MASTER THESIS

Learning in Complex Systems

2016

Conceptual Approaches to Culture and Communication

Approaches From Each of the Three Levels of Selection

Mohsen Bahari

Faculty of Health Sciences

Department of Behaviour Analysis

OSLO AND AKERSHUS
UNIVERSITY COLLEGE
OF APPLIED SCIENCES

Acknowledgments

I wish to thank the following people for their help in writing this thesis. I am heavily indebted to Kalliu Couto Carvalho for providing ideas for the experiments and helping in performing the experiments. He has also been helpful in suggesting and discussing some of the theoretical basis, for the conceptual article. Furthermore, I would like to thank professor Ingunn Sandaker for the constructive feedback she has provided in the process of writing this article. Anne-Lise Stokken for helping with performing the experiments. Lastly, I would like to thank thank professor Gunnar Ree, for his thought provoking lectures, that sparked my interest in multilevel-selection.

Table of contents

Abstract

B. F. Skinner suggested that selection by consequences is a process that occurs at three levels. Natural selection, selection of individual behavior and cultural selection. In this article we explore the third level of selection, through selectionist perspectives rooted in fields that have primarily focused on one of the three levels of selection. Contributions from evolutionary biology, sociobiology and cultural materialism are presented, and compared to behavior analytic views, commonalities are highlighted. We show how communication may be an elemental part of organizing in groups, and how this assertion is consistent across the approaches. From insect colonies to human society, communication is essential in coordinating group efforts. The cooperation among individual members of a group working towards a common goal(s) is enabled through communication. In addition, human communication is a prerequisite for members to work towards common group goals as opposed to individual interest when these elements are in conflict. Furthermore, we draw some links between the three levels of selection, and look at how they may influence each other.

Introduction

The behavior analytic framework involves three levels of selection: 1) natural selection; the selection and transmission of genes through generations. 2) Selection of individual behavior; the shaping and maintenance of behavior through an individual`s ontogenesis. 3) Cultural selection; the transmission of cultural practices and social environments (Skinner, 1981). Behavior analysis has focused on discovering generative principles of behavior at the individual level, specifically how operant and respondent behaviors are selected and maintained through interaction with a selecting environment. (Cooper, 2007; Skinner, 1974, 1981). However, in a similar way that consequences play a role in the development of an individual's behavioral repertoire, cultural selection may explain how cultures evolve. Thus, behavior analysis may offer a suited platform for the further development of a science of culture, as the basis of culture consist of behavior at the individual level. A good place to start such an endeavor, is first and foremost with the selectionist perspective at hand. The process of selection may not abide by our constructed boundaries of these three levels, the levels of selection may be far more intertwined. Given this presumption, I will consider knowledge produced in fields that have mainly focused on natural selection, such as evolutionary biology (Jablonka & Lamb, 2014; D. Wilson, 2015; E. Wilson, 1962) and selection at the third level as anthropology (Harris, 1979), and attempt to relate them to a behavior analytic framework (Skinner, 1957, 1974, 1981). The main focus will be towards interaction/communication among group members in relation to group benefits. Furthermore, I will attempt to clarify how communication is considered a prerequisite for cultural evolution across the approaches. Also, how they may altogether offer an in depth view of the role of how communication may lead to benefits, from being

organized in groups or societies. In complementing the behavior analytic framework with approaches from other disciplines in the area of communication and cultural analysis we may gather an account of culture and communication across levels of selection, that can offer a more complete interpretation of these phenomena as opposed to focusing only on one level.

As mentioned, all of the approaches presented here, have their foundation in the selection process, and are rooted in natural selection. Thus, I will start by presenting some basic elements of natural selection, in order to establish common platform to the understanding of selection of organizing in groups. I will then continue by presenting some contributions from biology and cultural materialism to the understanding of selection of organized groups as cultures, and finally, I will present relevant elements from the behavior analytic framework. In the discussion, I will attempt to identify commonalities between the disciplines in their approaches to culture and communication.

A common platform; Natural selection, organizing in groups and communication

In this section, I will briefly touch on some basic elements of natural selection that were important in the buildup to the behavioral and cultural sophistication observed in modern human history. Natural selection presumably first occurred in the first molecules that came into existence with the ability to reproduce itself. Further reproduction gave way for the natural selection of gradually more complex cells and eventually multicellular organisms (Skinner, 1981). In the interplay with environment, organisms evolved complex biological functions (i.e. breathing, the regulation of bodily temperature, sneezing) that could be transferred to new generations by gene transmission. Each species is composed by a set of individual members belonging to the same gene pool, featuring similar traits, (e.g. like ability to hear, see, run). However, there are variations between individual traits, due to different

genes, mutations and previous environmental conditions (phenotype) (Jablonka & Lamb, 2014). Some may have sharper eyesight, while others may have more sensitive hearing abilities, or have a body type that is better suited for running etc.

Environmental conditions will determine which of those characteristics will facilitate the organism's survival and thereby its chances to reproduce, so that the successful trait will become prevalent in that species' gene pool. Therefore, when the environment changes, the contingencies of survival for members of a species may also change. For example, Ahola, Brommer, Karell, Karstinen and Valkama (2011) described a shift in a species of owls' tawny as a function of climate changes and, thereby decreased levels of snow in Finland. The owls used to be grey (pale), an attribute that functioned as camouflage with the snow making them less detectable to prey, in turn they would yield greater success in hunting for food. Over the last decades there has been a decrease of snow in the areas they inhabit due to (global warming) higher temperatures. The number of grey owls have also decreased while the number of brown owls have increased. The grey feathers which previously functioned as camouflage was now making the owls stick out in the environment, so they were more visible to prey and that made them less successful in their hunt. The brown owls were more successful in catching prey due to the environmental change, and so they have increased in numbers. This is an actual example of how a species physical characteristics are subject to selection pressure from survival contingencies.

At some point in history, living in groups became beneficial for individual humans. This would have increased the chances for survival for the members of these groups, when being confronted with possible threats there were/is safety in numbers and groups working together would have reached greater success in hunting and gathering. The groups with the most effective cooperation strategies would also reap greater success than groups with lesser strategies (D. Wilson, 2015). The time it took for the development from newborn to an

independent youth would also be a variable that favored organizing in groups, as early hominid species practiced alloparenting; “care of the young by individuals other than the mother.” Alloparenting would be beneficial as the parent would then be able to perform tasks as foraging for food or working, while someone else looked after their child (Jablonka & Lamb, 2014). In turn, these survival contingencies (selection pressure) would have enabled the selection of gradually more complex and effective interactions between the group members. In the development from rudimentary interactions in small groups to human organization in modern society, the role of communication became increasingly relevant. The communication between individuals enabled competitors to become allies working for common benefits in a coordinated manner. As the groups became larger, coordination of efforts had to become increasingly complex, thus the complexity of the communication must also have evolved in concession with the challenges of the group, allowing effective strategies to be formed. Several mechanisms have evolved and enhanced the efficiency of group living. One essential mechanism that developed is the control and structure of the vocal musculature that enabled language. (Jablonka & Lamb, 2014; Skinner, 1981; D. Wilson, 2015)

Another selected mechanism was the ability to learn through interaction with the local environment. Organisms who shared environmental information through communication were able to increase both their own fitness and their group. Accordingly individuals sharing the same environment, and interacting with each other may have met challenges in a more successful way, than individuals with lesser communicative abilities (D. Wilson, 2015).

Evolutionary Biology: communication and culture

(D. Wilson, 2015) presents his views on group selection in the book “Does altruism exist”. It is a behavioral approach to prosocial behavior, as opposed to a mentalistic approach. He takes the reader through different studies in the field and looks at similarities between organized functional units that consist of groups of insects and groups of humans. A group is functionally organized when the parts of the system (individual members) work together in a coordinated fashion achieving common goals. Some aspects are highlighted like the competition within individuals in a group and the competition between groups, the different advantages and disadvantages are exemplified mainly in a biologic perspective.

Furthermore, in the presentation of within group selection and between group selection, Wilson calls attention to the great success humans have achieved as a species. He argues that this success is partly due to the shift from the dominance of what he calls destructive within group selection to the predominance of between group selection and/or group-beneficial forms of within group competition. This shift was enabled through social control. The following citation underscores the importance of social control in the shift. “The kind of social control that suppresses destructive within-group competition but permits and often cultivates group-beneficial forms of within-group competition is part of what the concept of major evolutionary transitions is all about” (D. Wilson, 2015, p. 49).

In the field of sociobiology, communication is an essential part of coordinating group efforts. For example (E. Wilson, 1962) shows a study that reveals communication methods in ant colonies. Which consist of the release of a chemical odor trail that enables the recruitment of workers and designates the location of objects in space. This communication system allows the transmission of at least three information components (a) quality; includes both richness and quantity of food, measured by the number of workers responding (laying a trail, the accumulative result). (b) Compass direction of the food find. (c) Distance of the find from

the nest. An ant colony is dependent upon effective functional communication in order to attack larger prey or defend the nest from attacking adversaries. The ants can release 10-20 different chemical pheromones eliciting or signaling a variety of behaviors and information, from attack, escape, defend, food, new hive, queen and so on.

(Seeley, Visscher, & Passino, 2006) present a review of the research done on the group decision making process by honey bees. Through the review of extensive research that stretches over half a century, they show that honeybees communicate through a functional form of what is referred to as a waggle dance, through the dance (movement) the bees convey information to each other. The communication that is interacted consist of variables such as size, opening and directions to a potential nest cite. In this process, scout bees go out and locate potential nest sites, they may find several different locations, however there is usually only one scout that visits one of the potential cites (the scout can then not compare the different cites by itself). After the scouting process, the bees regroup and start the decision making process, the nest-cite selection in may lasted for 16 hours of dance activity spread over three days. During the first half of the decision making process, the scout bees reported 11 potential nest sites. During the second half, the dance representing one specific cite gradually became more advertised than others (more bees performed this dance). During the last few hours of the process, the cite that in the second half started to become predominantly represented, gradually became unanimously performed by 3000 waggle dances. In this process there are five features that are highlighted; (1) the scouts locate potential nest sites in all directions, up to 2 km from the swarm. (2) initially, the scout bees advertise a dozen or more nest cites but eventually they advertise only one. (3) within an hour or so after "consensus" is reached the swarm lifts off. (4) there is a crescendo of dancing just before liftoff. (5) the chosen cite is not necessarily the first to be advertised on the swarm. Furthermore, another very interesting point is that; after a few hours of dancing (rallying for a

particular cite), most bees cease performing the dance if they do not get additional followers during that time. This enables competing scouts or group of scouts to rally for their respective cite of "choice". The groups compete for additional dancers. One group of dancers grow in numbers and exclude its competitors. This is a leaderless process of group decision making. Here, it is the aspect of communication that is elementary in the process of decision making, a decision that will affect the whole colony. Thereby, the fact that the decision is taken in such a collective manner, also serves the group as a group dynamic and results in the achievement of a common goal.

We have now looked at communication in an evolutionary perspective, building from relatively simple forms to gradually more complex. Taking us to the most complex form, the human communication system. Jablonka and Lamb (2014) describe a set of different transmission systems, mainly regarding accounts of genetic, epigenetic and cultural transmission. Their view of human cultural transmission is referred to as the symbolic inheritance system, which helps to describe the transmission of cultural practices, through abstract concepts and symbolic communication. The interplay between natural selection and cultural evolution is also a significant part that may explain how the social environment has played a significant role in the selection of increased brain capacity in early hominid species. This coevolution enabled more efficient communication and gradually language. "…. language can best be thought of as a partially genetically accommodated communication technology whose evolution has been driven by cultural practices." (Jablonka & Lamb, 2014, p. 433.). Phenomenona such as "alloparenting was both a product and cause of social selection for the cooperation and information sharing that eventually led to language (Jablonka & Lamb, 2014, p 436). Collaborative efforts like food foraging, hunting, complex tool making and alloparenting required some form of instruction, and these processes could have been especially important in driving the evolutionary lineage of human communication.

This view suggests that culture came before language, and that language to some extent is a product of culture. However, in the detailed description it becomes clear that it is rudimentary culture that is suggested to have set the occasion for the coevolution of language and eventually (gradually) more sophisticated cultural practices. Rudimentary, in the sense of limited communication, restricted to simple hand gestures and imitation.

Jablonka and Lamb (2014) also refer to the work of neuroscientist Merlin Donald, which holds the view that language evolved from gestures, imitation and mimes. They also stress the point that the gestures and motor skills required for early communication were very similar to the skills needed for tool-making and other technological capabilities. Both (tool-making and communication) required motor-skills and social learning, the technological capabilities and gestural communication capabilities have most likely coevolved. That coevolution has then provided the neural scaffold for vocal communication, and in turn freeing the hands to perform other tasks while communicating vocally. Jablonka and Lamb (2014, p. 435-436) emphasize two critical points of which they consider to be overlooked in the evolution of human cooperative capacities. The first reflects “a change in social emotions” The second is “a change in human memory and imagination.” The definitions are as follows “For cooperation among our ancestors to improve, they had to become more tolerant, better at figuring out and accommodating to the mental states of others, and more able to control their emotions,”. This is exemplified by the emotional control needed to learn a skill or task by another group member. Most of us have been subjected to the tolerance and patience needed in teaching or learning a complex task. Subsequently the sensitivity to social approval or disapproval from other group members increased. The second part is related to the increase in brain capacity, that enabled humans to deal with abstract concepts such as time and probability.

Cultural materialism: communication and culture

Harris (1979) presents an approach to analyzing culture, in which he divides culture in three categories; infrastructural, structural and superstructural. This is a conceptualization of constituents in a sociocultural system, they are interrelated, and therefore a change in any one of the components usually lead to a change in others. In this session, I will attempt to describe the taxonomy described by Harris, followed by relevant elements of infrastructural, structural and superstructural components.

The purpose of Harris (1979) taxonomy is to analyze the communication within a group or culture. In his taxonomy, Harris distinguishes two operations, emic and etic. In short, emic operations consists of acquiring knowledge that represents the categories and rules that one must know in order to be able to think or act as a member of the group or culture that is subject for analysis. While etic operations consist of accounts that can generate scientifically productive theories about sociocultural differences and similarities. “Etic operations often involve the measurement and juxtaposition of activities and events that native informants may find meaningless or inappropriate.” (Harris, 1979, p. 32). In a simplified account, emic operations are the categories and rules that members of a particular culture would assign causation to for a particular cultural practice, belief or idea. While etic operations consist of the scientifically testable theories regarding the cultural practice in question, they do not necessarily coincide with the emic accounts as they are designed to reveal functional relationships between the group behavior or cultural practices and the consequences in which they produce in relation to the groups environment or structure.

Infrastructure “is the principal interface between culture and nature, the boundary across which the ecological, chemical and physical restraints to which human action is

subject interact with principal sociocultural practices aimed at overcoming or modifying those restraints."(Harris, 1979, p. 57). This approach is rooted in the fact that human beings like all living organisms have to use energy in order to obtain energy, and in order to obtain energy humans must interact with nature. Cultures (groups of people) develop strategies in order to overcome or modify the energy consumption and production in the most efficient or optimal way with the available technology within the culture in question.

Structure consists of the organization of domestic and political strategies and elements of influence on economy. The domestic economy is how the family (families within a culture) are structured, the domestic division of labor, domestic socialization, enculturation, education, age and sex roles, hierarchies and sanctions. Political economy is the organization of exchange and consumption within and between bands, villages, chiefdoms, states and empires. Elements of influence in this component is political organization, corporations, division of labor, taxation, social class, caste, police/military control and war.

Superstructure consists of cultural practices like art, music, dance, literature, rituals, sports, hobbies and science. Emic elements within this component are defined as "the conscious and unconscious cognitive goals, categories, rules, plans, values, philosophies and beliefs about behavior elicited from the participants or inferred by the observer." (Harris, 1979, p. 54)

Harris emphasizes the interdependency between the components in the following quote; "Productive and reproductive processes are functionally dependent on etic domestic and political organization, and the entire etic conjunction is functionally dependent on ideological commitments to values and goals that enhance cooperation and/or minimize the costs of maintaining order and an efficient level of productive and reproductive inputs. It follows from this that ideologies and political movements which lessen the resistance to infrastructural change increase the likelihood that a new infrastructure will be propagated and

amplified instead of dampened and extinguished." (Harris, 1979, p. 72) The strategies a culture use in order to tackle its challenges in relation to obtain and consume energy are restricted to the context of the culture. The context consists of the structure of the political and domestic organization together with the available technology. Methods and strategies for overcoming ecological restraints may change with the help of ideological commitments to values and goals that are in concession with and facilitate such a change. A highly relevant example of this can be analyzed in the much needed shift of energy sources for human society. Regarding the current climate changes, we are subjected to, there is a need for a change from using fossil fuels to renewable energy or energy that does not pollute the environment. Corporations and governments have grown powerful from the large consumption of fossil fuels and this energy source is still available for these corporations and governments. There is decent technology in alternative energy sources, but more is needed (superstructure). However, there have been made huge investments in extracting oil and gas and also in developing new technologies, the global economy is dependent upon the consumption of fossil fuels, so there is great resistance for an infrastructural change to be propagated. Accordingly, the corporations and governments (the structure) will not facilitate a change in energy sources (infrastructural change) unless there are extensive commitments to the values and goals (emic operations), of changing to a more environmentally friendly energy source (infrastructural change).

The importance of communication is stressed through all the three divisions; "Communication, including speech, serves a vital instrumental role in coordinating infrastructural, structural, and superstructural activities; hence it cannot be regarded as belonging exclusively to anyone of these divisions."(Harris, 1979, p. 54). Furthermore, he also states that it is not ideas, rules or inventions that shape cultures, but it is the culture that shape the individuals to invent solutions and make rules in accordance to the challenges they

face. "…the conclusion seems inescapable that when the infrastructural conditions are ripe, the appropriate thoughts will occur, not once but again and again. Furthermore, there is ample evidence to indicate that some of the greatest inventions ever made- for example, agriculture – were known in thought for thousands of years before they began to play a significant role in the infrastructures of prehistoric societies." (Harris, 1979, p. 59). In this approach Harris argues that groups are and always have been subjected to environmental stress, and their culture offers strategies to cope with the environmental challenges, however it is not given that the members of the group can state the environmental function of a given cultural practice.

Behavior analysis: communication and culture

Communication is not restricted to language, there are more aspects that are encompassed in the category of communication. Aspects such as body language, facial expressions, gestures and more. In the behavior analytic approach to communication, verbal behavior may offer explanations and generative principles to all these aspects of communication. Verbal behavior is considered operant behavior and is subjected to the same principles that govern behavior in a broader context. Operant behavior is learned through experience, a discriminative stimulus that signals the availability of a reinforcer given a certain response/behavior is (occasionally) followed by a reinforcer. In the presence of its parents, an infant will be reinforced for performing rudimentary vocal sounds (babbling), these sounds are gradually shaped into words and over time, to sentences and abstract concepts through differential reinforcement. Skinner (1957) defined verbal behavior as behavior reinforced through the mediation of another person's behavior. His definition of is not restricted to vocal behavior, all aspects of interaction between two or more people is

captured by the definition. Hand gestures, facial expressions, basically, anything a person can do to influence the behavior of another person.

The development of verbal behavior allowed individuals to benefit from what other members of the group had experienced. By repeatedly being subjected to a contingency of reinforcement or punishment, an individual may form a rule that specifies the experienced contingencies, the individual may then communicate the rule to other members of the group. When teaching skills to other members of the group, instructions are given. These instructions are beneficial, as the individual receiving them does not necessarily need to be subjected to the environmental contingencies in order to learn a skill, avoid dangers or uncomfortable events. A common example is someone learning to drive, learning this skill without someone giving instructions would be highly hazardous. Children are taught from an early age to follow instructions, they are reinforced for following rules and occasionally punished for breaking them. These contingencies most often continue throughout an individual's lifespan.

The verbal community arrange reinforcement contingencies in order for its members to follow instructions. Eventually the instructed behavior may be followed by nonverbal stimuli/reinforcement, independent of the mediation initially arranged by the verbal community. In learning a complex skill, it may take an extensive number of trials to master the skill. It is usually more economical to receive instructions or tips from someone that already masters the skill. The arrangement of discriminative reinforcement by another individual can decrease the time and effort in attaining the new skill. For example, an individual learning how to fish a certain species of fish, the learner may receive instructions. In terms of what types of bait to use, tips on positioning and what times of the year or day it may be advantageous to explore this skill. This enables the learner to acquire a skill or a set

of skills with far less effort, than if he had tried without any tips, the behavior might even have been subject for extinction if he would be unsuccessful in his solo attempt.

As earlier mentioned, people living in groups or societies have at some point been reinforced for following rules, so the behavior is arguably in any way operant/contingency shaped behavior (Skinner, 1974). Distinguishing between contingency shaped and rule-following behavior fulfills the purpose of analyzing to which extent a behavior is shaped and/or maintained by the social or non-social environment. Behaviors that are shaped by the social environment are an essential part of cultural evolution, as they are learned through contingencies arranged by the group of which the individual is a member (Baum, 2005).

An individual's social environment, shape the individual's behavior in accordance to group manners and customs through the processes of reinforcement and punishment. These manners and customs are often intertwined with the effects of behavior, in interaction with the non-social environment. The techniques a cross-country skier uses are the most energy efficient way of moving in the given terrain (snow), the techniques are most often learned through the mediation of social consequences arranged by the individual's social environment or culture. In this way skills and "values" are transmitted within a culture and across generations. These skills, values, customs and manners are classified as cultural practices. A group's cultural practices may have had a survival value in the past, and the culture with a specific set of cultural practices may have survived in competition with other cultures. However, even though a certain cultural practice may have had survival value in the past, the environment may change and the consequences of the given practice may no longer produce favorable outcomes for the group. Then, the environment may select a variation of the cultural practice or a new mutation may occur, a completely new cultural practice may evolve, much like the process of natural selection. A culture evolves when its practices "contribute to the success of the practicing group in solving its problems." "It is the effect on

the group, not the reinforcing consequences of individual members, which is responsible for the evolution of the culture." (Skinner, 1965; Skinner, 1981, p. 502).

Discussion

Evolutionary biology in relation to Behavior Analysis

The cooperating mechanisms found in insect colonies, such as ant colonies are predominantly originated and transmitted through natural selection (Bourke, 1999). Within human society, individual preferences may become more dominating than serving group interests or altruistic behavior. Such pro-group behaviors must be administered through the individual's social environment or culture. "The kind of social control that suppresses destructive within-group competition but permits and often cultivates group-beneficial forms of within-group competition is part of what the concept of major evolutionary transitions is all about" (D. Wilson, 2015, p. 59). The type of social control that D. Wilson is referring to is also described by Skinner (1965) in the control exerted by the individual's verbal community through rule-governed behavior, as it is the social environment of a group member that facilitates the group beneficial behavior, making the individual's behavior an asset to the group or culture.

Whether the group consists of insects, birds or humans a coordinated action to reach a common goal requires communication of some sort. However, the individual members do not necessarily need to be "aware" of the common goal or the function of the coordinated action, the individual members merely follow the contingencies they are subjected to. This is shown in the studies of insect colonies, where individual efforts make up a symphony of group level functions.

The communication methods of ants and bees shows that relatively simple communication signals may facilitate the coordination of individual behaviors that are beneficial to the group, hive or colony. However, there are two important distinctions, between insect colonies and human groups that must be addressed; (a). The communication methods of for instance ants, consist of chemical signals, in which is predominantly biologically transmitted, as opposed to the human verbal behavior that is predominantly learned through the individual's social environment. (b). An insect colony is more or less genetically homogeneous, as its individuals stem from the same queen. As opposed to a human group or society that is far more genetically diverse. Accordingly, the insects may be genetically inclined to cooperate (Dawkins, 2006).

The human group must develop reinforcing consequences for its individual members so that they act in accordance to the benefit of the group. "What is good for the individual or culture may have bad consequences for the species, as when sexual reinforcement leads to overpopulation or the reinforcing amenities of civilization to the exhaustion of resources; what is good for the species or culture may be bad for the individual, as when practices designed to control procreation or preserve resources restrict individual freedom; and so on." (Skinner, 1981, p. 504). The human verbal behavior enables self-control, and thereby individuals to learn to suppress their inclination for reinforcers according to group norms, customs or manners. Thus self-control is essential in cooperation between humans, as verbal behavior or communication plays an important part in keeping individuals working towards group benefits or common goals. Furthermore, there is a distinction between cultural practices that evolve naturally and the ones that are administered by the group or society. The first is a process that occurs without a controlled intervention while the latter is a procedure that is designed.

In complex communication systems, such as the symbolic inheritance system. Humans have the potential to communicate through a symbolic system. Where information and experience can accumulate, which is an important part of cultural evolution. The

symbolic inheritance system is described mainly as a communication system that enables the accumulation of knowledge. Hayes and Sanford (2014) argue that the evolutionary approach of the symbolic inheritance system strengthens the behavior analytic approach of stimulus equivalence and the relational frame theory. Many of the same or similar phenomena have been defined and studied within the behavior analytic framework, phenomena such as the forming of abstract concepts, how a symbol is a part of a network of references and how young children acquire language. It is interesting that two fields land on such similar phenomena to be essential in language development. These phenomena are studied within the behavior analytic field of stimulus equivalence (Cooper, 2007). Jablonka and Lamb (2014) bring some very interesting aspects to the table in that they suggest how the culture of communication or language has coevolved with natural selection, and how these two phenomena are mutually dependent. Among other aspects, this part of their approach is complementary to the behavior analytic view and that it offers an in depth view of the intertwined relationship of selection across levels. "Human behavior is the joint product of natural selection, selection of individual behavior and special contingencies arranged by an evolved social environment. (Culture)" (Skinner, 1981, p. 502)

Cultural Materialism in relation to Behavior Analysis

Harris, (1979) clearly states that it is behavior at the individual level that in aggregate makes a group behavior, the individual acts according to the context it is subjected. This is exemplified by how victims of a caste system support that very system. "Those that benefit the least from such a system ardently support it." and "…the victims of the caste system cannot base their behavior on long-term abstract calculations." Harris (1979 p.62.) Given that individuals seek to maximize their individual benefits, the behavior of an individual may not be compatible with the "optimal" group benefits. The individual's inclination to

maximization of resources may lead to the depletion of resources. The overall energy production may decline as a result. An example may be if an individual hunts a prey and kill animals at a higher rate than that particular species of animals would be able to recuperate from the losses. This would lead to a depletion of that particular prey for other group members. A more relevant example might be a person living in a city, the amount of energy that individual may consume in his or her daily routines, like driving to work, washing clothes, purchasing products like food and other consumer items and so on. Such "normal" routines contribute to the global overconsumption of energy in which has led us to the climate changes we now are subjected to. These habits have been established as merely routines for subsistence but also for maximization of benefits or rewards. This may have conflicting group effects. The economic markets will benefit, as they are dependent upon consumers to buy their products. While the accumulative environmental effects of extensive energy consumption are disastrous to the global eco system.

We may draw parallels between emic end etic operations to the behavior analytic approach of rule-governed behavior. Emic operations may be regarded as the verbal behavior in a group that maintains a certain cultural practice. This verbal behavior may consist of rules, customs, manners, values and such that function as controlling or guiding elements for members of the group. While etic operations may be regarded as the function a cultural practice has for the group in interaction with the environment. Another important point of contact between these disciplines is mentioned by Harris; "As a species we have been selected for our ability to acquire elaborate repertoires of socially learned responses, rather than species-specific drives and instincts." (Harris, 1979, p. 62). In this citation Harris suggests that our susceptibility to social learning has been selected biologically. This is very much in tune with the behavior analytic view. Furthermore, the distinction between the three components of infrastructure, structure and superstructure offer tools that may be helpful in

analyzing the dynamics of modern culture. They account for the practices that the culture use to overcome challenges to obtain and use energy. They may account for the limitations posed by the context and organization of governing bodies in addition to science, technology, rituals and so. In the emic and etic distinction together with the quote about our genetically transmitted susceptibility for social reinforcement and learning, Harris has touched and treated the same three levels of selection as behavior analysis does. There are several relevant contributions we may reap from this approach, some of which are the connection between individual contingencies in concession with group functions in regards to ecological challenges, in the light of the context of the culture.

Summary

In Evolutionary Biology communication is fundamental in reaching common goals across species. Natural selection and culture is mutually influenced by each other. Social processes facilitate cooperation among individuals. Behavior Analysis highlight how the three levels of selection offer their respective units of selection that occasionally are in conflict with one another. Rule-governed behavior is fundamental in order for an individual to act according to a group function and overcoming some of these conflicts. Individual behavior is the mediating level between natural selection and cultural evolution, as addressed by Hayes and Sanford (2014). Cultural Materialism describe how humans are genetically predisposed to acquire social repertoires. The distinction between etic and emic operations, which distinguishes between the social rules, norms, customs or values and such, to the group level functions and in turn, given the ecological challenges of that particular culture.

The various approaches presented here may offer a theoretical and conceptual background to the development of interventions that will have impact in behavior with large scale consequences

(e.g. climate change, obesity, delinquent behavior). The distinction between emic and etic distinction is relevant in introducing values, rules, laws and goals (emic operations), that are in tune with the changes we need to undergo, that may result, as it shows how a group level function is maintained at the individual level. It helps us to recognize how contingencies at the individual level connects to functions at a higher level.

It is important to underline that the approaches presented in this paper, may be considered as representatives of each of the three levels of selection. Natural selection, selection of individual behavior and cultural selection. However, there is overlap throughout the three levels of selection, thereby also between disciplines. We have now established that there is consensus among these approaches that communication and/or social interaction is a fundamental part of cooperation among individuals in reaching common goals or benefits. The interaction or communication between individuals is fundamental in any culture or group in order for the culture to have the possibility to reap benefits by being organized in a group. In the endeavor of inducing cultural change, we must facilitate the changes both on the individual level but also on the group level. The benefits (consequences) at the individual and the group levels would be so distant in time that we must arrange consequences that are favorable and may facilitate the changes in real time. The consequences and incentives on the individual level and the ones on the group level should be in concession with each other.

References

Baum, W. M. (2005). *Understanding Behaviorism: Science, Behavior, and Culture* (2nd ed.). Oxford, UK.: Blackwell Publishing.

Bourke, A. F. G. (1999). Colony size, social complexity and reproductive conflict in social insects. *Journal of Evolutionary Biology*, *12*(2), 245-257.

Dawkins, R. (2006). *The Selfish Gene*. OUP Oxford.
Glenn, S. S. (1986). Metacontingencies in Waiden Two. *Behavior analysis and social action, 5*, 2-8.
Glenn, S. S. (1988). Contingencies and metacontingencies: Toward a synthesis of behavior analysis and cultural materialism. *The Behavior Analyst, 11*(2), 161.
Glenn, S. S. (1991). Contingencies and metacontingencies: Relations among behavioral, cultural, and biological evolution. *Behavioral analysis of societies and cultural practices*, 39-73.
Glenn, S. S. (2004). Individual behavior, culture, and social change. *The Behavior Analyst, 27*(2), 133.
Glenn, S. S., & Madden, G. J. (1995). Units of interaction, evolution, and replication: Organic and behavioral parallels. *The Behavior Analyst, 18*(2), 237.
Harris, M. (1979). *Cultural materialism: the struggle for a science of culture*. New York: Random House, Inc.
Hayes, S. C., & Sanford, B. T. (2014). Cooperation came first: Evolution and human cognition. *Journal of the Experimental Analysis of Behavior, 101*(1), 112-129.
Cooper, J., Heron, T., & Heward, W. (2007). *Applied Behavior Analysis* (2nd ed.). Upper Saddle River, New Jersey Columbus, Ohio: Pearson Merrill Prentice Hall.
Jablonka, E., & Lamb, M. (2014). *Evolution in four dimensions* (Revised Edition): Cambridge: The MIT Press.
Karell, P., Ahola, K., Karstinen, T., Valkama, J., & Brommer, J. E. (2011). Climate change drives microevolution in a wild bird. *Nature Communications, 2*, 208.
Seeley, T. D., Visscher, P. K., & Passino, K. M. (2006). Group decision making in honey bee swarms. *American Scientist, 94*(3), 220.
Skinner, B. F. (1965). *Science and human behavior*: Simon and Schuster.
Skinner, B. F. (1974). *About Behaviorism*. New York, USA: Random House, Inc.
Skinner, B. F. (1981). Selection by consequences. *Science, 213*(4507), 501-504.
Skinner, B. F. (1957). *Verbal behavior*. BF Skinner Foundation.
Wilson, D. (2015). *Does altruism exist?: culture, genes, and the welfare of others*: Yale University Press.
Wilson, E. O. (1962). Chemical communication among workers of the fire ant Solenopsis saevissima (Fr. Smith) 2. An information analysis of the odour trail. *Animal Behaviour, 10*(1), 148-158.

MASTER THESIS
Learning in Complex Systems
2016

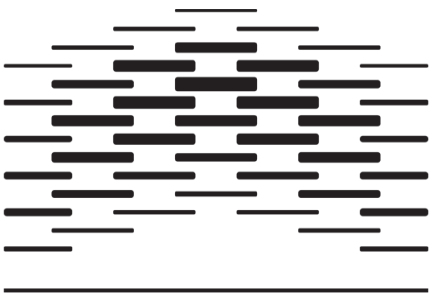
Group Selection:

Effects of Environmental Feedback on Group and Individual Responses

Mohsen Bahari

Faculty of Health Sciences

Department of Behaviour Analysis



OSLO AND AKERSHUS
UNIVERSITY COLLEGE
OF APPLIED SCIENCES

Table of contents

Abstract

Three experiments were done to see how groups of four individuals learn and respond to environmental contingencies and changes in those contingencies. Experiment one was done with groups of four individuals, that were allowed to discuss answers and solutions. The participants varied in age and sex, they were all above 18 years of age. Experiment two was done with individuals, in order to see how they would solve the task in contrast to the groups. While experiment three was done with groups, of individuals, that were instructed not to talk to each other during the experiment. Throughout, the three experiments, there were presented a number of images displaying people in an environment, with four descriptive alternatives connected to the image. For each trial the participants (in the groups) were to agree on and choose one of the four alternatives. The alternatives were divided in to two categories, environment and person. The participants earned collective points when choosing the "correct" answer in accordance to the criteria in effect. The experiment consisted of four

phases, alternating between the two categories of person and environment, between each phase. The results show that learning took place within all the three experiments, most of the groups and some of the individuals chose more correct alternatives towards the end of each phase than in the start. However, the groups scored higher than the individuals. There were minor differences between the groups that were instructed to restrict from vocal communication (during the experiment) and the groups that were allowed to discuss with fellow participants. The individuals were either very successful or scored relatively low. The findings show that groups were more sensitive to the contingencies and the changes than the individuals. It is concluded that the selection of group responses took place. This study revealed some unexpected, group dynamics that may inspire further research. The groups were more sensitive to the points or feedback, than the individuals were. In the discussion it is argued that some of the social elements in the groups, contributed to increased effectiveness of the feedback that was given contingent upon correct or incorrect trials.

Introduction

The principles of the selection process lay at the core of the behavior analytic framework. Skinner has suggested that selection occurs at three levels, the first of which is natural selection, the second being the selection of individual behavior and the third, cultural selection or the selection of cultural practices. Natural selection has been well established as the core process of change and sustainment of living organisms, within the field of biology. The selection of individual behavior has been established as the main object of study in behavior analysis (Skinner, 1953; Skinner, 1965; Skinner, 1972, 1974, 1981). Cultural phenomena have been researched upon mostly within the fields of anthropology and sociology. Behavior analysis may have some contributions to the study of cultural phenomena, as it is grounded as a science that focuses on selection processes, and these principles may encompass cultural phenomena. Furthermore, culture involves behavior of individuals, which has been extensively studied through behavior analysis.

Within the field behavior analysis cultural phenomena have been conceptually developed .(Glenn, 1988, 1991, 2010; Houmanfar & Rodrigues, 2006; Malott & Glenn, 2006a, 2006b; Todorov, 2006) and experimentally tested (Vichi, Andery & Glenn, 2009; Smith, Houmanfar & Louis, 2012; Tavares & Zagury, 2012). I will merely mention some of the relevant conceptual approaches; Sigrid Glenn has developed the concepts of metacontingencies and macrocontingencies. Metacontingencies consist of interlocking behavioral contingencies (IBC's) that is the interrelated behavior of two or more individuals, resulting in an aggregate product, that in turn may or may not be selected by the environment. Macrocontingencies describes how the behavior of many individuals, that is not interrelated, leads to a cumulative result. Couto and Sandaker (2016), highlighted a distinction between the selection of cultures and cultural selection. "Selection of cultures refers to the selection of

cultural-social environments whereas cultural selection refers to how those environmental settings selects behavior of individuals and practices within this culture." (Couto & Sandaker 2016, p. 30). In this paper the environmental setting in which the behavior of individuals and practices were selected, is relevant and this approach best fits the setting and manipulations in the experiments that will be presented later. Cultural selection is believed to set the occasions for the selection the behavior of individuals belonging to the culture. Thereby, the selection of practices in a group or culture, through environmental settings established by an evolved history. We have attempted to manipulate environmental settings to see an effect on group responses. Following, is some of the previous experimental work done in this area.

Using the metacontingency as a conceptual tool Vichi, Andery and Glenn (2009) investigated how IBC's can be selected by environmental consequences. Two groups, each of four participants took part in a betting game based on a matrix of eight columns and eight rows. The members of the group had to choose a row. Each participant had to place an individual bet on whether or not the group would be successful in the trial. The experimenter determined if the participants would win or lose, based on how they distributed the earnings from the previous trial. The participants were not aware of the contingency of winning. There were two conditions A and B, during condition A, participants won after they had distributed the earnings equally. While in condition B participants' unequal distribution was reinforced by a succeeding successful trial. Both groups adhered to the prevailing contingencies of both conditions. It was concluded that environmental events selected the practices of distributing earnings equally or unequally. The winning or losing as the environmental events (independent variable) and the distribution of earnings among group members being the interrelated group behavior (dependent variable).

Smith, Houmanfar and Louis (2012) presented a study where they experimentally

tested a modified account of the original metacontingency concept (see Houmanfar, Rodrigues and Ward 2010 for the modified account). The study also included an analysis of the verbal behavior between dyads. The study was performed with 10 pairs of individuals that underwent an ABACABACA design. The dyads were instructed to produce hypothetical products using a computer program, which in turn they received feedback for, thought to simulate consumer demands. The products the participants constructed, were produced by choosing between a number of variables, color and size and shape. The participants had to interact to complete the trials. The independent variables were rules presented at the start of each phase, alternating between no rules (condition A), implicit rules (condition B) and explicit rules (condition C). The rules stated the criteria for customer demands to variable degrees depending on the condition in effect. The explicit rules were precise, the implicit rules were vague, no rules were as the name suggests. The conditions alternated every 7 minutes. The criteria for customer demands were arbitrarily selected by the experimenter. Smith, Houmanfar and Louis (2012) concluded that selection by the environment is applicable at the sociological level of analysis and that social interactions are susceptible to selection by environmental conditions. Furthermore, they highlighted the importance of verbal behavior between group members in the processes of the selection of cultural entities.

The following study does not treat the selection of cultural practices. As no direct cooperation between individuals was involved. However, it is relevant as it shows how a social context may facilitate the initiation of problem solving. Krasheninnikova and Schneider (2014) tested problem-solving capabilities in parrots, comparing between individually and in a social context. The parrots were to perform some tasks which led to food. The tasks consisted of moving different strings, some of the strings were attached to food. The parrots had to visually determine which strings that were attached to food. The results revealed that there were minor differences between the results from the parrots tested

individually and the parrots tested in social settings. The parrots in the groups scored slightly higher. However, they found that the parrots in the social context, more eagerly initiated the tasks than the parrots in the individual setting. It was argued that in the presence of other parrots, the social context facilitates the initiation of the task faster than in the individual context.

Cultural phenomena are highly complex, and it can be challenging to investigate them in an experimental setting. These challenges have not stopped researchers from trying to capture some of the core elements of cultural phenomena. In performing experiments one should have a conceptual framework to work within. For these experiments a relatively broad selectionist approach was adopted. The selectionist approach used here, is adopted from (Skinner, 1965; Skinner 1981) Following are some quotes that best explain this approach;

"There is still a third kind of selection which applies to cultural practices. A group adopts a given practice—a custom, a manner, a controlling device—either by design or through some event which, so far as its effect on the group is concerned, may be wholly accidental. As a characteristic of the social environment this practice modifies the behavior of members of the group. The resulting behavior may affect the success of the group in competition with other groups or with the nonsocial environment. Cultural practices which are advantageous will tend to be characteristic of the groups which survive and which therefore perpetuate those practices." (Skinner, 1965, p. 430)

"Verbal behavior greatly increased the importance of a third kind of selection by consequences, the evolution of social environments or cultures. The process presumably begins at the level of the individual. A better way of making a tool, growing food or teaching a child is reinforced by its consequences—the tool, the food or a useful helper, respectively.

A culture evolves when practices evolving in this way contributes to the success of the practicing group in solving its problems. It is the effect on the group, not the reinforcing consequences for individual members which is responsible for the evolution of the culture." (Skinner, 1981, p. 502)

These quotes illustrate the conceptual framework in which we have designed the following experiments. We have attempted to facilitate conditions in which these processes may occur and be examined in an experimental setting. Some of the main principles are; (a) A group adopts a given practice—a custom, a manner, a controlling device. The process presumably begins at the level of the individual. This can be an individual finding either a new and innovative way of solving a task or simply finding a way of solving a task, which in turn is reinforced by its consequences. (b) The social environment of the group modifies the behavior of the members in the group in accordance to the practice. (c) The resulting behavior may affect the success of the group. It is the effect on the group that determines the evolution of the culture, in contrast to the reinforcing consequences for individual members, these two elements do not necessarily coincide. In this study three experiments design to investigate those principles, are presented.

Experiment one was designed to test how groups of four individuals would solve a task, and how the groups would adapt to environmental changes (feedback).
Experiment two was designed to test how nine individuals would respond to the same tasks as the groups in experiment one, and compare the results with the group experiments.
Experiment three was designed to test how groups of four individuals would respond to the same tasks, but with limited communication possibilities (they were instructed not to talk to each other during the experiment). We were interested in observing how the groups would solve the tasks, with limited communication. Thereby, we wanted to clarify the role of the vocal communication.

Method

Three sets of experiments were carried out, experiment one was done with six different groups of four individuals and so was experiment three, with the exception of one group that consisted of three individuals. Experiment two was carried out on nine different individuals.

Experiment 1

Participants

Twenty-four participants were recruited for this experiment, residing in and around the Oslo area. They were all 18 years or older. The participants were asked to take part in a research study by describing pictures while sitting in groups. They were divided into six groups, each consisting of four individuals. No money or course credit was offered as incentives for participation.

Equipment/ Apparatus

The experiment was conducted in an 8 x 7-meter room, where there was placed two laptop computers, one video camera, one computer monitor, one image projector and one central screen (see figure1) and a set of 65 picture slides, with 4 alternatives connected to each picture on each slide.

Figure. 1.

Details of the Experimental Laboratory Set-up.

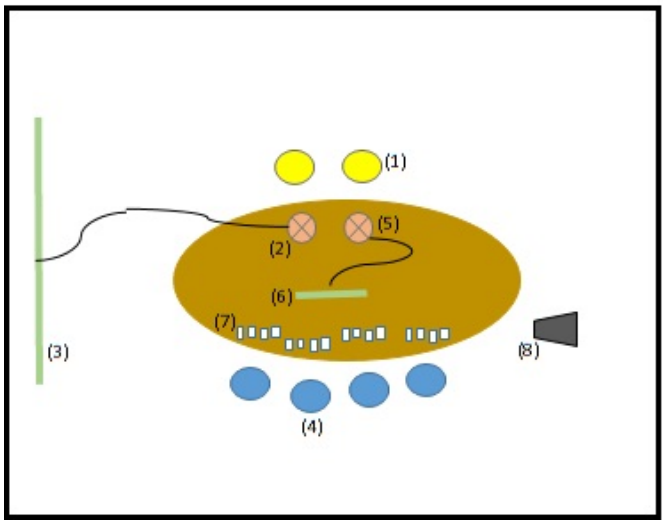


Figure 1. Top view from experimental room. (1)Two experimenters. The two computers where used by the experimenters to give feedback to the participants and control the trials. Computer one (2) controlled a central screen (3) where slides were displayed to the four participants (4). The other computer (5) controlled feedback and points displayed in a monitor (6) facing the participants. Each participant had access to four-answer card that were numbered from one to four (7). A video camera (8) was used to record the experimental sessions.

Experimental task

A series of images were presented to the participants, alongside each image there were four alternatives describing the picture on display on the central projector screen. On each image there was a person performing a behavior, the person and behavior varied from picture to picture. The alternatives were divided into two categories: two of the four alternatives described the person in the picture and the other two described the environment *(*categories *person* and *environment),* (see figure 2). The distinction between person and environment was drawn as, everything surrounding the person, including tools and accessories was considered environment. While the person category consisted of the individual in the photo, together with verbs or any activity the person was doing.

Figure. 2.

Example of the Pictures Presented, With Choice Alternatives.

Figure 2. One of the slides used in the experiments. Picture of a person behaving in a environment and four alternatives alongside describing it. In this example, alternatives 1 and 3 describes the person in the figure and alternatives 2 and 4 the environment.

Procedure

Each group underwent Sixty-five trials, (one baseline phase with five slides and four phases with fifteen slides each BP (baseline phase), P1, P2, P3, and P4), making an ABCBC alternating conditions design. Slides were presented on the central screen for up to one minute and participants were instructed to discuss with each other and choose one of the alternatives, in which they considered to represent the picture appropriately. After the participants agreed upon one alternative, they all had to show to the experimenter the card with the agreed number that corresponded with the alternative displayed on the central screen. They were free to discuss and decide which alternative they considered to best describe each the picture. The order of the images and the alternatives were randomized.

In the five base line trials any alternative chosen by the participants resulted in the message “you did not score any points in this phase, please wait for the next” (see figure 3), displayed on the feedback monitor. The experimenters would then register the group preference for which of the two categories that the group had, either person or environment. During the initial five test trials, the group preference for category was established. For example, if the participants had chosen alternatives related to the category person in three

trials and chose two alternatives belonging in the category of environment (3 person > 2 environment) out of the five base line trials, following the next fifteen trials, Phase 1 (P1), the experimenters would give points only for alternatives describing environment. Subsequently the positive feedback was given contingent upon chosen alternatives belonging to the opposite category. In this case, when in condition P1, choices of environment would be followed by a smiley face and the message "congratulations, you won 10 points" (see Figure 4) and ten points were accumulated in the common score. Accordingly, during phase P1 group answers belonging to the person category would be followed by "you did not score any points in this phase, please wait for the next" (Figure 3) and no points were scored. Subsequently, in phases P2, P3 and P4 opposite categories led to the smiley face, making an ABCBC alternating conditions design.

Figure. 3 and 4.

Details of the Feedback.

Figure 3. Stimuli presented when participants did not scored points.

Figure 4. Stimuli presented when participants scored points.

Experiment 2

Participants

Nine participants over 18 years of age, were recruited from in and around the Oslo area were invited to answer questions about a set of pictures. No money or course credit was

given as incentives for participation. The participants were asked to take part in a research study by describing pictures that would be presented.

Equipment/ Apparatus

The same as in experiment 1. However, only one set of cards were present as it was only one participant.

Procedure

Experiment 2 was a systematic replication of experiment 1 with one variation; the participants answered the questions individually rather than in a group. The participants sat in the very same room that was used in experiment 1, with two experimenter sitting on the opposite side of the table. The very same procedure was in effect as in experiment 1.

Experiment 3

Participants

25 participants over 18 years of age, were recruited from in and around the Oslo area were invited to answer questions about a set of pictures. The participants were divided into five groups of four participants and one group of three participants. For group number 4, one of our scheduled participants did not show up. We decided to go through with the experiment with only three participants. This may have affected the results for that group.

No money or course credit was given as incentives for participation.

Equipment/ Apparatus

Same as experiment 1.

Procedure

Experiment 3 was another systematic replication of experiment 1. The participants in experiment 3 were instructed not to talk to each other during the experiment. Vocal communication was not allowed between participants in experiment 3, however the participants were still required to to agree on one alternative in each trial. Thus, the participants communicated through hand gestures and facial expressions.

Results

If we disregard the five first preference test slides. Each experiment consisted of four phases, each of 15 trials. With a shift between the two criteria of environment/person coming after every 15 trials. Data from each phase was divided in three sets of 5 trials, represented as percentage of "correct" responses. The percentage was calculated dividing the number of correct trials by the number of trials in the set (5 trials). If there were 3 correct answers in the first set of 5 trials (3/5), 4 correct trials in the second set (4/5) and 5 correct in the third set (5/5), then percentages for that phase would be 60 %, 80% and 100% correct, respectively. There were four alternatives on each slide, two representing person and two representing environment. Therefore, it was a 50% probability that the groups or individuals would answer in accordance with the phase criteria (person or environment). This probability is illustrated by the line crossing each diagram at the 50 % mark. Figure 5, 6 and 7 shows the data for each set from experiments 1, 2 and 3 respectively.

Figure. 5.

Experiment 1, Groups 1-6, Phases 1-4.

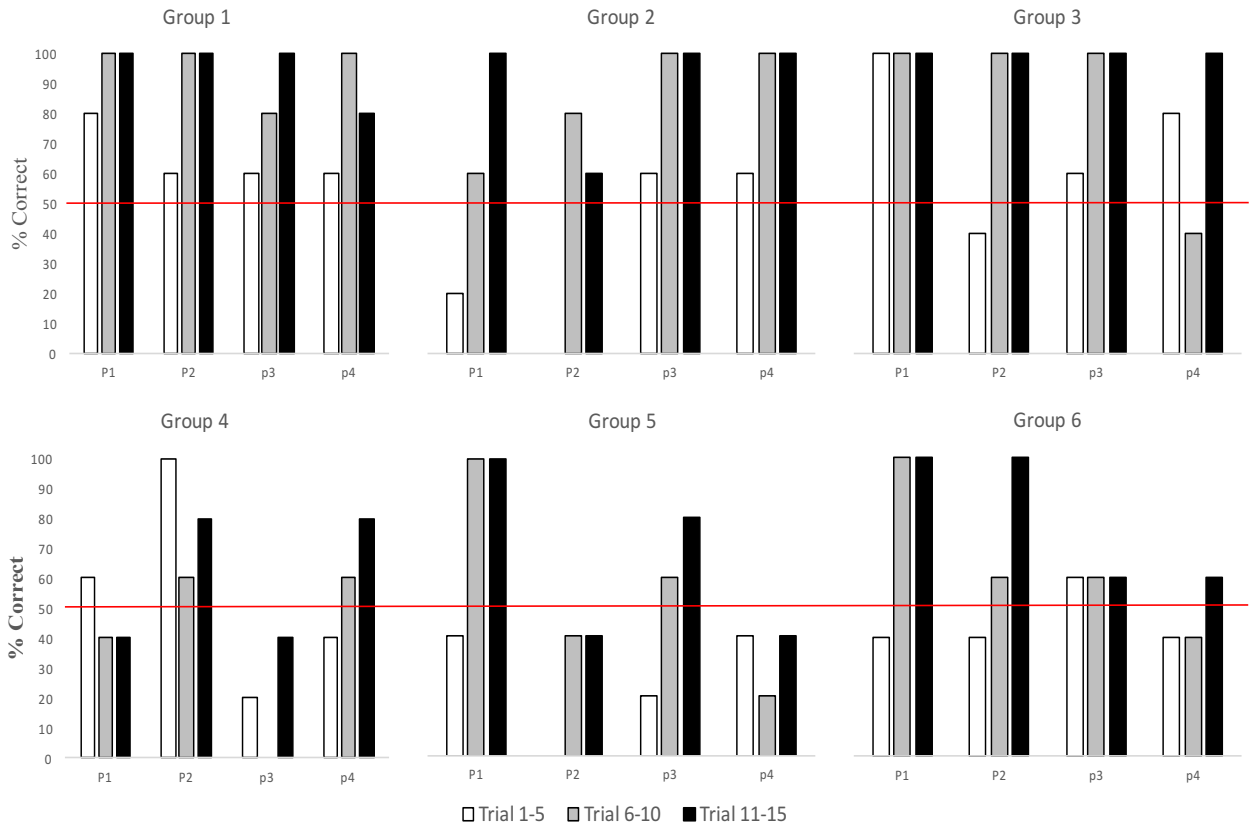


Figure 5. The figure shows the consecutive results of each group for the five first, five second and five third part of each of the four phases. The red line illustrates the 50% line of responding correctly by chance.

The diagram shows that group one, two, three and arguably, group six had their best results in the 2nd and 3rd set of each phase, showing that the group has answered gradually better as the phases proceeded and feedback was given. Group number five had their best results in phase one and three, this means that they may have had a biased preference for one of the categories, either person or environment.

Figure. 6.

Experiment 2, individuals 1-9, phases 1-4.

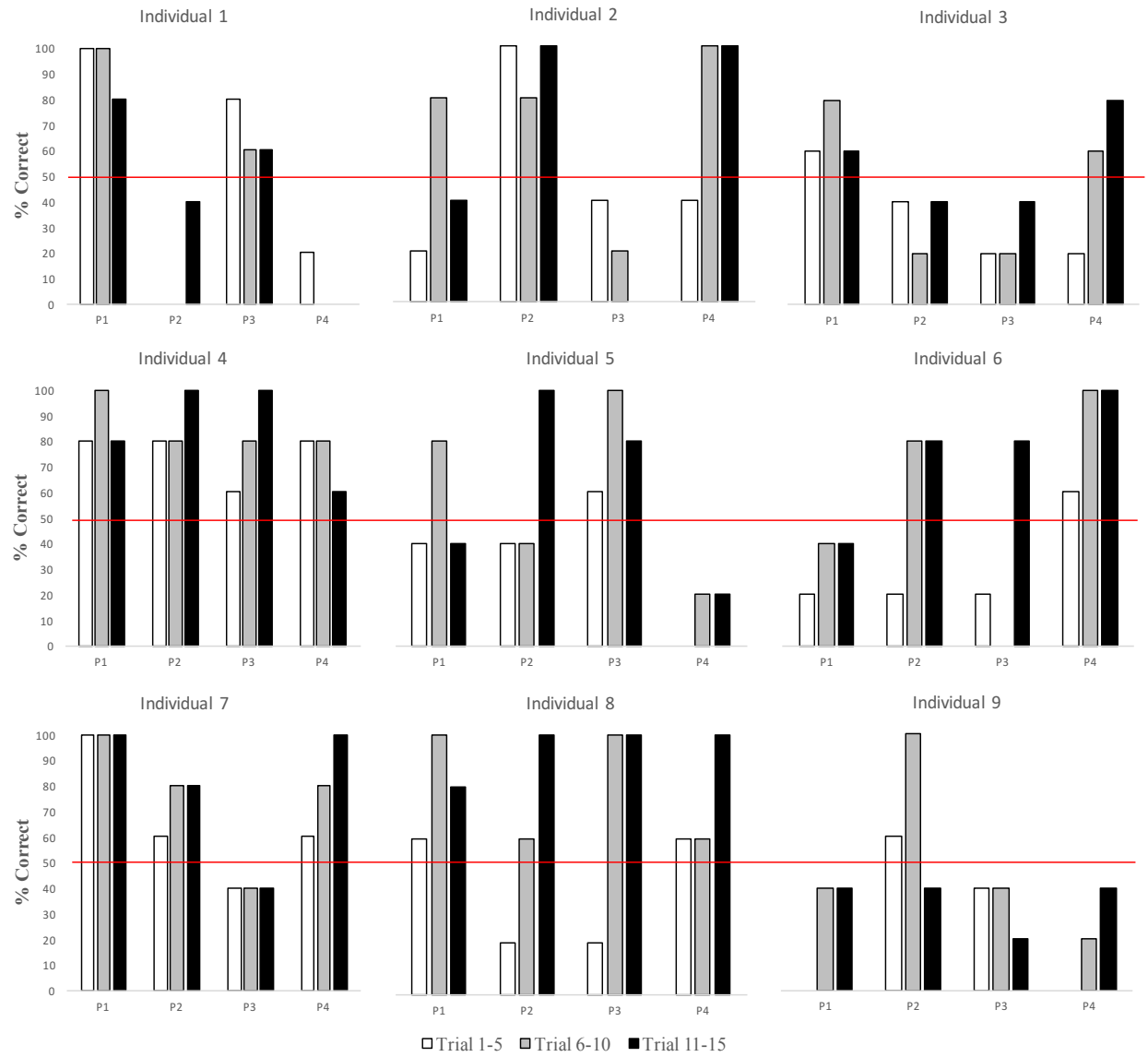


Figure 6. The figure shows the consecutive results of each individual for the five first, five second and five third part of each of the four phases. The red line illustrates the 50% probability level of responding correctly by chance or through probability.

In experiment two individual number four scored very high, by clearing the chance line in all four of the phases and also in all three sessions of each phase. Individual number seven also kept above the 50% probability line in phase one, two and four, however in phase three, the individual gave correct answers only in about 40% of the 15 trials, only to gradually reach 100% correct in the fourth and last phase. Individual number eight had his/her lowest score on the five first trials of each phase, compared to the following five trials and the final five trials of each phase. Individuals number one, two and six scored well either

in phases one and three or phases two and four, these phases would consist of the same criteria for both the two successful, corresponding phases, either person or environment. Thus they have either developed a bias or had a preference for a certain category, remaining relatively insensitive to the changes of criteria. The remaining individuals, number three, five and nine scored for the most part below or very close to the chance line, occasionally exceeding probability. However, the order in which they score over and under the chance line, suggests that the individual did not respond in accordance to the prevailing contingencies.

Figure. 7.

Experiment 3, Groups 1-6, phases 1-4.

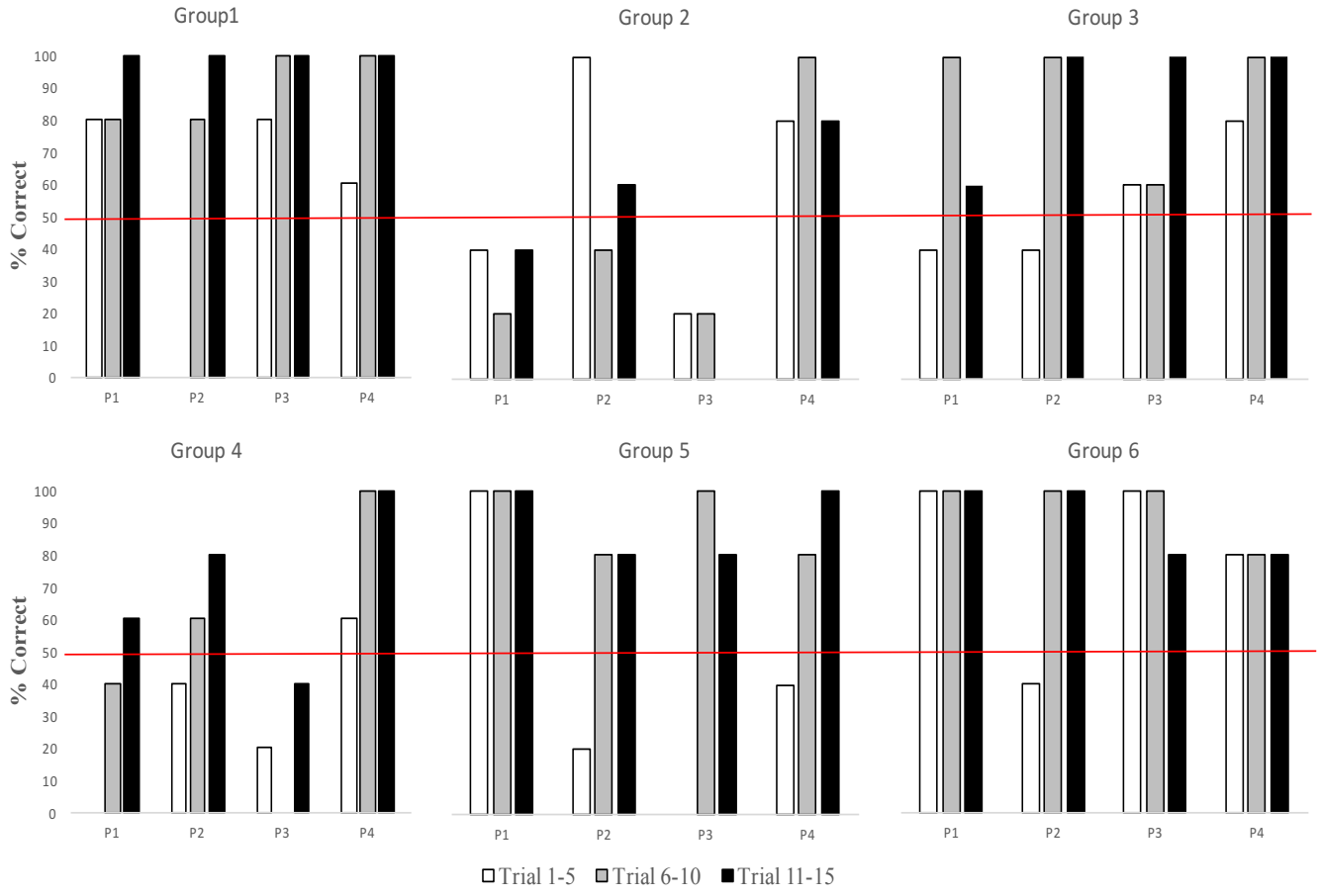


Figure 7. The figure shows the consecutive results of each group for the five first, five second and five third part of each of the four phases. The orange line illustrates the 50% probability level of responding correctly by chance.

In experiment three, groups number one, three, five and six had very high scores, clearly exceeding the 50% probability line in all of the four phases and even reaching 100% correct in five or more of the twelve illustrated sets. Groups number two and four both had their best scores above the probability line in phase two and phase four, suggesting a bias towards one of the two categories.

Result comparison 50% chance to experiment 1, 2 and 3

Figure. 8.

Average results in trial 1-15 through the 4 phases, divided in experiment 1, 2 and 3.

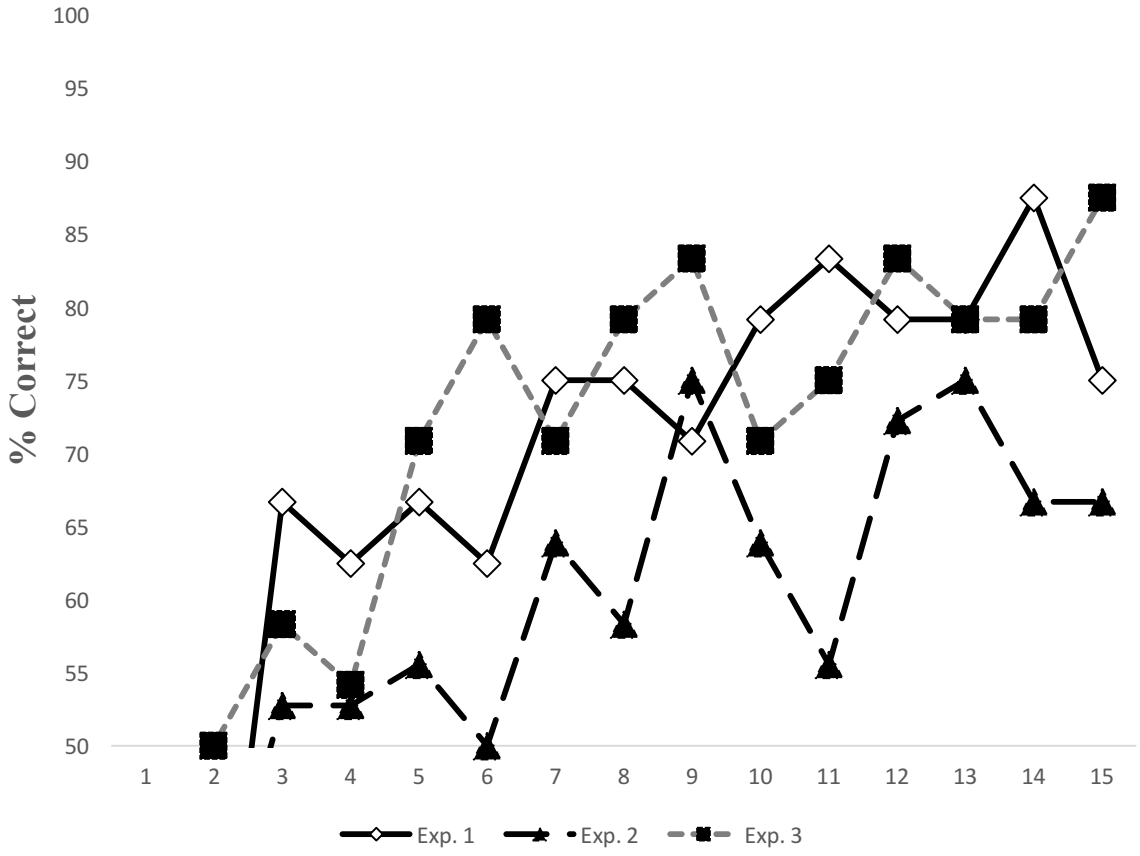


Figure 8. This graph shows the average score for each trial across phases 1-4 and groups 1-6(experiment 1 and 3) or individuals 1-9(experiment 2), for the three respective experiments. The data is shown from 50% and above, as the number of possible correct answers per trial was 2/4. Accordingly, the scores beneath the 50% mark may be assigned to chance or probability.

The graph in figure 8 shows that there was a learning curve across all of the three experiments during the four phases. The results from experiment 1 and 3 was somewhat better than the results from experiment 2. After the groups came above the 50% chance mark they kept above it and gradually improved, except in the average score from trial 6 in experiment 2, where the individuals touched the 50% chance mark.

Figure 9.

Average three sets of trials compared between the three experiments

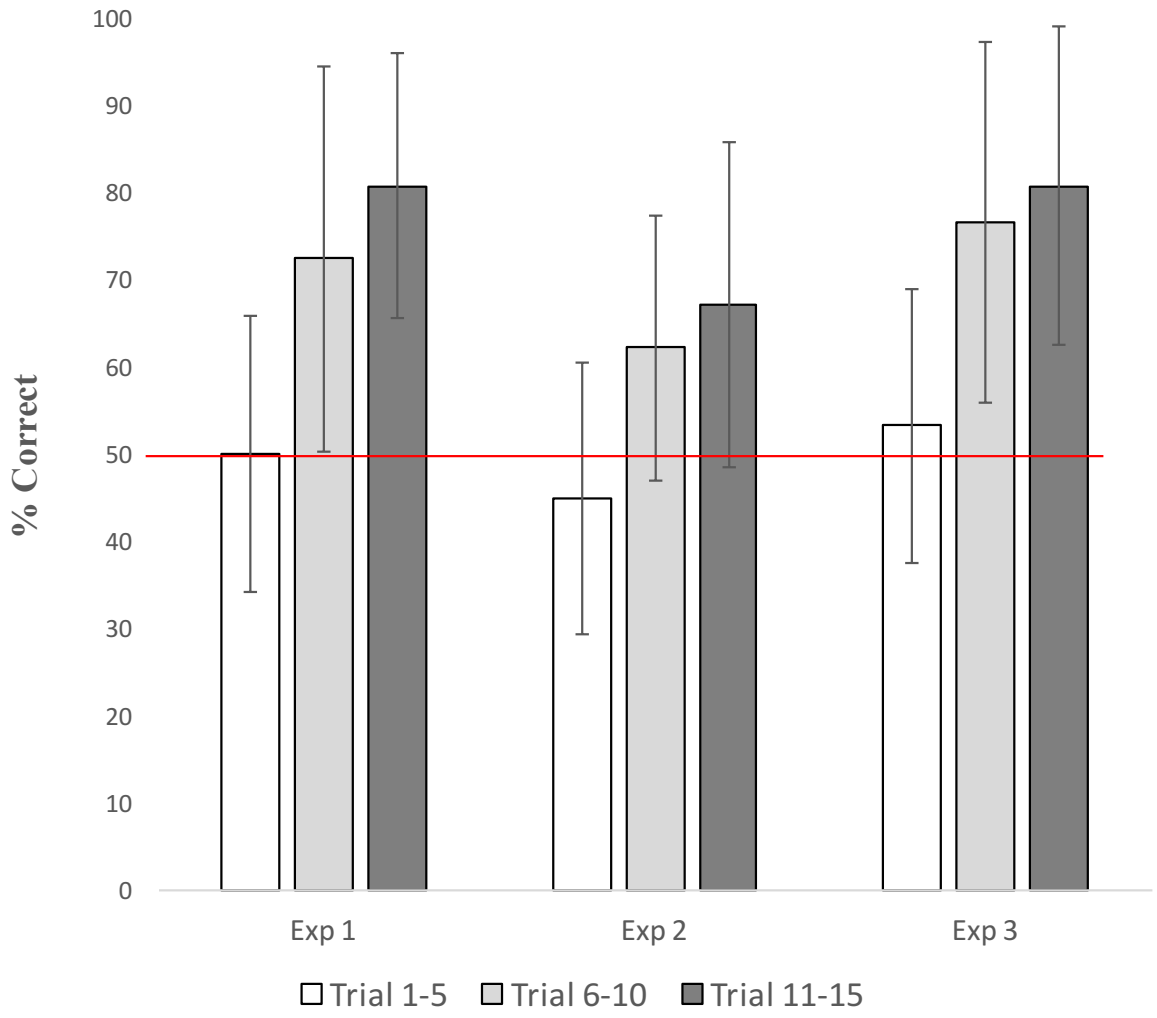


Figure 9. This chart shows the average scores for the five first, five second and five third part of the four phases for all the individuals and groups from experiment 1, 2 and 3, with error bars. The red line crossing the diagram illustrates a 50 % chance mark.

It is evident that there was a tendency of improvement or adaptation towards the prevailing contingencies, both in the responses of the groups and individuals. There are clear leaps from trial 1-5 to trial 6-10 and to 11-15, this trend can be observed throughout all of the three experiments. If we visually compare the scores from each set of trials with the corresponding set in the other experiments, the scores from experiment one and three were clearly higher than the scores from experiment two. The scores from experiment three were slightly higher than the scores from experiment one in the two first sessions, and in the third session the scores were identical at 80.8% correct.

Table 1.
Data characteristics from experiments 1-3, compared to a hypothetical comparison group.

Experiment	Trials	N	Mean	SD	t	*p*	Cohen`s *d*
	1-5	6	.5	0.158	0	1	0
1	6-10	6	.725	0.221	1.761	.108	1.016
	11-15	6	.808	0.151	3.533	**.005	2.039
	1-5	9	.45	0.156	-0.678	.507	-0.319
2	6-10	9	.622	0.151	1.715	.105	0.808
	11-15	9	.672	0.185	1.966	.066	0.927
	1-5	6	.533	0.157	0.367	.721	0.211
3	6-10	6	.766	0.207	2.225	*.050	1.285
	11-15	6	.808	0.183	2.225	*.015	1.680

*Values shown to be statistically significant at .05 significant level.
** Values shown to be statistically significant at .01 significant level.

Table 1. Shows the average scores from experiment 1, 2 and 3. Each divided in to three sets, trials 1-5, 6-10 and 11-15. The scores are calculated from the mean of each of the three sets, across phases and groups (or individuals).

All the three experiments and the respective sets were each compared to a hypothetical group with a mean of 50 % correct scores, given that all other variables were equal. This was done as the experimental task consisted of choosing between alternatives, where 2/4 alternatives were correct. The significance level was set at, $\alpha = 0.05$. Table 1 shows that in trials 1-5 none of the experiment results were significantly above the chance. The *p* values for trials 6-10 were considerably lower in all the three experiments, however it was only in experiment 3 that the *p* value tested (marginally) statistically significant, $p = .05$. The data from trial 11-15 shows that the groups from both experiment 1 and 3 tested significantly higher than chance. Although the results from experiment 2 shows a gradual

decline in the p value from trial 1-5 to 6-10 and lastly 11-15, they did not score significantly different than what we may expect from chance.

The results from the Cohen's *d* test show results that are consistent with the other findings. The effect sizes, started out relatively low in the 5 first trials, and gradually increased throughout the 5 second and 5 third sets of trials. Table 1 shows that the groups did better than the individuals, and also that the last 5 trials in phase averages were the most successful trials. This was consistent across all the three experiments, however none of the results from experiment 2 was significant at .05 level.

Discussion

Sequential confounding and carryover effects may have influenced the results, as participants' responses were reinforced for a certain category and the criteria switched directly to another category without an intermediate session. However, these effects would be apparent throughout all the three experiments, making the comparison between groups, individuals and experiments relevant. The results are consistent with previous findings, such as the findings of Vichy, Andery and Glenn (2009), where they found that IBC's were selected by consequences effecting the group. Smith, Houmanfar and Louis (2012) found that participants succeeded in creating simulated products in accordance to shifting customer demands or feedback, which is also consistent with the results from this study. Furthermore, Krasheninnikova and Schneider (2014) found that parrots took initiative in problem-solving tasks, considerably faster when in a social context, as opposed to individually. We may draw a parallel to this study, as the participants seemed more engaged in the tasks when in groups, than individually.

Experiment 1 and 3 were designed to investigate the role of communication in group decision making, but also the group dynamics themselves and possibly give some insight to the process of developing a rule. While experiment 2 was conducted to see how individual performance was sensitive to the same external contingency as in experiments 1 and 3.

Results from the experiments show that the groups in experiment 1 and 3 did better than the individuals (experiment 2). However, a small number (2-3) of the individuals were very successful in answering in accordance to the experiment criteria that was in effect. The differences may be due to a great number of variables, some possible reasons will be highlighted.

The number of participants in experiment 2 consisted of 9, while the number of participants in each of experiment 1 and 3 consisted of respectively 24 and 23(exp.3). As mentioned, in experiment 3, when we were going to do group number 4. One of our scheduled participants did not show up. We decided to go through with the experiment with only three participants. This may have affected the results for that group.

The number of data-points in experiment 2 (9 experiments, N=9) exceeded the number of data-points in experiment 1 and experiment 3 (each of which had 6 experiments *N=24/23*). Given this fact, an assumption follows; the higher the number of participants in the experiment, the higher the probability of having a participant that is able to respond in accordance with the experimental conditions. Given that assumption, the groups with 4 participants would have a better chance of responding "correctly", however there are some complications that follow this assumption. First of all, the participant that identify the contingency or criteria, must be able to convince the others to choose the "correct" alternative, and if he/she is successful in this, the other participants in the group may also develop an adherence to the criteria. Then again, if the individual is not successful in convincing his/her fellow participants, valuable trials may be lost and the benefit of having a

highly competent person in the group would be diminished. In experiment 2, the individuals did not need to convince anyone to choose any alternative, neither did they have the opportunity to learn from any fellow participant. This may explain why the participants among the individuals were either highly successful or relatively unsuccessful in choosing correct alternatives. In performing these experiments, it is very difficult to say at least, to account for the individuals learning history. Let us consider if a certain individual has a preference for choosing a certain category, such as *person* for example. Then in the group experiments, that individual's preference may be shaped by the other participants to attempt to choose one of the other categories as well, the point being that in the group experiments, the individual`s learning history may be diminished through social influence by the other participants. That social influence was absent in experiment 2, resulting in that individuals may have kept to their initial preference throughout the experiment (given that the feedback had a relatively small effect).

Another important factor that must be mentioned is the role of social reinforcement. The points, probably had variable reinforcing value for the participants, the reinforcing value would be dependent upon each participant's previous reinforcement history. As the points themselves did not lead to any primary reinforcers or (arguably) conditioned reinforcers provided by the experimenters. We as experimenters observed that when the participants received points they performed a variety of different behaviors such as raising their hands, clapping, pointing to the feedback screen, clinching a fist, smiling, laughing, etc. Participants that had discussed intensely prior to choosing a given alternative, would make or break as a "leader" in the group given the intensity the individual put in to convincing the other participants in the group to choose the given alternative. Thus the sensitivity to the points seemed to be greater among the groups than the individuals, as the points played a part in determining who had right or wrong in a discussion, thereby also increasing or decreasing the

individual's status in the group as the joint attention seemed to be directed to participants that had, most frequently pointed out correct alternatives in previous trials. Joint attention is considered a behavioral cusp in social behavior, in that it may lead to many new learning opportunities. The research on joint attention, has mainly been in regards to child development approaches, and also in connection to autism specter disorders. Joint attention is also important in developing social skills (Dawson et al., 2004 Osterling, Munson, Estes, & Liaw 2004; Tomasello & Farrar, 1986). These skills, are sustained and further developed throughout an individual's lifetime, therefore it may be interesting to further pursue the role of joint attention in group dynamics. The element of joint attention, was absent in experiment 2, where the participants seemed to be less affected by the feedback. One of the participants from experiment 2, even stated after the experiment, that he tried avoid to paying attention to the points. Altogether the points or the feedback seemed to be less potent in experiment 2 than in experiment 1 and 3, presumably due to the lack of social reinforcement.

In discussing the alternatives, the participants may form rules or strategies that lead to various results. Some of the participants developed an adherence to the strategy or rule through social processes or through the efficiency of the method in the first phase. This made the group less sensitive to the change of criteria for receiving points. One of the groups even used the strategy of "rock, scissors, paper" in determining which alternative to choose when the participants disagreed. In experiment 3, where the participants were not able to discuss strategies or rules, they were seemingly more sensitive to the change of criteria, there were small overall differences in group 1 and 3, however the groups in experiment 3 seemed to catch on to criterial changes slightly faster than groups in experiment 1.

Rulemaking and following appears to have two effects, when comparing results from experiment 1 and results from experiment 3. As participants of experiment 1 made a rule (even being a superstitious rule), any mistake made by the group seemed to be directed

towards the rule, instead of an individual`s suggestions. Secondly, it seemed to be easier to shape a behavioral pattern in groups when there was no possibility for discussions. Although verbal behavior or communication is a constituent part of group selection. The restrictions on communication, in experiment three did not stop the participants in communicating with relative ease. They scored as good and somewhat better than the groups in experiment one. The participants in experiment three used hand gesticulates, facial expressions and lip miming to communicate. The effectiveness of communication was seemingly difficult in the start, however they communicated relatively fluently after a few trials. A key element to communicate with other members was apparently, to get the attention of the other members. Leaderships seemed to emerge and shift more naturally, superstitious rules may have had less influence on variability in answers. In addition, leaders tended to give more chances to others to pick an alternative when the groups were able to discuss, especially after there had been some disagreements, this may have increased the time between responses, or facilitated a shift in leaders if the alternative choice turned out to be successful. In experiment 3 (most of) the participants started by pointing to one of the alternatives, initially the attention of the participants was dispersed looking at each other and comparing alternative choices until they made a choice. The participants continued like this and when one of the participant's initial choice was correct more often than the others. That person took somewhat of a leader position in the group, as soon as a new image was presented on the screen, the "leader" received joint attention from the other members of the group anticipating which alternative he or she would suggest. This endured until the "leader" suggested the "wrong" alternative a number of times, then the leader often offered other members to make suggestions or the attention was more dispersed and the leader position was more or less up for grabs. In experiment 1, the participants discussed their suggestions, thereby they also assigned causation or theorized the criteria for receiving points. Accordingly, if one participant had

identified the actual contingency he or she would also have to persuade the other participants to choose a particular alternative, this in turn made the decision making process more complex. If the participant successfully persuaded the other participants to choose a particular set of alternatives based on an incorrect theory, they may have received points for some trials and then when the criteria changed the may have gone many trials without receiving points in staying loyal or sticking to the theory or strategy. However, when one person identifies the criteria and the other participants adhere to his or her suggestions, the other participants may act according to the criteria and thereby learn them. Insight in these processes may help to reveal how they work and what makes them effective or ineffective. These behavioral process may provide valuable insight in arranging social consequences when people are behaving together in groups.

All the experiments showed that learning had occurred, it seems that the individuals performed better in groups than alone, as expected. The implemented environmental stress or change caused a change or adaptation in the groups response. The changes in responding presumably started at the individual level and was most likely reinforced by social contingencies, in addition to points. However, some of the groups did not show these adaptations, differences in group performances is also a recurring phenomenon in the natural social world. Experiments 1 and 3 revealed some interesting aspects worth pursuing further, such as the dynamic establishment and shifts of leadership positions in the groups. Some of the most interesting aspects of this study, may not be the results themselves, but the processes within the groups. The processes of establishing a leader and the role of the joint attention that followed. The shifts of leaders, and also, how cooperation and new suggestions facilitated success. In an eventual replication of these studies, I would have suggested to operationally define some aspects of these processes, register and analyze them together with the results. There may have been a correlation in the number of changes of leaders and

accumulation of points with some with the presumption of floor and ceiling effects.. Analyzing the dynamics of these changes may give a more complete account of the phenomena.

This study was intended to explore the concepts stated in the introduction, and possibly contribute to further refinement of these concepts. The study has some weaknesses as the ones already mentioned. Another weakness, may be in that these studies consisted mainly of groups of four individuals, while the concept of cultural selection may encompass far larger groups. It is arguably, not a sufficient amount of individuals to be defined as a culture. It may not be an adequate amount of individuals to generalize the findings to large societies. Thereby, we may conclude that group responses were selected in contrast to the selection of cultural practices. However, there may be some interesting aspects to take from these findings, as cultures and large societies have at some point started out with such a limited number of individual members. And within cultures and societies, there are also smaller groups and subcultures, this study may offer some insight in such group processes.

References

Couto Carvalho, K., & Sandaker, I. (2016). Natural, Behavioral, and Cultural Selection. *Norsk Tidsskrift for Atferdsanalyse, 43*(1), 27-33.

Dawson, G., Toth, K., Abbott, R., Osterling, J., Munson, J., Estes, A., & Liaw, J. (2004). Early social attention impairments in autism: social orienting, joint attention, and attention to distress. *Developmental psychology, 40*(2), 271.

Glenn, S. S. (1988). Contingencies and metacontingencies: Toward a synthesis of behavior analysis and cultural materialism. *The Behavior Analyst, 11*(2), 161.

Glenn, S. S. (1991). Contingencies and metacontingencies: Relations among behavioral, cultural, and biological evolution. *Behavioral analysis of societies and cultural practices*, 39-73.

Glenn, S. S. (2010). Metacontingencies, Selection and OBM: Comments on" Emergence and Metacontingency". *Behavior and Social Issues, 19*, 79-85.

Houmanfar, R., & Rodrigues, N. J. (2006). The metacontingency and the behavioral contingency: Points of contact and departure. *Behavior and Social Issues, 15*(1), 13.

Houmanfar, R., Rodrigues, N. J., & Ward, T. A. (2010). Emergence & Metacontingency: Points of Contact and Departure. *Behavior and Social Issues*, *19*, 53-78.

Krasheninnikova, A., & Schneider, J. M. (2014). Testing problem-solving capacities: differences between individual testing and social group setting. *Animal cognition*, *17*(5), 1227-1232.

Malott, M. E., & Glenn, S. S. (2006). Targets of Intervention in Cultural and Behavioral Change. *Behavior and Social Issues*, *15*(1), 31-56.

Skinner, B. F. (1953). Some contributions of an experimental analysis of behavior to psychology as a whole. *American Psychologist, 8*(2), 69.

Skinner, B. F. (1965). *Science and human behavior*: Simon and Schuster.

Skinner, B. F. (1972). *Beyond freedom and dignity*: Springer.

Skinner, B. F. (1974). *About Behaviorism*. New York, USA.: Random House, Inc.

Skinner, B. F. (1981). Selection by consequences. *Science, 213*(4507), 501-504.

Smith, G. S., Houmanfar, R., & Louis, S. J. (2012). The participatory role of verbal behavior in an elaborated account of metacontingency: From conceptualization to investigation. *Behavior and Social Issues*, *20*, 122-146.

Tavares Tadaiesky, L., & Zagury Tourinho, E. (2012). Effects of support consequences and cultural consequences on the selection of interlocking behavioral contingencies. *Revista Latinoamericana de Psicología*, *44*(1), 133-147.

Todorov, J. C. (2006). The metacontingency as a conceptual tool. *Behavior and Social Issues, 15*(1), 92.

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child development*, 1454-1463.

Vichi, C., Andery, M. A. P. A., & Glenn, S. S. (2009). A metacontingency experiment: The effects of contingent consequences on patterns of interlocking contingencies of reinforcement. *Behavior and Social Issues*, *18*, 41.