6.3% respectively. Figure 2 shows group mean performance related to I_{D4}, session one (baseline) through seven.

During RR components Group 3 had the greatest increase in I_{D4}, distributing in average 14.7% more clicks to active lower buttons during treatment compared to baseline conditions (average treatment 97.2%, baseline 82.5%). Group 1 and Group 2 increased 7.8% and 8.8% respectively. During RI components average discrimination during treatment increased 4%, 3.9% and 4.1% groups one through three respectively, Group 1 distributed 92.8% of clicks to lower active buttons during baseline, and on average 96.8% during treatment, Group 2 distributed 93% during baseline, and an average of 97% during treatment, and Group 3 distributed 92.3% of clicks during baseline and 96.4% in average during treatment.

Significant differences. All indexes were tested for effect of differential instructions across (Kruskal-Wallis test of variance, df = 2) and within groups (Friedman's ANOVA, df = 6) using IBM SPSS 23. No significant differences were found at specified alpha level of .05. The first alternative hypothesis (H_1) is rejected, there is no significant differences in discrimination across differential instructions. Variations found in discrimination as here defined cannot within a 95% confidence level be attributed differential instructions. Appendix E portrays results of Wilcoxon Sign Rank Test following up on Friedman's ANOVA, elaborating on other significant differences across conditions in baseline versus session 2.

Contingency Testing

At any moment during button pressing sessions, due to schedules alternating between buttons, there was at least one deactivated button ($S^{\Delta}_{\mathrm{MULT}}$), at times two, counting the center button (S^{Δ}_{p}) with the exception of latency consisting of time from the green light was lit (S^{D}_{p}) until center button was clicked. Exploring on discriminated operants, contingency testing was defined as clicks distributed to inactive buttons (S^{Δ}_{MULTp}), thus correlated with S^{Δ}_{MULT} and S^{Δ}_{p}, during MULT RR20 RI10 components. Data consist of grouped scores of individual participants. Means, grouped median ranks and standard deviations related to discriminative and non-discriminative conditions are offered in Tables 3 and 4. Means are followed by standard deviation in parenthesis when referenced in text if not otherwise specified.

Baseline

Tests revealed no significant differences relating to testing of contingencies during baseline conditions, S^{Δ}_{MULTp}, *H*(2) = 2.537, *p* =.281, means of 23 (31.0), 11 (21.0) and 11 (15.5) for Group 1, Group 2 and Group 3 respectively. However, with an initial variance in $S^{D}_{MULTRI10}$ of 21,001 clicks ^{2} (c^2), 8,768 c^2 and 12,284 c^2 groups one through three respectively (overall experiment 15,402 c^2), significant differences were revealed in response rates to the lower buttons on the RI10 component, *H*(2) = 6.17, *p*= .046, as well as in subsequent programmed points, S^{D}_{pRI10}, *H*(2) = 6.565, *p*= *.038*. Variance in points of 9.8 points^2 (p^2), 9.1 p^2, and 6.9 p^2, constituting overall experiment variance of 10.19 p^2. Pairwise comparisons with adjusted p-values showed Group 1 had a significantly higher response rate ($S^{D}_{\mathrm{MULTRI10}}$) than did Group 3 (*p* =.039, *r*= 1.63), group means of 174.7 (144.91), versus 73.1 (110.83) respectively, Group 2 having a mean of 99.4 (93.64). Subsequent points differed significantly between Group 3 and Group 2 (*p*=.005, *r*= 0.53). Group 3 earned less than the other two groups, with mean points of 3.4 (2.62), versus 6.7 (3.0) for Group 2 and 5.8 (3.1) for Group 1 respectively. See Table 3 for median ranks.

The differences in points and response rate on initial active RI10 component being substantial, it also produced a significant difference in overall clicks during baseline, *H*(2) = 6.977, *p*= .031, with a variance of 66,7403 c^2 for Group 1, 29,274c^2 for Group 2 and 34,353c^2

for Group 3, 49,588 c^2 for the overall experiment. Group 1 (M = 339, SD = 258.35) and Group 3 (M = 132, SD = 185.35), being significantly different according to pairwise comparison with adjusted p-values (p =.025, r= 0.45).

Treatment

As a control adjusting for initial differences, a second dataset was created and baseline values set to zero, in order to investigate effects of differential instructions on group (thus participant) level of contingency testing relative to individual baseline conditions, from here on referred to as changes from baseline. Table 3 shows group mean and median clicks correlated with S^Ds. Table 4 shows group mean and median clicks correlated with S^Δs. Table 1 shows ratio distributions between, within and across groups respectively.

Contingency testing on RR20 components. Group 2 had the highest and lowest group means of RR20 contingency testing ($\mathrm{S}^{\Delta}_{\mathrm{MULTpRR20}}$) during treatment, highest mean in session three (M = 11.67, SD = 33.84) and four (M = 12.33, SD = 12.59), lowest in session seven (M = 1.78, SD = 2.51), closely followed by sessions two (M = 2.06, SD = 6.12) and six (M = 2.06 SD = 7.27). While Group 2 had the highest and lowest means, they also show the greatest variability among groups in session three (SD = 33.84, variance 1,145c^2) and the lowest in session 7 (SD = 2.51, variance 6 c^2). Group 3 showed the highest (5.40) and lowest (0.20) median among groups.

Contingency testing on RI10 components. Group 2 had the highest (M = 20.39, SD = 71.38) and Group 3 the lowest (M = 3.18 SD = 11.34) group mean of RI10 contingency testing ($\mathrm{S}^{\Delta}_{\mathrm{MULTpRI10}}$) in sessions five and three respectively. While Group 2 had the highest mean, they also had the by far greatest variability, showing standard deviations of 47.16, 71.38, 64.32 and 49.17 in sessions four through seven, with a variance of 2,224, 5,095, 4,137, 2,418 c^2 respectively (lowest standard deviation in Group 2 was 12.46 in session three, variance of 155

c^2). The largest standard deviation (variance in parentheses) in the other groups were 26.50 (703 c^2) in Group 1, and 33.08 (1,094 c^2) in Group 3. Smallest standard deviation across groups and settings being 10.37 (108 c^2) for Group 1 in session five. Group 1 showed the highest median rank during treatment in session two (2.17), Group 2 the lowest in session seven (0.27), closely followed by Group 3 (0.29).

Overall contingency testing. Group 2 had the highest overall mean of contingency testing during treatment with a mean of 117.5 clicks to elements not signaling reinforcement ($S^{\Delta}_{\text{MULTp}}$) and shows as well the greatest overall variability in scores during treatment, standard deviation (variance in parenthesis) ranging from 25.7 (661 c^2) in session two to 89.4 (7,999 c^2) in session four. The standard deviation of Group 1 during treatment ranged from 45.5 (2,067 c^2) in session four to 16.1 (258 c^2) in session seven. Group 3 reached its highest variability in clicking between participants during session two with a standard deviation of 49.7 (2,469c^2), showing lowest variability in session three with a standard deviation of 30.4 (925c^2).

Significant differences. No significant differences pertaining to contingency testing was found at the specified .05 alpha level.

Relative Rates of Responding

Relative rates of responding on the two schedules was computed per participant by dividing the total number of responses in the RR component by the total number of responses in both components for each session, B representing response rates on individual schedules: $\boldsymbol{B}_{\boldsymbol{RR20}}/\boldsymbol{B}_{RR20} + \boldsymbol{B}_{RI10}$ (Hayes, Brownstein, Haas, et al., 1986, p. 140; Pierce & Cheney, 2008; Rosenfarb, Newland, Brannon, & Howey, 1992). As the optimal way to earn points on the multiple RR RI schedule was clicking fast on the RR component and slow on the RI component, the higher the scores, the more likely the participants were to show a combination of high-rate

RR and lower-rate RI responding, index ranging from 0 to 1. Relative rate of clicks distributed to the RR component across sessions are offered in Table 6.

Significant differences

Session two. While both Group 1 and Group 3 distributed marginally less (-2%) of their mean clicks to the RR component in session two, Group 2 increases their mean distribution of clicks to the RR component with 19%. While allocating a rate of .37 to the RR condition during baseline, they distributed .56 of the clicks to the RR component in session 2. However, differences evens out, groups one through three distributed a mean overall rate of .59, .63 and .62 to the RR component during treatment sessions. The Kruskal-Wallis test of variance revealed the difference in relative rates during session two was significant across groups, $H(2) = 7.313$, $p = .026$. Pairwise comparisons with adjusted p-values showed Group 2 distributed a significantly higher percentage of total clicks on the MULT schedule to the RR20 component, than did Group 1 ($p = .024$, $r = -.44$). Mean relative rate of responding to the RR component during this session was .39 (.15), .56 (.16) and .45 (.17) for Group 1, Group 2 and Group 3 respectively (standard deviations in parenthesis). Variance across groups was .37, .23 and .06 for the groups in order, and .041 for the overall experiment.

Right button, second component**.** All groups distributed higher rates to the RR schedule when placed on the right buttons as the second component (sessions 3, 5 and 7). The preference seems to be the greatest in Group 3, reducing allocated clicks to the RR schedule with a mean rate of .25 in sessions 4 and 6, when the RR schedule constituted the first component and was allocated to the left button.

In Group 1 46% of the participants had an average relative response rate higher than .60 during treatment, 56% exceeded .60 in Group 2 and 57% in Group 3. When the RR component was allocated to the right button, as the second component, an average of 84% of the participants had a relative rate higher than .60, compared to 23% of participants when the RR component was allocated to the left button and constituted the first component of the multiple schedule. In Group 1, 81% of participants had a relative rate exceeding .60, in Group 2 80% of the participants, and in Group 3 90% exceeded a relative responding rate of .60. When the RR component was allocated to the left button, as the first component, an average of 11% of the participants Group 1, 33% in Group 2 and 24% in Group 3 exceeded a relative responding rate of .60.

The Kruskal-Wallis test revealed a significant difference in overall relative response rate during sessions 2,4 and 6 in which the RR20 schedule constituted the first component, allocated to the left button $H(2) = 6{,}676$, $p = .036$. Variance across groups, in order, was .011, .015 and .024, and .018 for the overall experiment, mean overall relative response rate in the three sessions (standard deviation in parenthesis) was .45 for Group 1, .55 for Group 2 and .48 for Group 3. Pairwise comparisons with adjusted p-values showed Group 1 distributed a significantly lower percentage of total clicks on the MULT schedule to the RR20 component, than did Group 2 ($p = .032$, $r = -.43$). No other significant differences pertaining to relative response rates was revealed in this test.

Generalized Matching Equation. Exploring on differences in relative rates of response, the generalized matching equation was applied to the data. Expanding on the matching law, the generalized matching equation compares relative rates of reinforcement on response alternatives to the relative rate of responding on each alternative (Pierce & Cheney, 2008; Reed, 2009). As such, parameters denoted by the coefficient *k*, exponent *a* are included as constants in the generalized matching equation, *k* represents apparent bias, preferences not attributable to changes in ratios of reinforcement, *a* represents apparent sensitivity as sources of error: $B_1 / B_2 =$

$k(R_1/R_2)^a$. As such, the generalized matching equation states choice and preference as a relative function of responses allocated to the individual components (Pierce & Cheney, 2008). Apparent schedule sensitivity (*a*), bias (k), and Variance Accounted For (VAF) was calculated for each of the participants using the generalized matching equation and log-linear regression analysis in Microsoft Excel 2010, in line with the instructions provided by Reed (2009):

$$\log\left(\frac{B_1}{B_2}\right) = a\ \log\left(\frac{R_1}{R_2}\right) + \ \log k\ \ .$$

Variance Accounted For (VAF). The generalized matching equation explains more than 75% of the variance in distribution for 24% of the members (4 participants) in Group 3. Participant demographics related to matching participants are portrayed in Table 7. For two members (12%) the generalized matching equation accounts for more than 95% of the variance in click distribution between reinforcement schedules (R2>.75 for P027: .79, and P032: .83, R2>.95 for P014: 1.0 and P050: .96). Neither of the matching participants in Group 3 had previous formal knowledge of reinforcement schedules, two had creative occupations, and two had mercantile occupations.

The highest explained variance in participant click distribution in Group 2 was 75% (R2= .75, P034), and in Group 1 the highest explained variance was 66% (P010, R2 =.658), both reporting having previous formal knowledge of reinforcement schedules.

Apparent schedule sensitivity. The slope of the best fit line (*a*) for matching participants (more than 90% explained variance) in Group 3 was 0.745 and 0.472 (P014 and P050). The slopes of the other two participants were 0.568 (P027) and 0.988 (P032). Slopes near 1.0 indicates sensitivity, thus matching responding to contingent reinforcement programmed in reinforcement schedules, maximizing reinforcement (Reed, 2009). All but one of the participants of which VAF was over 75% *undermatch*, implying parameter *a* taking a value less than one, indicating changes in the response ratio are smaller than changes in reinforcement ratio. The one not undermatching (P032) seem to approximate perfect matching (a = 0.988).

Apparent bias. The bias parameter for participants with more than 90% variance explained was .040 (P14) and -.263 (P50). Parameters for the two other participants were -.207 (P27) and -.449 (P32). A bias parameter substantially greater than zero indicates existing bias towards the RR schedule, parameters substantially less than zero indicates existing bias towards the RI schedule.

General Findings

Participants in all groups showed overall levels of stimulus control, clicks over sessions generally increased correlated with discriminative stimuli and decreased in its absence.

Differential instructions did not produce significant differences in either of the four discrimination indexes across groups. However, all indexes were high, the lowest of which was the center button (I_{D2}), the one of the buttons potentially least frequently correlated with a discriminant (S_p^D), or at least submitted to the thinnest variable interval schedule of reinforcement.

Overall contingency testing ($S^{\Delta}_{\mathrm{MULTp}}$), rendered no significant differences across groups, tests applied across original scores, scores adjusted for initial baseline differences, per session, per schedule component (RR20 RI10) and across treatment period, individual sessions and total (session two through seven). Isolated scores on S^{Δ} conditions, constituting the variable of contingency testing, rendered no significant differences ($S^{\Delta}_{MULTRR20}$, $S^{\Delta}_{MULTRI10}$, S^{Δ}_{pRI10}, S^{Δ}_{pRR20}). Hypotheses H_1 and H_2 are rejected. There are no significant differences across group pertaining to discrimination as measured by the indexes here applied, nor in contingency testing as defined.

Differential instructions did, however, produce significant differences pertaining to relative response rates across groups. In the group given general instructions combined with behavioral precursors and information on how to test contingencies, matching explains more than 75% of the behavior of 24% of the participants. None of these had reported any formal knowledge of reinforcement schedules. The behavior of one participant in Group 2, given a general instruction, came close to Group 3 levels, with a VAF of 74.8%. This participant reported previous formal knowledge of reinforcement schedules, as did the participant with highest VAF (69%) in Group 1. Among the matching accounted for by the generalized matching equation in Group 3 (VAF >.75), apparent sensitivity was high in the scores of two participants, approximating 1 at 0.988 and 0.745. The bias parameter indicated one participant in particular was biased towards the RI schedule (k = -0.449), two others to a lesser extent (k = -0.263 and k = -0.207). One participant appeared more or less unbiased (k = 0.04). Hypothesis three is not rejected. Differential instructions do, within a 95% confidence interval, produce differences in relative response across groups.

Discussion

The findings of this study supports previous indications of apparent schedule sensitivity being mediated by rules, as well as the type of rule affecting sensitivity to prevailing contingencies (Catania et al., 1989; Hayes, Brownstein, Haas, et al., 1986). Significant differences linked to relative response rates and apparent matching between multiple schedules was found across differential instructions. This indicates rules specifying what stimuli to pay attention to, as well how contingencies may be tested, render a higher rate of explained adaption to the prevailing contingencies even in complex settings. However not revealed significant by the non-parametric tests applied, the data of this study support previous findings indicating general rules sets the occasion for more variability in behaviors, than does discriminative rules or entirely privately generated rules as in the control group (Catania et al., 1989; Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Wulfert et al., 1994). The group receiving general instructions (Group 2) contacted alternative contingencies to a greater extent than the other groups. This group showed a substantial variability in response rates across groups evidenced in standard deviations more than twice the size of the other groups during RI contingency testing (highest SD = 71.38 versus highest SD = 33.08 in the discriminative instructions group, and highest SD = 26.5 in the control group). Although differences were smaller, the tendency withheld during contingency testing in RR components. The general instructions group allocated the greatest amount of clicks to overall S^{Δ} conditions, yet still accumulated a roughly 6% higher mean score related to points across treatment than did the other two groups (see Table 1). This amounts to considerable differences between groups related to variability in response rates on both components, as depicted in Figures 2 and 3 as well as Tables 1 and 4.

Discriminated operants are likely to be verbally governed. The experiment was set up prompting participants to formulate guesses in between sessions. Contrasting the previous studies of Shimoff et al. (1981), Catania et al. (1982), Matthews et al. (1985) and Catania et al. (1989), there was no exchange of points for money. As such, the contingency maintaining operant behavior accumulating points (clicking rates) was verbal in itself. Further, itself interesting, groups show indications of a strong preference towards the right button. Response rates increase markedly on RR schedules when constituting the second component on the right button compared to constituting the first component on the left button. A comparable effect is detected relevant to the RI component, response rates are consistently higher on the second component, allocated to the right button. The preference towards the right button and/ or the second component during RR schedules seems to be the greatest in Group 3. This group reduce allocated clicks to the RR schedule with a mean rate of .25 in sessions 4 and 6, when the RR schedule constituted the first component, allocated to the left button compared to being second, allocated to the right. An initial analysis of text responses does not reveal any apparent right-biased formulated verbal rule (it does however indicate a substantial amount of superstitious behaviors across groups), however the tendency holds across groups and components. Differences could be due to phylogenetically selected bias toward right-hand responding, an extinction effect, as the preceding component represent a thinner reinforcement schedule, or ratio strain causing consecutive rates on RI schedules (before and after) to be lower than they would otherwise (Pierce & Cheney, 2008). Thus, attributing the difference to changes in the relative reinforcement rates is not an obvious solution. This corresponds with previous research indicating rules may reduce behavioral variability however, in relation to these data this is an empirical question suited for further research.

Performances for all groups was comparable to those found related to non-verbal organisms after attaining some experience with the apparatus. Response rates were generally higher on the RR component than on the RI component, overall and during treatment alone. This also applies when correcting for the number of sessions the individual components was assigned left and right buttons, indicating groups being sensitive to RR versus RI schedules despite a potential rule of high rate right-button responding. Relative rates indicate a distribution of approximately 60% to RR schedules and 40% to RI schedules across groups and in the overall experiment (relative reinforcement rates of course programmed). All groups however, distributed the majority of clicks (relevant to S^Dconditions) towards the right button during baseline (Matthews et al., 1977).

It has been claimed the only way to confirm whether behavior is rule-governed or contingency shaped is pitting rules and contingencies against each other, examining the behavioral product (Catania et al., 1989). Even then, if discriminating and deeming rule-governed behaviors those insensitive to the raw contingencies (see for instance Catania et al., 1989, p. 121), we may be fooled by our biased perceptions causing us to ignore feedback or confounding controlling variables. Additionally problematic, the occurrence of private antecedent self-instructions based on previous learning histories can hardly be precluded, should the behavioral products not differ (Skinner, 2000). If not exposed to an identical previous situation, organisms may certainly generalize upon previous experiences with similar stimuli. The fact remains, the study of rules and contingencies that might produce comparable results renders us somewhat helpless in determining which is which, as responding can be sensitive to either or both (see Hayes, Brownstein, Haas, et al., 1986, pp. 144-145). Although of interest in experimental settings and on conceptual levels increasing the understanding of human behavior, in practical life, distinctions are necessarily less relevant, as observers cannot be sure of what stimulus properties regulate a response (Pierce & Cheney, 2008).

If faced with behavior apparently insensitive to (any of) its contingencies, is it not always because some aspect of the controlling contingency is unavailable to the observer (private rule, uncovered raw contingency)? Thus, irrespective of the origin of the behavior, if seeking behavioral change, the question remains if and how behavior is most effectively manipulated by verbal antecedents. The discriminated operants in this study is probably predominantly rule-governed, however, if anything contingency shaped, differential consequences also predominantly verbal (Catania et al., 1989). Consistent with previous research, it seems specific instructions as a variable can reduce behavioral variability. Probably qualifying as “verbal behaviors shaped by contact with contingencies” (Catania et al., 1989, p. 146), the shaping contingencies being verbal, the discriminative instructions group shows greater numbers of explained schedule sensitive behavior by participants than the other groups, however they have a consistently low response rate compared to the other groups. There are indications of general rules occasioning greater variability in repertoires despite points not exchanging for tangible conditioned reinforcers. It seem not necessarily so that all rules restrict variation in behavioral repertoires, at least there seem to be possibilities of manipulating degree of variations along the continuum of general to specific (Wulfert et al., 1994). This in accordance with previous research indicating type of rule to mediate behavioral variability (Catania et al., 1989; Hayes, Brownstein, Haas, et al., 1986; Matthews et al., 1977; Wulfert et al., 1994).

Limitations and Reflections on Validity

Findings suggest there are initial differences in response rates. While the control group and general instructions group accounts for 51% and 30% of the clicks respectively, participants in the discriminative instructions group accounted for merely 19% of total clicks during baseline condition. Somewhat evening out throughout the experiment, the discriminative instructions group had a consistently lower overall response rate. This may be an expression of experimental conditions representing instructed behavior as this group was specifically informed on how to test prevailing contingencies by “waiting”. However, as differences are also present during baseline, selection bias cannot be ruled out. In an effort of refuting initial differences, relative within group ratios was applied to calculations and a data set controlling for initial differences established. In order to increase experimental control related to baseline conditions, later experiments should consider baseline to last two or more sessions, or if faced with fatigue effects, instructions to be given at a later stage not necessarily extending the experiment in itself (Shadish, Cook, & Campbell, 2002). While it may be that the reinforcing value of points are weak and differing across participants, there are no indications of this representing a problematic issue in the data of included participants. However, it might have affected the performance of participants withdrawn, especially the participant frequently leaving the experimental room for further directions and the one who withdrew due to personal reasons.

While the keyboard on laptops was deactivated during sessions, it turns out the touchpad was not, leaving participants with the opportunity to use both, in practice possibly adding operants to the experimental condition. Although the response class probably would be the same for additional operants, and no one commented on using the touchpad, an effect on results cannot be ruled out. Reliability and validity of data should otherwise be satisfactory per se, data collection exclusively digital and standardized for all participants. While non-parametric tests do not rely on the restrictive assumptions of parametric tests, assuming amongst other things samples to be normally distributed, the Kruskal-Wallis test investigates whether the sample curves are significantly different comparing median ranks of the respective sub groups. The disadvantage however, are loss of information associated with spread of data (Chan & Walmsley, 1997; Field, 2013; Pallant, 2001).

Directions for Future Research

The conditions under which instructions are effective is of fundamental importance analyzing human behavior. Taking an applied perspective it would certainly be interesting further exploring if and how manipulation of rule characteristics may induce explained levels of matching by participants. This study includes participants having a relatively broad age range and occupational background, and did, besides not primarily test psychology students of whom perfectly well may have a verbal repertoire "knowing of" reinforcements schedules, collect data pertaining to potentially influencing variables (Matthews et al., 1985). It is interesting then, as previous contingencies are what makes rule following effective, noting that the participants of whom behavior is best accounted for applying the generalized matching equation reported having no previous formal knowledge of reinforcement schedules.

However including 53 participants, the individual group samples was small and not normally distributed, precluding the application of parametric tests. Increasing sample sizes to see if results hold is most definitely food for thought. Whether the testing of contingencies would have produced different results had the rule been inaccurate or describing negatively reinforcing events remains an empirical question suitable for future research. Potential subsequent experiments should alternate the sequence of active buttons, to tangle out whether the apparent preference stems from species-specific bias, temporal or physical contiguity or a potential behavioral contrast. Reinforcers offered are most definitely substitutable, see for instance Pierce and Cheney (2008) or Williams (1983) on behavioral contrast in multiple schedules.

Concluding Remarks

The results of this study increase generality of previous findings based predominantly on single subject designs. Indications are apparent sensitivity manipulates also in instructed verbal behaviors with verbal consequences, producing significant differences on group levels. Whether what is measured is in fact genuine sensitivity, or in reality rule-governed behavior, is difficult to untangle and not necessarily of crucial importance pertaining to everyday organizational life. Choice will always come down to matching of consequences. As such, knowledge of reinforcement schedules, attention to competing contingencies and values of reinforcement, how they manipulate and may be manipulated, cannot be overlooked. The simultaneous workings of three level selection however, renders a result of operant behavior sensitive to differential verbal stimuli. As such, the results of this study indicate that level of stimulus control, attained by *how* knowledge is conveyed, should be taken into account given the type of contingencies described by the rule. If consequences are dangerous or adverse, indications are the rule should be specific defining behavioral precursors in order to attain as strict stimulus control as possible. Information pertaining to how contingencies may be tested does not necessarily generate variability in responses, rather it seems rendering little variability and greater predictability in and of responses. If the contingencies are rapidly changing, or high variability in behavior is otherwise called for, indications are the rule should be general, allowing for less strict stimulus control and greater variability in responses.

Data indicate groups overall being sensitive to differences in reinforcement rates, however with the generalized matching equation accounting for a considerable higher number of participants' behavior in the discriminative instructions group. This study does not embark on consequences of inconsistent rules.

In an applied setting, like that of approximating the phenomenon of downsizing decisions, it is as such tempting with these data in hand to suggest a combination of a general and specific rule, utilizing simulations to establish contact with remote contingencies, pointing up contingencies and map feedback loops (Skinner, 2000; Sterman, 2000). In this way an attempt may be made harnessing the complexity, rather than controlling it (Axelrod & Cohen, 2001). Software are generally easy to come by, and some empirical data relevant to define precursors for individual organizations should, at least to some extent for larger cooperation's, be available in fiscal reports. If simulations were based on "big data", say under the direction of a governmental statistical institute, logarithms might include the possibility to discriminate cost savings from decreased earnings among industries, hierarchical levels, occupational direction or even type of position potentially downsized. Along with other macro-economic variables like that of price and wage indexes across countries and continents, this could allow for adherence to a general rule with specific precursors, thus increase predictability by a system generating context specific rules (S^D). Simulations would perhaps serve as an appropriate antecedent alleviating bounded rationality, contributing to complementary solutions, not only on the level of a discriminative stimuli (S^D, S^Δ, S^{ave}) securing a higher degree of prediction of events in complex settings, but depending on general knowledge of such a possibility also serve as an MO (Bar-Yam, 2003; Simon, 1955).

Based on the notion of social control the value of competing reinforcing events (like that of individual incentives) would conceivably be affected. It could perhaps also serve to adjust the pressure on top executives of whom decisions to downsize are negatively reinforced by keeping the board on arm's length, or inform executives if the immediate financial results based on short-term cost cutting like those linked to downsizing, as studies indicate, come at the literal expense of future profitability based on respective contexts. Shifting attention from short term negatively reinforced "fire-control" to longer-termed positively reinforced continuous change strategies may also allow for increased stability in performance and variability in organizational repertoires. Variation is the stuff "innovative solutions" and "competitive advantages" amount from in knowledge based industries, however to date relevant across industries, seen as technologic advances permeate society (Axelrod & Cohen, 2001; Daniels, 2006; Sandaker, 2009; Sims & Lorenzi, 1992).

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Table 1.

Ratio distribution of clicks between and within groups, and across conditions.

Session	Total Clicks				S^{d}_{MULT}				S^{Δ}_{MULT}				S^{d}_{p}				S^{Δ}_{p}			
	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE
Between groups																				
BL	.51	.30	.19		.52	.29	.18	.87	.53	.24	.23	.07	.41	.39	.19	.04	.30	.45	.25	.03
2	.38	.35	.27		.39	.35	.27		.34	.34	.32		.33	.37	.30		.16	.11	.74	
3	.34	.34	.32		.34	.34	.32		.29	.53	.18		.34	.31	.35		.38	.20	.42	
4	.33	.38	.28		.33	.38	.28		.38	.47	.16		.34	.38	.28		.18	.40	.43	
5	.33	.35	.32		.33	.35	.32		.20	.61	.19		.33	.35	.32		.29	.35	.37	
6	.34	.37	.29		.34	.37	.29		.26	.56	.18		.33	.36	.31		.20	.16	.63	
7	.32	.35	.33		.32	.35	.33		.26	.50	.23		.32	.34	.33		.26	.14	.60	
Session 2-7	.34	.36	.31		.34	.35	.31	.94	.30	.50	.21	.02	.33	.35	.31	.03	.24	.23	.54	.01
Within groups across sessions																				
BL	.10	.05	.04	.07	.09	.05	.04	.06	.28	.09	.19	.18	.10	.09	.05	.08	.23	.32	.10	.19
2	.13	.11	.11	.12	.13	.11	.10	.11	.13	.10	.20	.13	.14	.15	.14	.14	.11	.07	.27	.18
3	.17	.17	.18	.17	.17	.17	.18	.17	.09	.13	.09	.11	.15	.13	.17	.15	.17	.08	.09	.11
4	.13	.14	.12	.13	.12	.14	.12	.13	.23	.21	.15	.20	.16	.17	.14	.16	.10	.20	.12	.13
5	.18	.19	.20	.19	.18	.19	.20	.19	.08	.19	.13	.14	.15	.15	.17	.16	.18	.20	.12	.15
6	.13	.14	.13	.13	.13	.14	.13	.13	.10	.16	.11	.13	.15	.16	.15	.15	.10	.07	.16	.12
7	.18	.20	.22	.20	.19	.20	.23	.20	.09	.12	.12	.11	.16	.16	.18	.16	.12	.06	.15	.12
Per group across conditions																				
BL					.89	.86	.85		.07	.05	.08		.03	.05	.04		.01	.04	.03	
2					.94	.93	.89		.03	.03	.03		.03	.04	.04		.01	.00	.04	
3					.95	.95	.95		.01	.02	.01		.03	.02	.03		.01	.00	.01	
4					.91	.91	.93		.04	.05	.02		.04	.04	.04		.00	.01	.01	
5					.96	.94	.95		.01	.03	.01		.03	.03	.03		.01	.01	.01	
6					.94	.92	.93		.02	.04	.01		.04	.04	.04		.00	.00	.02	
7					.96	.95	.96		.01	.02	.01		.03	.03	.03		.00	.00	.01	
Session 2-7					.95	.93	.94		.02	.03	.01		.01	.00	.01		.01	.00	.01	

Note. N = 53, $n_1 = 18$, $n_2 = 18$, $n_3 = 17$. TE= Total Experiment, across groups. BL = Baseline. S^{D}_{MULT} = Active right or left lower buttons, S^{Δ}_{MULT} = Inactive right or left lower buttons, S^{D}_{p} = Clicks when center click is enabled, S^{Δ}_{p} = Clicks when center click is not enabled. Different decimal format relating to variables and method is set to accommodate relative numbers under .05, however consistent within variable and method. No significant differences revealed ($p < .05$).

Table 2.

Discrimination Indexes in percent. Mean results per group, button, session (RR20 RI10) and treatment.

Session	I_{D1}				I_{D2}				I_{D3}				I_{D4}			
	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE
BL	92	90	88	91	68	57	54	80	93	94	91	93	91	90	88	90
2	97	97	93	96	86	91	53	86	97	97	96	97	97	97	93	96
3	98	97	98	98	81	88	80	88	99	98	99	98	98	97	98	98
4	95	94	97	95	89	80	74	88	95	95	98	96	95	94	96	95
5	98	96	98	97	81	78	76	89	99	97	99	98	98	96	98	97
6	98	96	97	97	88	91	69	93	98	96	98	97	98	96	97	97
7	98	98	98	98	86	93	73	89	99	98	99	99	98	98	98	98
Min Treatment	95	94	93	95	81	78	53	86	95	95	96	96	95	94	93	95
Max Treatment	98	98	98	98	89	93	80	93	99	98	99	99	98	98	98	98

Note. N = 53, $n_1 = 18$, $n_2 = 18$, $n_3 = 17$. BL = Baseline. $I_{D1} = (S^{d}_{MULTp})/(S^{d}_{MULTp} + S^{\Delta}_{MULTp})$. $I_{D2} = S^{D}_{p}/(S^{D}_{p} + S^{\Delta}_{p})$. $I_{D3} = S^{D}_{MULT}/(S^{D}_{MULT} + S^{\Delta}_{MULT})$. $I_{D4} = S^{D}_{MULTp}/(S^{D}_{MULTp} + S^{\Delta}_{MULTp})$. S^{d}_{MULT} = Active right or left lower buttons, S^{Δ}_{MULT} = Inactive right or left lower buttons, S^{D}_{p} = Clicks when center click is enabled, S^{Δ}_{p} = Clicks when center click is not enabled. S^{D}_{MULTp} = Clicks active buttons + Clicks when center click is enabled. S^{Δ}_{MULTp} = Clicks inactive buttons + Clicks when center click is not enabled. No significant differences revealed ($p < .05$).

Table 3.

Group mean, median and standard deviations. Discriminative conditions, points and active buttons.

	S^{D}_{MULT}				$S^{D}_{MULTRR20}$				$S^{D}_{MULTRI10}$				S^{D}_{pRR20}				S^{D}_{pRI10}			
Session	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE
Grouped Mean																				
BL	301*	167	112*	195	126	68	39	78	175*	99	73*	117	4.6	3.2	1.7	3.2	5.8	6.7*	3.4*	5.3
2	416	376	303	366	190	207	137	179	226	168	165	187	7.7	10.4	7.4	8.5	6.7	**6.1**	**6.6**	6.5
3	560	556	552	556	369	369	406	381	191	188	146	175	9.2	8.1	10.3	9.2	6.6	**6.4**	**6.9**	6.6
4	**402**	**458**	362	408	**201**	**239**	165	202	201	219	197	206	9.6	11.6	7.5	9.6	7.6	7.6	7.2	7.5
5	594	628	607	610	415	421	461	432	**179**	**207**	146	178	9.1	9.8	10.2	9.7	7.4	6.8	6.7	7.2
6	414	451	377	415	214	254	188	219	201	198	190	196	8.5	11.0	9.5	9.7	7.6	6.7	6.3	6.9
7	620	668	679	655	424	453	491	455	**197**	**215**	188	200	9.6	10.9	11.5	10.7	7.0	**6.7**	**6.7**	6.8
Grouped Median																				
BL	342*	102	22*	79	120	24	11	19	195*	86	13*	69	4.0	1.7	0.6	1.1	6.2	7.8*	3.4*	5.5
2	408	391	278	366	195	242	116	181	230	167	164	170	6.0	9.5	7.0	7.5	7.2	**6.0**	**5.6**	6.5
3	703	568	545	635	457	403	404	412	230	221	141	190	9.7	8.5	10.3	9.4	7.6	**6.1**	**7.4**	6.9
4	**430**	**448**	343	409	**209**	**268**	148	194	239	223	190	207	10.5	11.5	7.0	10.3	7.7	7.4	7.3	7.5
5	664	668	664	671	476	459	518	478	**205**	**219**	96	147	9.5	9.7	10.8	10.1	7.0	7.5	6.3	6.9
6	444	520	410	463	247	275	186	244	223	208	191	219	9.5	13.0	9.7	10.3	7.4	7.0	6.3	6.9
7	760	713	720	727	528	535	516	532	**199**	**224**	142	208	10.7	10.7	12.5	11.3	7.0	**6.8**	**6.7**	7.7
Standard Deviation																				
BL	246*	170	173*	211	111	82	69	95	145*	94	111*	124	4.6	4.2	3.1	4.1	3.1	3.0*	2.6*	3.2
2	291	194	183	229	150	115	95	124	144	114	111	125	6.8	7.1	6.2	6.7	2.7	**2.9**	**3.3**	2.9
3	388	313	241	315	256	204	193	216	144	127	106	126	6.7	5.1	4.8	5.6	3.5	**3.3**	**2.7**	3.2
4	**238**	**228**	187	219	**127**	**109**	103	115	119	145	136	131	6.1	5.4	4.7	5.6	3.0	3.7	2.0	3.0
5	340	330	307	320	228	215	232	222	**127**	**146**	123	132	5.6	6.4	6.1	6.0	3.1	2.8	3.1	3.0
6	246	227	206	225	134	126	120	127	123	121	124	120	5.4	6.9	6.7	6.3	1.8	2.7	2.2	2.3
7	376	339	310	338	256	225	229	234	**135**	**138**	130	132	6.5	6.8	5.8	6.3	2.5	**3.1**	**2.0**	2.5

Note. N = 53, n_1 = 18, n_2 = 18, n_3 = 17. TE= Total Experiment, across groups. BL = Baseline. S^{D}_{MULT} = Active right or left lower buttons, S^{Δ}_{MULT} = Inactive right or left lower buttons, S^{D}_{p} = Clicks when center click is enabled, S^{Δ}_{p} = Clicks when center click is not enabled. Different decimal format relating variables and method is set to accommodate relative numbers under .05, however consistent within variable and method. * $p < .05$ in dataset later adjusted for initial significant differences, significant changes ($p < .05$) from baseline in boldface.

Table 4.

Group mean, median and standard deviations. Responses to s-delta conditions, inactive buttons and surplus center clicks.

	S^{Δ}_{MULT}				$S^{\Delta}_{MULTRR20}$				$S^{\Delta}_{MULTRI10}$				S^{Δ}_{pRR20}				S^{Δ}_{pRI10}			
Session	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE	G1	G2	G3	TE
									Grouped Mean											
BL	23	11	11	15	11	4	5	7	12	7	6	8	3.4	4.2	3.3	3.7	1.6	3.4	1.1	2.0
2	11	11	11	11	5	1	3	3	6	10	8	8	2.2	0.7	6.3	3.0	0.2	0.9	5.9	2.3
3	8	14	5	9	3	11	4	6	5	3	2	3	0.3	0.8	2.5	1.2	3.4	1.2	1.7	2.1
4	19	24	8	17	11	11	3	8	8	13	6	9	1.0	1.4	2.9	1.8	1.1	3.3	2.4	2.3
5	7	22	7	12	3	4	4	4	4	17	3	8	3.4	1.7	2.7	2.6	0.5	3.0	2.5	2.0
6	8	18	6	11	3	1	2	2	5	17	4	9	1.6	1.5	3.8	2.3	0.6	0.2	3.4	1.3
7	7	14	7	9	4	1	3	3	3	12	1	7	0.2	0.5	3.4	1.3	2.5	0.9	3.4	2.2
									Grouped Median											
BL	4.5	2.3	4.0	3.5	1.9	1.3	2.4	1.8	2.2	1.0	0.8	1.3	1.7	1.3	2.3	2.0	0.5	0.9	0.7	0.6
2	2.3	1.6	2.0	2.0	0.3	1.3	0.4	0.2	1.9	1.6	1.3	1.6	0.5	0.4	0.3	0.4	0.2	0.2	0.2	0.2
3	1.9	1.8	1.3	1.6	1.8	1.3	1.3	1.5	0.3	0.3	0.1	0.2	0.2	0.3	0.2	0.3	0.5	0.4	0.3	0.3
4	2.6	1.7	1.4	1.8	0.6	2.5	1.1	0.3	1.7	1.7	1.1	1.6	0.4	0.3	0.2	0.3	0.3	0.5	0.2	0.3
5	2.4	1.4	1.4	1.7	1.8	1.0	1.3	1.4	0.9	0.2	0.4	0.3	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3
6	1.6	1.8	1.6	1.7	0.2	0.6	0.1	0.1	1.4	1.8	1.6	1.6	0.3	0.3	0.2	0.3	0.3	0.2	0.6	0.2
7	3.0	1.5	1.0	1.6	1.8	1.2	0.7	1.1	0.4	0.3	2.0	0.3	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2
									Standard Deviation											
BL	31.0	21.2	15.5	23.9	17.7	7.2	7.6	12.1	23.9	14.7	11.8	17.6	4.5	6.5	2.4	4.7	4.4	7.8	1.5	5.3
2	17.4	23.9	23.5	21.4	13.3	5.7	7.3	9.3	11.3	23.7	19.1	18.4	5.8	1.4	18.0	10.8	0.4	2.7	17.6	10.2
3	19.8	44.2	15.3	29.2	4.2	33.1	9.5	20.2	15.9	11.3	5.8	11.7	0.6	1.8	9.7	5.6	9.2	2.4	5.5	6.3
4	42.3	88.1	19.1	57.2	25.0	41.3	9.3	28.3	23.6	47.0	12.2	31.0	2.0	4.3	11.4	6.9	3.1	6.5	9.2	6.6
5	13.2	70.7	16.5	42.7	3.8	9.0	8.6	7.4	10.0	71.0	10.6	42.0	13.6	6.1	9.6	10.1	1.0	8.8	9.2	7.3
6	24.4	64.3	16.4	40.7	12.2	2.4	7.3	8.3	12.3	64.4	9.3	38.3	5.4	5.0	14.8	9.2	1.2	0.7	12.1	6.9
7	14.6	49.6	16.4	31.1	4.7	1.3	7.6	5.2	11.7	48.7	10.1	29.4	0.4	1.4	12.6	7.2	8.4	3.5	12.8	8.9

Note. N = 53, $n_1 = 18$, $n_2 = 18$, $n_3 = 17$. TE= Total Experiment, across groups. BL = Baseline. S^{d}_{MULT} = Active right or left lower buttons, S^{Δ}_{MULT} = Inactive right or left lower buttons, S^{d}_{p} = Clicks when center click is enabled, S^{Δ}_{p} = Clicks when center click is not enabled. Different decimal format relating to variables and method is set to accommodate relative numbers under .05, however consistent within variable and method. No significant differences revealed ($p < .05$).

Table 5.

Contingency testing

Session	S^{Δ}_{MULTp} G1	S^{Δ}_{MULTp} G2	S^{Δ}_{MULTp} G3	S^{Δ}_{MULTp} TE	$S^{\Delta}_{MULTpRR20}$ G1	$S^{\Delta}_{MULTpRR20}$ G2	$S^{\Delta}_{MULTpRR20}$ G3	$S^{\Delta}_{MULTpRR20}$ TE	$S^{\Delta}_{MULTpRI10}$ G1	$S^{\Delta}_{MULTpRI10}$ G2	$S^{\Delta}_{MULTpRI10}$ G3	$S^{\Delta}_{MULTpRI10}$ TE
Grouped Mean												
BL	28,06	18,11	14,82	20,43	14,28	8,22	8,18	10,26	13,78	9,89	6,65	6,65
2	13,61	12,61	23,35	16,40	6,94	2,06	9,41	66,08	6,67	10,56	13,94	13,94
3	11,44	16,06	9,24	12,30	3,00	11,67	6,06	6,92	8,44	4,39	3,18	3,18
4	20,94	28,22	13,71	21,09	4,50	12,33	5,71	9,92	9,44	15,89	8,00	8,00
5	10,89	26,17	12,29	16,53	6,22	5,78	6,82	6,26	4,67	20,39	5,47	5,47
6	10,33	19,50	13,00	14,30	4,72	2,06	5,59	4,09	5,61	17,44	7,41	7,41
7	9,78	14,94	13,35	12,68	3,00	1,78	5,88	3,79	5,94	13,17	7,47	7,47
Grouped Median												
BL	4,83	3,67	10,00	4,89	3,25	2,50	5,40	3,67	2,80	1,50	1,40	1,79
2	4,00	2,17	2,83	2,67	0,67	0,40	1,00	0,53	2,17	1,71	1,71	1,86
3	2,14	2,17	1,63	1,95	1,78	1,75	1,38	1,62	0,36	0,43	0,33	0,37
4	3,20	2,13	1,67	2,31	0,91	0,27	0,20	0,41	1,89	2,13	1,29	1,81
5	2,75	2,00	2,00	2,30	1,86	1,43	1,50	1,61	1,38	0,40	0,36	0,41
6	2,20	2,29	2,00	2,18	0,36	0,27	0,27	0,30	1,43	2,00	1,83	1,76
7	4,25	1,64	1,38	1,90	2,00	1,40	0,82	1,35	0,73	0,27	0,29	0,40
Standard Deviation												
BL	33,98	32,93	16,46	29,11	18,90	12,83	8,44	14,18	25,14	21,24	12,00	20,17
2	19,85	25,71	49,69	33,59	15,94	6,12	21,08	15,54	11,20	25,20	33,08	24,38
3	28,32	45,86	30,41	35,25	4,28	33,84	19,10	22,49	24,65	12,46	11,34	17,15
4	45,46	89,44	38,20	61,44	25,36	12,59	20,61	30,70	26,50	47,16	19,14	32,89
5	23,61	72,40	34,28	48,03	14,66	12,61	15,64	14,06	10,37	71,38	19,78	43,30
6	29,64	65,12	43,15	47,56	17,59	7,27	22,02	16,43	12,42	64,32	21,25	39,62
7	16,06	51,51	40,94	38,37	4,72	2,51	20,17	11,72	13,95	49,17	21,43	31,71

Note. N = 53, $n_1 = 18$, $n_2 = 18$, $n_3 = 17$. TE= Total Experiment, across groups. BL = Baseline. S^{Δ}_{MULTp} = Inactive right, left or center buttons, $S^{\Delta}_{MULTpRR20}$ = Inactive right, left or center buttons during RR20 components of the multiple RR20 RI10 schedule. $S^{\Delta}_{MULTpRI10}$ = Inactive right, left or center lower buttons during RI10 components of the multiple RR20 RI10 schedule. No significant differences revealed ($p < .05$).

Table 6.
Relative Response Rates RR20

Session	G1	G2	G3	TE
	Group Mean			
BL	.41	.37	.47	.42
2	**.39**	**.56**	**.45**	**.47**
3	.64	.69	.73	.69
4	.47	.53	.49	.50
5	.70	.67	.75	.71
6	.50	.56	.51	.52
7	.68	.65	.70	.68
Session 2-7	.59	.63	.65	.62
	Grouped Median			
BL	.41	.37	.44	.41
2	**.46**	**.52**	**.47**	**.48**
3	.64	.69	.71	.67
4	.47	.49	.51	.48
5	.68	.67	.76	.68
6	.49	.55	.50	.50
7	.67	.68	.66	.67
	Standard Deviation			
BL	.19	.15	.25	.20
2	**.15**	**.16**	**.17**	**.17**
3	.10	.11	.18	.14
4	.11	.19	.22	.18
5	.10	.15	.14	.13
6	.11	.16	.18	.15
7	.96	.19	.15	.15

Note. TE = Total Experiment. Significant differences across groups ($p < .05$) in boldface.

Table 7.
Participant demographic matching

ID	VAF	Group	Age	Gender	Schedule	Room	Occ.Dir
P027	.791	3	45	Male	No	2	Creative
P032	.830	3	49	Male	No	2	Mercantile
P050	.960	3	39	Female	No	2	Creative
P014	.996	3	36	Female	No	1	Mercantile
P034	.748	2	33	Female	Yes	1	Mercantile
P010	.658	1	40	Male	Yes	1	Social

Note. VAF = Variance Accounted For. Occ.Dir = Occupational Direction. Sorted by VAF, then Group.

Figure 1. Participant software interface during the two components of button-clicking sessions, left to right. The upper images as shown to participants, lower images with Mechner notations. The first image portrays an active left button signaled by the blue corresponding stimulus, center counter showing two points collected. The second image portrays an active right button signaled by the blue corresponding stimulus. The activated green stimulus over the right button signals click contingent point (RR20 RI10) available for collection on the bright blue center button.

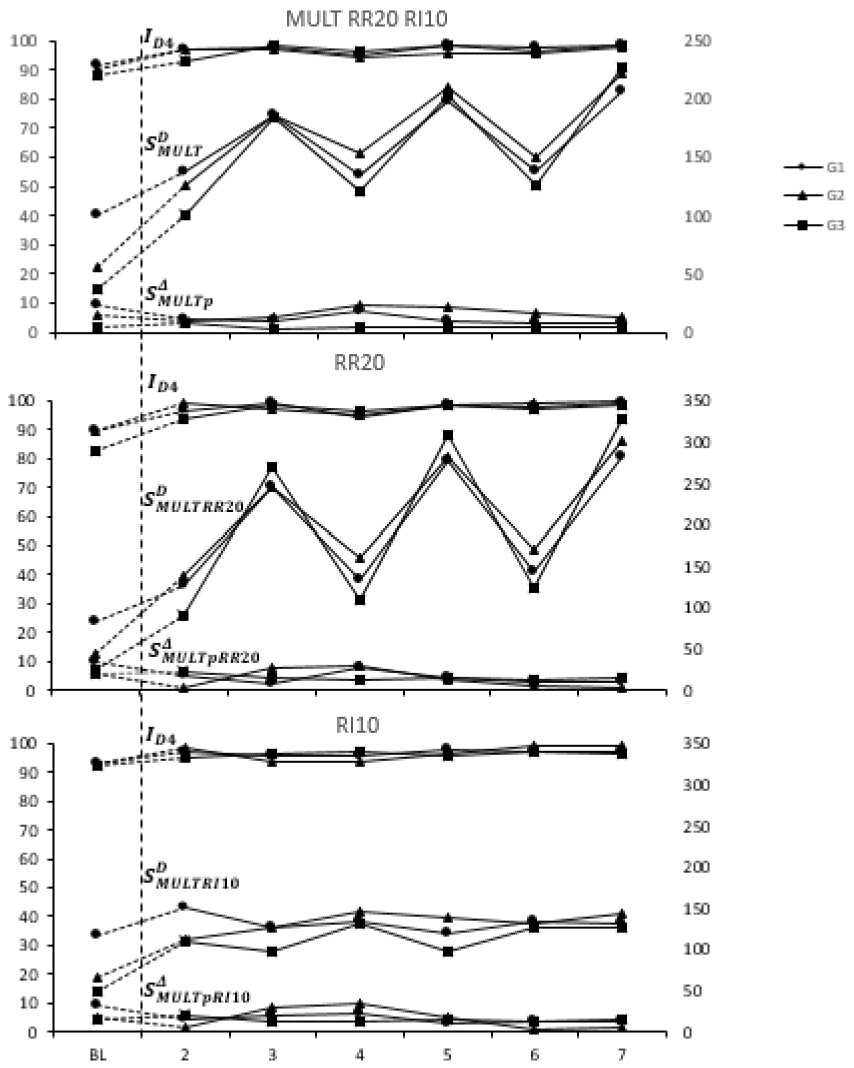

Figure 2. Discrimination Index 4 across groups, sessions and components

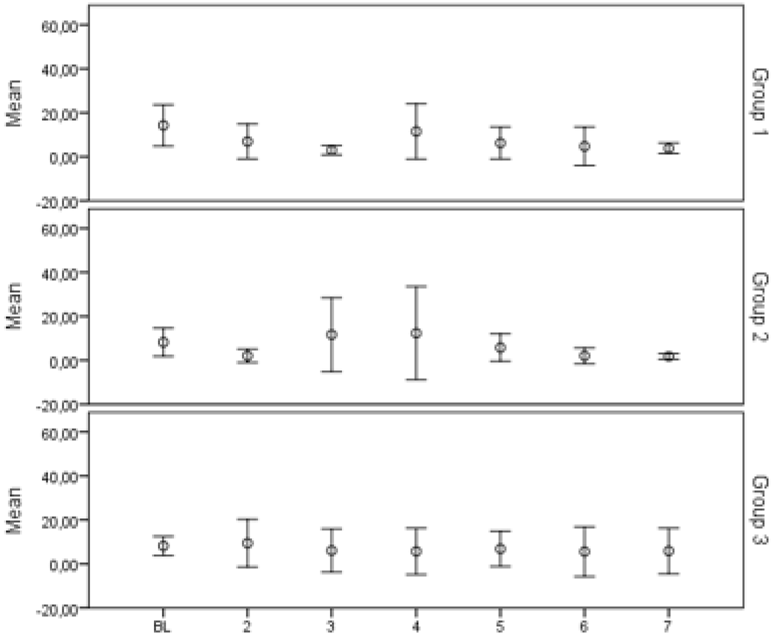

Figure 3. Variability in contingency testing per group during RR20 components session 1-7. Group means with error bars. Confidence interval 95%.

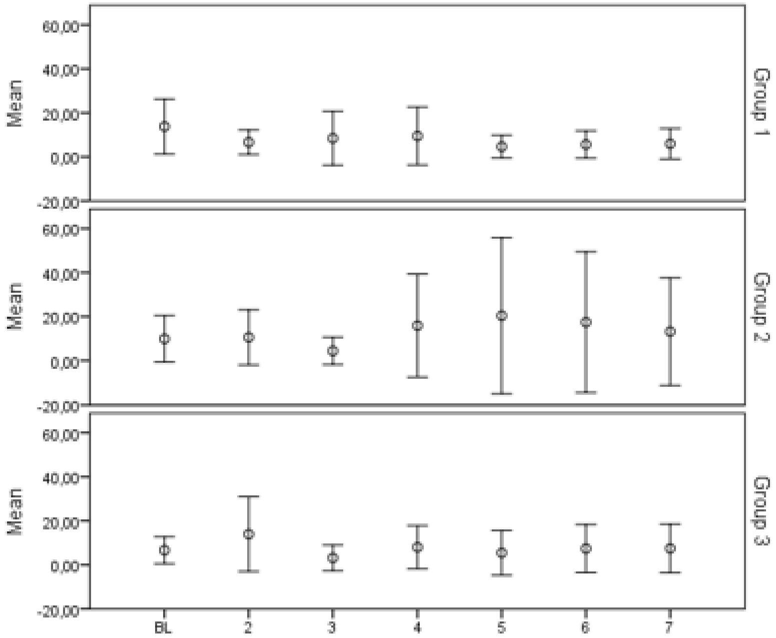

Figure 4. Variability in contingency testing per group during RI10 components, session 1-7. Group means with error bars. Confidence interval 95%.

Appendix A.

Studie av atferd relatert til valgsituasjoner

Informasjon til deltakere

Bakgrunn og formål med studien

I forbindelse med masteroppgaven ved linjen Læring i Komplekse Systemer på Høgskolen i Oslo og Akershus (HiOA), arbeider jeg med en problemstilling relatert til atferd i valgsituasjoner. Målsetningen er å lære mer om hvilke variabler som påvirker hvordan mennesker tar beslutninger. Formålet er å bedre forståelsen av hvordan kunnskap best formidles i ulike situasjoner. Masteroppgaven sorterer faglig under kategorien læringspsykologi, og foregår i lokalene til Høgskolen i Oslo og Akershus, Institutt for Atferdsvitenskap.

Hva innebærer det å være deltaker?

Selve forsøket har en estimert varighet på 45 minutter, og innebærer at du som deltaker spiller et enkelt spill på PC, der målet er å samle flest mulig poeng. Informasjon om hvordan og hva du til enhver tid skal gjøre vil fremgå av instruksjonene i programmet. Det er derfor viktig å lese de innledende instruksjonene grundig.

Forsøkene vil foregå ved at deltaker sitter ved en arbeidspult i rolige omgivelser i et eget, og dertil egnet rom, og skal på ingen måte påføre deltakerne ubehag, risiko eller andre ubeleiligheter. For at ikke resultatene skal påvirkes kan jeg i forkant av eksperimentet ikke gå ytterligere i detalj når det kommer til hva selve eksperimentet går ut på. Alle deltakere vil derimot rett etter at de har deltatt få en utførlig gjennomgang med mulighet til å stille spørsmål, se egne resultater, samt få informasjon om hvilke spesifikke variabler man har undersøkt og hvorfor. Deltaker står til enhver tid fritt til å avbryte forsøket eller trekke seg fra studiet.

Ansvarlig for forsøket er Karoline Giæver Helgesen. Karoline er masterstudent ved linjen Læring i Komplekse Systemer ved HiOA, og kan kontaktes på telefonnummer 930 16 953 eller karoline.helgesen@gmail.com. Eventuelle spørsmål kan også rettes til veileder ved HiOA, Jan Wright per mail jan.wright@hioa.no.

Anonymitet

Studiet er av ren forskningsmessig art, og vil utover informasjon om alder og yrke/ utdannelse, ikke innebære innhenting av personlige opplysninger. Alle resultater vil bli anonymisert, med den hensikt at det ikke skal være mulig å spore resultatene tilbake til den som har deltatt. Dette innebærer at resultater merkes med et deltakernummer, som ikke på noe tidspunkt kodes eller kobles mot navn. Det vil ikke under noen forutsetning bli oppbevart registre med navn eller oppgitt personlige opplysninger som kan bidra til identifisering av deltaker, ei heller i eventuelle publikasjoner av noen art.

Med vennlig hilsen

Karoline Giæver Helgesen

Masterstudent HiOA

Informert Samtykke

Jeg bekrefter med dette at jeg har lest igjennom, og mottatt egen kopi av informasjonsskrivet knyttet til studiet av atferd relatert til valgsituasjoner.

Jeg har fått svar på eventuelle spørsmål jeg måtte ha i tillegg til den skriftlige, og har mottatt kontaktinformasjon for henvendelser om jeg skulle ha flere spørsmål i etterkant.

Jeg er innforstått med at jeg når som helst kan velge å avbryte forsøket eller trekke meg fra studiet, og gir på bakgrunn av det overnevnte mitt samtykke til å delta i undersøkelsene knyttet til atferd i valgsituasjoner.

Sted/ dato Deltakers underskrift

Appendix B.
Detailed group demographics

	G1	G2	G3	TE
Included participants	18	18	17	53
Males	6	7	6	19
Females	12	11	11	34
Mean age	34	34	34	34
Previous knowledge of reinforcement schedules	8	9	5	22
Occupational Direction				
Social	6	8	5	19
Mercantile	7	5	5	17
Creative	3	2	3	8
Other	0	1	1	2

Note. Information collected post experiments, exclusively connected to assigned Participant ID, no coupling to TE = Total Experiment.

Appendix C. Participant experimental situation

Appendix D.
Available keyboard functions during button-pressing sessions.

Key	Function
F2	Dashboard
F9	Show/ Hide graph
F12	Swap schedules between buttons
F6	Stop session
Alt + F4	Exit programme

Note. Keyboard functions used post experiment to show graph during debrief, or to exit experimental session when participants withdrew. F12 was not used in relation to this experiment.