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Rule-governance and sensitivity to changes in contingencies
A literature review and an empirical study

Name: Anita Tootoonchi Poursharif

Course code: MALK5000

Faculty of Health Sciences

OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

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Abstract

Article 1 is a literature review with a purpose to bring together literature that addresses the issue of insensitivity to changes in contingencies when presented with an instruction, with an experimental approach. The literature have different experimental approaches, where the similar ones have been put together in categories and compared to each other with the purpose of having an overview of the different findings. The different findings in each category are also discussed, and possible ways to advance this research are suggested.

Article 2 is an empirical study which is conducted for the purpose to study the effect of changes in contingency on rule-governed behavior in groups and microcultures. Their verbal behavior and transmission of the rule throughout generations was also studied. Two experiments with groups had to choose between two concurrent time schedules of reinforcement. A progressive time schedule of two seconds and fixed time schedule of 30 seconds were the two alternatives. The groups went through two conditions, a history training phase where the instruction was accurate according to the direct contingency, and a testing phase where the contingency changes and the instruction is inaccurate according to the direct contingency. The changes in the contingencies was with diminishing returns in Experiment 1. The members of the groups in Experiment 2 was exchanged by a new member every other session to create generations and microcultures. Two of three groups in Experiment 1, and one of two groups in Experiment 2 showed sensitivity to the changes in the contingency.

Keywords: rule-governance, instructional control, insensitivity effect, sensitivity to contingencies, verbal behavior

Sammendrag

Artikkel 1 er en litteraturgjennomgang med hensikt om å bringe sammen litteratur som tar for seg sensitivitet til endringer i kontingenser når en instruksjon blir presentert, med en eksperimentell tilnærming. Litteraturen har forskjellige eksperimentelle tilnærminger der de med lignende tilnærminger er satt sammen i kategorier og sammenlignet med hverandre med hensikt om å få en oversikt over de forskjellige funnene. De forskjellige funnene i hver kategori blir diskutert og mulige måter å utvikle denne forskningen på er foreslått.

Artikkel 2 er en empirisk studie som er gjennomført med hensikt om å studere effekten av endinger i kontingenser i regelstyrt atferd i grupper og mikrokulturer. Deres verbale atferd og overføring av regel gjennom generasjoner ble også studert. To eksperimenter med grupper som måtte velge mellom to tidskjema av forsterkning som ble presentert samtidig. De to alternative var et progressivt tidskjema på to sekunder, og et fast tidskjema på 30 sekunder. Gruppene gikk igjennom to faser, en historie trenings fase hvor instruksjonen stemte med den direkte kontingensen, og en test fase hvor kontingensen ble endret og instruksjonen ikke lenger stemte med den direkte kontingensen. Endringene i kontingensen var med gradvis reduksjon i Eksperiment 1. Gruppemedlemmene i Eksperiment 2 ble byttet med nye medlemmer annenhver økt for å skape generasjoner og mikrokulturer. To av tre grupper i Experiment 1, og en av to grupper i Experiment 2 viste sensitivitet til endringer i kontingensene.

Nøkkelord: regelstyring, instruksjons kontroll, ufølsomhets effekt, sensitivitet til kontingenser, verbal atferd

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Artikkel I. Regelstyring og kontingens sensitivitet: En litteraturgjennomgang

Anita Tootoonchi Poursharif

Abstract

Insensitivity to changes in contingencies on rule-governed behavior has previously been reported. This literature review has a purpose to bring together literature that addresses this issue with an experimental approach. On order to have an overview of the different results the literature with similar experimental approach have been placed together in categories and compared to each other. The different findings in each category is discussed, and possible ways to advance this research are suggested.

Keywords: rule-governance, instructional control, insensitivity effect, sensitivity to contingencies, verbal behavior

Rule-governance and contingency sensitivity: A literature review

The distinction between contingency-shaped behavior and rule-governed behavior was introduced by Skinner in 1966. He described contingency-shaped behavior as a behavior that is shaped by the experiences of the organism. Rule-governed behavior was described as a behavior that is controlled by verbal description of an experience either from the organisms, or another person's experience (Skinner, 1969). A functional relation between an antecedent, response and consequence is called a three-term contingency. This is a functional relation where an organism has learned that in the presence of some stimuli class, their response will most likely have an effect on the environment around them as a consequence. The relation between a response class and consequences is called contingency. Contingency-shaped behavior is controlled by this relation and is shaped by the experiences of the organism through operant conditioning, which means that it is learned from the consequences that happens after the behavior (Catania, 2013; Cerutti, 1989; Cooper et al., 2014).

In laboratory studies where changes in a contingency has been programmed, human behavior has been reported to be insensitive to these changes in many situations. Contrary, other species has been relatively more sensitive to these changes. Because of this, research has been done to investigate why humans are less sensitive to contingencies of reinforcement and especially to changes in contingencies, compared to other species (Fox & Kyonka, 2017; Hayes, Brownstein, Zettle, et al., 1986; Hojo, 2002). Even though other species has demonstrated to be more sensitive to changes in contingencies than humans, it is important to look into aspects that makes human behavior different to other species behavior. The most social significant aspect that is unique to human behavior involves verbal behavior. Human infants have also been reported to perform like animals on schedules of reinforcement, and this could be because their verbal behavior has not yet been developed (Lowe et al., 1983).

Verbal behavior can have an effect on human behavior when changes in contingencies is programmed (Hayes, Brownstein, Zettle, et al., 1986).

Variables can influence humans and animals differently when they are placed in a laboratory setting. When humans are placed into a laboratory setting, verbal behavior is mediated between the researcher and the participant. Humans will often get an instruction before going through with a task to solve in an experiment, but this would not be the case with animals. Research has been done where the effect of verbal behavior has been tested, to see if it does influence human behavior when changes in contingencies are programmed (Hayes, Brownstein, Zettle, et al., 1986).

Skinner (1974) defined verbal behavior as behavior that is reinforced through mediation between the listener and the speaker. A person's behavior can be changed with another person's verbal behavior through instructions. Verbal behavior can be a verbal description of a contingency, and this description is what we call a rule. A rule is when a stimulus describes a specific contingency in the future and has three functions (Skinner, 1974). One of the functions is that the rule is working as a discriminative stimulus where it signals possible reinforcers if a specific behavior occurs. Another function is that a rule describes how a behavior now can be controlled by consequences in the future. The third function is that a rule is effective when it comes to transmitting cultural practices (Catania, 2013; Hayes, 1989).

When a behavior is under influence of another person's verbal behavior, we call this rule-governed behavior. Rule-governed behavior is in contact with two sets of reinforcement contingencies. One is the contingency that is described and another is the direct contingency with a consequence that follows the behavior (Pierce & Cheney, 2013). When the behavior of an individual is under the influence of their own verbal behavior which is describing a

contingency in the future, it is called self-governance according to Hayes (1989). There are also different types of rules that can be given. A rule can be a promise, an advice, a threat or a warning. A promise and an advice are describing a contingency with a reinforcing consequence, a threat and a warning are describing a contingency with a punishing consequence. The consequence described in a promise and a threat is mediated by the speaker, and the consequence described in a advice and warning is not mediated by the speaker (Pierce & Cheney, 2013; Skinner, 1974).

Hayes (1989) describes two types of rule-governed behavior which he called pliance and tracking. Pliance is when the rule is followed under the influence of social conditions. An example is where we follow social norms such as waiting for the people to go out of the buss before we enter. Tracking is when the rule is followed because the rule corresponds with the contingency. A complete rule describes when a specific behavior should occur and what will happen if the behavior occurs or not, and the rule is followed according to this step by step. The reason why rules is an important aspect of verbal behavior is because it's easier to influence others behavior (Cerutti, 1989; Pierce & Cheney, 2013; Skinner, 1957).

According to Skinner (1974), rules are often more effective in shaping behavior than the contingency itself. Rules are very effective when the contingencies are unclear or complex. When a rule is describing a future contingency that does not match with the direct contingency, it can lead to a person not following the rule, but rather follow the direct contingency instead, we can say that the person is sensitive to the contingency. When a person keeps following the rule that is given to them, even if it does not match with the contingency it describes, we can say that the person is insensitive to the contingency.

The reason why rule-governed behavior and contingency-shaped behavior is important to study, is because we can see what the organisms are most sensitive to when we study

behavior that are exposed to both. We can study this to investigate the reasons for why insensitivity occurs when there is changes in contingencies. We can also investigate if people follow rules even if it does not match with the direct contingency. Rule-governance can be a way to use instructions to control behavior, but there is a distinction between rule-governance and instructional control. A rule suggests control in different types of circumstances, while instruction suggest situational contingencies. Because of this, many researchers that has studied rule-governance and contingency sensitivity uses the terms instructional control and schedule control instead (Cerutti, 1989).

When individuals get instructed on one specific schedule of reinforcement, studies have found that when the contingency changes, the individuals often continue to behave as the instructions suggested. When an instruction is presented, and the behavior shows insensitivity to changes in the contingency, it tells us that the actual consequences is not controlling the behavior, but that the instruction is. It has been found that behavior that has been reinforced on higher rates are more resistant to changes in contingencies. (Cerutti, 1989; Podlesnik & Chase, 2006).

The studies that has been done to investigate this insensitivity to contingency change when instructed has been done in various ways. This has been researched with various types of schedules, various ways to present the instructions, and various types of tasks to solve with an instruction. Research has compared differences with accurate and inaccurate instructions where the effect of an accurate instruction compared with an inaccurate instruction on changes in contingencies. Research has compared the differences with and without instructions where the effect of instruction is compared to no instruction on changes in contingencies. Research has compared the differences between an observer present in the room and without an observer present, to see if that has an effect on the instruction following.

Self-generated rules has also been researched to see if it has an effect on the sensitivity to changes in contingencies.

By looking at different studies with various types of approaches, we can get an overview of the different variables that has an effect on rule-governed behavior and contingency sensitivity. We can see which variable that leads to sensitivity and which variable that leads to insensitivity to changes in contingencies. Future research may be improved by having this information in mind while conducting experiments where they are investigating rule-governed behavior and contingency sensitivity.

This literature review focuses on articles with experiments done within rule-governance and sensitivity to changes in contingencies. The purpose of this review is to bring together the literature that addresses this issue with an experimental approach. The approaches that are more similar to each other, are put together in categories and then compared to each other to have an overview of the different findings. This overview can be useful to see what different variables there is that have an effect on rule-governed behavior and contingency sensitivity.

Method

First the search was done in databases with the search words "(instructional control) AND (schedule control)" and "(rule-governed behavior) AND (instructional control)". The databases that was first used was PsycINFO and Web of Science. With the inclusion criteria, it resulted in a few articles and because of this the search words were changed, and some search words were added in an attempt to get more results in the search. The search words that was changed and added were "Rule-Governed", "(Instructional control)", "Instruction-

following", "Instruction*", "Rule*", "(Insensitivity effect)", and "(Sensitivity to contingencies)".

Searching in this way resulted in thousands of articles which made it very difficult to pick out the relevant ones by going through all of them. This happened because the words "rule" or "instruction" resulted in many articles in different fields unrelated to behavior analysis. It was later decided to not search in these databases. Instead, the literature search was done in the most known journals in the field of behavior analysis that publish in English, with multiple search words (Zilio, 2019). Some of the Journals that was used, was the same used in Zilio (2019). The journals used to search for literature was journals that could possibly have publications that could be relevant for the review. The search words were also searched individually.

Journals

The literature search was done in 10 different journals in the field of behavior analysis, with 7 different search words. The journals were Behavior and Philosophy (B&P), Behavior and Social Issues (BSI), Behaviorism (B), Behavioural Processes (BP), European Journal of Behavior Analysis (EJOBA), Journal of Experimental Analysis of Behavior (JEAB), Journal of Organizational Behavior Management (JOBM), The Analysis of Verbal Behavior (TAVB), The Behavior Analyst Today (TBAT), and The Psychological Record (TPR). The search was done in September, 2020.

Search words

The words used in the search was "Rule-Governed", "(Instructional control)", "Instruction-following", "Instruction*", "Rule*", "(Insensitivity effect)", and "(Sensitivity to contingencies)". Each word was not linked with "AND" and "OR", but searched separately because the words are seldom used together in one article. All of the words were searched separately in each of the journals with keyword as a filter if applicable. There was no time-restrictions in this search, because as many articles as possible within the topic of rule-governance and sensitivity to contingencies was attempted to be included in the literature review. When the keyword filter was not applicable, then title would be used as a filter. When it was no option for a filter, the word was searched without any filter.

Inclusion criteria

The titles of every article were read through to select those who had a headline that could be relevant to the topic of rule-governance, instructional control or sensitivity to contingencies. The abstract for each article that had a relevant headline was also read through. If the abstract indicated that the article included an empirical study based on experiments about rule-governance, instructions and sensitivity to contingencies, then the article was included in this review. The articles also had to be in English, and only empirical studies was included. Books, theoretical and descriptive articles would not be included in this review. The empirical articles also had to have variables which included an instruction with a change in the contingency in at least one of the experiments. After reading through the abstract the whole article was read through to make sure it was in fact an empirical study based on experiments about rule-governance, instructions and sensitivity to contingencies.

In Figure 1, a flowchart demonstrates the steps of the search. The search words are listed with the number of search results in every journal. The number of articles included based on the inclusion criteria from each journal is also listed. The journals that was reviewed are listed in Table 1, also with the time period of each journal. The number of articles included in the categories from each journal is also listed in the table.

Results

All of the 32 articles were divided into four categories based on their research tasks and methods. The categories that they were divided into were accurate vs. inaccurate instruction, instruction vs. no instruction, with vs. without observer, and self-rules. From the 32 articles, 15 of them were included in the accurate vs. inaccurate instruction category, 10 were included in the instruction vs. no instruction category, three were included in the with vs. without observer category, and four were included in the self-rule category. The time aspect for the articles included is from 1964 to 2018, which is a time span of 54 years.

Accurate vs. Inaccurate Instruction

The articles in the accurate vs. inaccurate instruction category had procedures that included either groups or conditions where the participants were introduced to both accurate and inaccurate instructions. The initially accurate instructions later became inaccurate. An overview of the authors, journal, title, procedure and results from this category is listed in Table 2. In the articles included in this category, some of them had a procedure where the participants had to choose between two concurrent schedules to earn points. They were also given an instruction that was initially accurate, but in the second condition was no longer accurate according to the contingency (Fox & Kyonka, 2017; Fox & Pietras, 2013;

Hackenberg & Joker, 1994; Kudadjie-Gyamfi & Rachlin, 2002). Two used diminishing

returns in the second condition (Fox & Pietras, 2013; Hackenberg & Joker, 1994) and one of

the two also had groups with and without punishment (Fox & Pietras, 2013). Hackenberg and

Joker (1994) had results that demonstrated insensitivity to changes in the contingency until it

was an increase in the variability of choices which made the behavior more sensitive to the

contingency. Fox and Pietras (2013) had results that indicated that when the participants were

punished for not following the rules, they showed more insensitivity to the changes.

Fox and Kyonka (2017) had results that demonstrated that half of the participants

showed insensitivity to the changes, and the other half showed sensitivity to the changes in

the contingency when the rule was initially inaccurate All of the participants showed

insensitivity to the changes when the instruction was accurate in the first phase. Kudadjie-

Gyamfi and Rachlin (2002) demonstrated that the group who got a hint for the accurate

instruction showed insensitivity, and the group without a hint showed sensitivity to the

changes in the contingency.

Some of the articles in the accurate vs. inaccurate instruction category had groups with

minimal, partly inaccurate and accurate instructions where they were instructed to click fast or

slow on buttons that was on concurrent schedules (Hayes, Brownstein, Haas, et al., 1986;

Hayes, Brownstein, Zettle, et al., 1986). Hayes, Brownstein, Zettle, et al. (1986) had two

experiments where one of the results demonstrated insensitivity to changes in the

contingency, and one also demonstrated insensitivity when the instruction did not ensure

contact with the contingency. Hayes, Brownstein, Haas, et al. (1986) had results that

demonstrated that in the group where the instruction was inaccurate, that 25 of 39

demonstrated sensitivity to the changes in the contingency. In the group where the instruction

was accurate, 15 of 16 participants also demonstrated sensitivity to the changes.

Other articles included in this category had groups with different reinforcement schedules and conditions with different percentage of instructional accuracy presented to the participants (DeGrandpre & Buskist, 1991; Newman et al., 1995). The results of Newman et al. (1995) demonstrated insensitivity as a function of the schedule that reinforces it. DeGrandpre and Buskist (1991) had results that demonstrated insensitivity to the changes which was highly correlated with the accuracy of the instruction.

Other articles in this category had groups with instructions that were either directive, non-directive or generic (Henley et al., 2017; Miller et al., 2014). Henley et al. (2017) demonstrated that the directive and the generic groups behaved in accordance with the instructions, which means that they showed insensitivity to the changes in the contingency. The non-directive and control group demonstrated that the participants showed sensitivity to the changes. The same results was shown in Miller et al. (2014) where the directive group showed insensitivity, and the non-directive group showed sensitivity.

Some other articles in the accurate vs. inaccurate category had experiments with and without groups that went through conditions with punishments and reinforcements (O'Hora et al., 2014; Schmitt, 1998). O'Hora et al. (2014) had results that indicated derived instruction-following is sensitive to direct contingency control. Schmitt (1998) had results in all of the experiments where the participants showed more insensitivity to the direct contingency when they got instructions with understated losses as consequence than when they got instructions with overstated gains as a consequence.

The last three in this category had experiments with different groups (Baruch et al., 2007; Galizio, 1979; Martinez & Tamayo, 2005). Galizio (1979) had participants go through conditions with different instructions and programmed negative punishments. The results demonstrated that the participants reinforcement history do influence subsequent rule-

governed behavior. Baruch et al. (2007) had groups where the participants had to read the

instruction private or out loud to the observer, with accurate and inaccurate instructions. The

participants were either diagnosed as either dysphoric or non-dysphoric. The results

demonstrated that the individuals diagnosed as dysphoric responded with greater sensitivity to

the contingency than non-dysphoric individuals. Martinez and Tamayo (2005) had

experiments with different combinations of accurate and inaccurate instructions. The results

demonstrated that 31 of 40 participants demonstrated insensitivity to the contingency.

Instruction vs. No Instruction

The articles in the instruction vs. no instruction category had procedures that included

one or more groups with different conditions where the participants were introduced to both

instructions to follow and no instruction. When the participants did not get an instruction, they

followed the contingency until their responding pattern were stable, and then the contingency

changed. An overview of the authors, journal, title, procedure and results from this category is

listed in Table 3. Otto et al. (1999) had two experiments with groups where the participants

went through two or three conditions. One of the conditions had concurrent schedules,

another condition had differential reinforcement magnitude and instructions, and the last one

had no instructions. The results demonstrated that the participants showed insensitivity where

they failed to discriminate the inaccuracy of the response rate instructions and the relevant

schedule.

Some of the articles in this category had groups with different instructions. Accurate

or complete instruction, partially accurate or partially complete instruction and minimal

instructions. The participants also went through conditions with a specific pattern to follow or

differential schedules, and also no instruction with new schedules (Hojo, 2002; Podlesnik &

Chase, 2006). Hojo (2002) had results that indicated that the partially accurate instruction interfered with the optimal responding during new contingencies, which means that the participants showed insensitivity to the contingencies. Podlesnik and Chase (2006) also had results that demonstrated that instructed behavior is more insensitive to the changes in the contingencies.

One of the articles had six experiments and two conditions in each experiment with differential schedule and different instructions (Horne & Lowe, 1993). Horne and Lowe (1993) had experiments where the participants had to choose between multiple concurrent variable interval schedules to gather points. The variables that was manipulated in the first experiment was that each schedule was signaled to the participants. The second, fourth and sixth experiment, had a three second change over delay that was implemented. The participants in the third and fourth experiment got ordinal cues that was related to the schedule frequencies, and the participants in the fifth and sixth experiment got instructions that described the relations between the scheduled stimuli and the reinforcement frequency. In the results it was demonstrated that all five participants were stable with the rules in experiment one, experiment two had three of five participants showing a decreasing trend in contingency sensitivity. In the third experiment, two of five, and in fourth experiment, one out of five had a slight decreasing trend in contingency sensitivity. In experiment five, all five participants were stable with the rules, and finally in experiment six, one of five participants had an increasing trend in contingency sensitivity.

Other articles had experiments and groups with complete, incomplete and no instructions on multiple schedules (Catania et al., 1982; Joyce & Chase, 1990; Shimoff et al., 1986). Catania et al. (1982) had groups where the participants had to guess the best way to earn points. Contingencies for guesses was not arranged in one of the groups, in the other

group the guesses were shaped, and the last group got instructed guesses. The results indicated that consistent control of pressing rates by guesses did not occur when they were instructed, but they did occur when they were shaped. Instructed guesses sometimes produced contingency sensitivity.

Joyce and Chase (1990) had results from experiment one where all the participants in the stability trained group showed insensitivity to the contingency and the responding in the group without stability showed more contingency sensitivity. In experiment two, the results demonstrated that when a strategic instruction was given, the participants responded more efficient, then when they did not get a strategic instruction. Shimoff et al. (1986) had experiments with multiple schedules and instructions. The results demonstrated that all the participants showed contingency sensitive behavior.

The last three articles in the instruction vs. no instruction category had experiments and groups with specific, minimal, a variety and no instructions (Ayllon & Azrin, 1964; LeFrancois et al., 1988; Okouchi, 1999). Okouchi (1999) had groups with no instruction and inaccurate instruction with and without an instruction history had results that showed if behavior was differentially reinforced with an instruction, then the behavior could be controlled by the instruction even if the behavior was not similar to what was specified by the instruction. Structurally identical instructions could be functionally different. LeFrancois et al. (1988) had groups with minimal, specific and a variety of instructions with different schedule. The results showed that only in the participants in the variety condition showed contingency sensitivity. Ayllon and Azrin (1964) had two experiments and conditions with and without instructions, with participants that was mental patients. The results strongly suggested that the responding to the contingency could not be effective on a patient without a verbal repertoire, and that it is important to arrange consequences for the patients in addition to the instructions.

With vs. without observer

The articles in the with vs. without observer category had procedures that included either groups or conditions where the observer was either present or not present in the experiments (Alessandri et al., 2017; Donadeli & Strapasson, 2015; Kroger-Costa & Abreu-Rodrigues, 2012). An overview of the authors, journal, title, procedure and results from this category is listed in Table 4. Alessandri et al. (2017) had results where 12 of 14 participants showed insensitivity to the contingency. Whether the observer was present or not in the room did not have an effect on the instruction following.

Donadeli and Strapasson (2015) had three experiments, where the contingency or the instruction changed, with differences in the reinforcement magnitude and an observer present and not present. The results demonstrated that social control was important for maintaining rule-governed behavior. There was no difference in the results where the contingency or the instruction changed. Kroger-Costa and Abreu-Rodrigues (2012) had three groups, where one was a control group, another one a group with an observer, and the last group without an observer. The groups went through two conditions with a concurrent schedule, and a change in the contingency. The results showed that rule-governed behavior is affected and maintained by the presence of the observer.

Self-Rule

The articles in the self-rule category had procedures that included either groups or conditions where the participants generated their own rules (Baumann et al., 2009; Kissi et al., 2018; Ninness & Ninness, 1998; Rosenfarb et al., 1992). An overview of the authors, journal, title, procedure and results from this category is listed in Table 5. Rosenfarb et al. (1992) had

three groups with different rules, self-generated rules, yoked rules/yoked time and no

rules/yoked time. The conditions had multiple schedules with and without instructions, and

extinction. The results demonstrated that all participants changed their response immediately

and demonstrated sensitivity to the contingency. Kissi et al. (2018) had three groups, no

instructions, ply instruction (pliance) and track instruction (tracking). The result suggested

that the participants adhered more to socially generated rules then self-generated rules, and

more to ply than track rules.

Baumann et al. (2009) had four experiments with multiple groups. These groups had

either varied or specific self-rules, instruction group and a control group. The results indicated

that the exposure to varied self-rules and rules that generated variable behavior pattern

increased contingency sensitivity if the variable behavior pattern was obtained. Ninness and

Ninness (1998) had three experiments and groups with an accurate rule, a fallacious rule and a

group with no rule. The conditions had multiple schedules, delays and extinction. The results

indicated that the participants that had both self-generated rules and was instructed by others,

showed contingency-shaped behavior.

Discussion

The purpose of this review was to bring together literature with an experimental

approach that investigated the issue of insensitivity to changes in contingency, when an

instruction was presented. The articles in the accurate vs inaccurate category had different

approaches to investigate the issue. When individuals had to choose between two concurrent

schedules and was given an instruction that was accurate in the first condition, and inaccurate

in the second condition demonstrated insensitivity to the changes in the contingencies. Most

of the participants followed the instruction and was insensitive to the contingency change,

however some of them showed contingency sensitivity when they were not hinted with an accurate instruction and when it was more choice variability. The behavior showed more insensitivity, especially when the participants got punished for not following the rule and got hints with an accurate instruction (Fox & Kyonka, 2017; Fox & Pietras, 2013; Hackenberg & Joker, 1994; Kudadjie-Gyamfi & Rachlin, 2002).

When the participants was presented with minimal instruction, partly inaccurate instruction or accurate instructions, they responded with both sensitivity and insensitivity to the changes in the contingencies (Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986). When participants went through conditions with different percentage of instructional accuracy, the participants showed insensitivity to the changes in the contingency, especially when they were presented with an accurate instruction (DeGrandpre & Buskist, 1991; Newman et al., 1995). This corresponds with the findings mentioned above.

How the instructions are presented and phrased were also studied. When directive and generic instructions were presented, the participants showed insensitivity to the contingency, however, when the not directive instruction was presented, the participants showed contingency sensitive behavior (Henley et al., 2017; Miller et al., 2014). When instruction following was reinforced or punished, derived instruction-following demonstrated sensitivity to the direct contingency. Instructions that understated losses resulted in more insensitivity to the contingency than instructions that overstated gains. More results indicated that the participants reinforcement history had an effect on rule-governed behavior, with an exception in diagnosed dysphoric individuals according to one study included (Baruch et al., 2007; Galizio, 1979; Martinez & Tamayo, 2005; O'Hora et al., 2014; Schmitt, 1998).

The results in most of the articles in the accurate vs inaccurate instruction category, continuously showed that insensitivity to the contingency occurs more when the instruction is

accurate. When individuals get an instruction that is accurate according to the contingency, they continue to follow the instruction even when changes in the contingency occur. This shows that reinforcement history does influence rule-governed behavior and makes it more insensitive to contingency changes.

The articles in the instruction vs. no instruction also had different approaches to the issue. When individuals had to choose between two concurrent schedules with differential reinforcement magnitude, the individuals responded with contingency insensitive behavior. When individuals got differential instructions, including no instruction, the behavior was more insensitive to the direct contingency when they got an instruction compared to when they got no instruction (Hojo, 2002; Horne & Lowe, 1993; Otto et al., 1999; Podlesnik & Chase, 2006).

When individuals had to guess the most optimal way to earn most reinforcements, instructed guesses showed sometimes more contingency sensitive behavior. However, when it was studied to see if stability in response for instruction-following had an effect, it indicated that stability led to insensitivity, while no stability led to contingency sensitive behavior. Strategic instructions also showed contingency sensitive behavior, more so than with non-strategic instructions. For mental patients it has been demonstrated that instruction is important to pair with the contingency. Behavior was more rule-governed when they got differentially reinforced with instructions, except when they received a variety of instructions where the behavior was more contingency shaped (Ayllon & Azrin, 1964; Catania et al., 1982; Joyce & Chase, 1990; Okouchi, 1999; Shimoff et al., 1986). LeFrancois et al. (1988) suggests that variety training may be effective to generate sensitivity when there is changes in contingencies.

The results in most of the articles in the instruction vs. no instruction category, continuously showed that sensitivity to changes in contingency occurs less when individuals gets an instruction, compared when they are not getting instructions. When individuals get an instruction, they continue to follow the instruction even when changes in the contingency occur. An exception is when Shimoff et al. (1986) demonstrated that the individuals showed more contingency sensitive behavior when they got an instruction on multiple schedules. Having instructions on multiple schedules could lead to variability which can lead to more contingency sensitive behavior because it also increases variability in their responses overall. However, most of the articles in this category shows that reinforcement history does influence rule-governed behavior, and make it insensitive to the contingency changes, while no instruction presented, allows the individuals to get in touch with the contingency when it is changed.

In the with and without observer category the articles demonstrated that the presence of an observer does make a difference for maintaining rule-governed behavior when there is changes in the contingency. There is one exception where one of these articles found no differences when an observer was present or not, but the behaviors was more insensitive to the direct contingency. Most of the results in the articles within the with and without observer category suggests that social control may be important for maintenance of instruction following behavior (Alessandri et al., 2017; Donadeli & Strapasson, 2015; Kroger-Costa & Abreu-Rodrigues, 2012).

The articles in the self-rule category had individuals generate their own rules. These articles mostly demonstrated that both self-generated rules, and rules that was instructed by others showed more contingency sensitive behavior. The individuals showed more sensitivity to the direct contingency, especially when varied self-rules and rules produced variable

behavior patterns. Kissi et al. (2018) had found that individuals more often adhered to rules generated by others than to self-generated rules. Most of the articles in the self-rule category suggests that the option for the individuals to generated their own rules may increase the sensitivity to the changes in the contingency (Baumann et al., 2009; Ninness & Ninness, 1998; Rosenfarb et al., 1992).

It can be multiple explanations and sources of why instructions can make behavior more insensitive to changes in the contingencies. One of the explanations may be that when a rule is given and it is initially accurate to the contingency, the behavior continues to be rule-governed even if the contingency changes and the rule is no longer accurate. The type of rule-following when the rule corresponds with the contingency, is called tracking. Rule-following is called pliance when the rule is followed under the influence of socially mediated reinforcement history (Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986).

This can indicate that individuals who first get an instruction that is accurate to the contingency, are insensitive to changes in the contingencies because humans are very sensitive to social contingencies (Fox & Pietras, 2013). Because of this, Hayes, Brownstein, Zettle, et al. (1986) suggests that it is important to be careful about social dimensions of verbal manipulations . This could also be why rule-governed behavior is more maintained when an observer is present (Alessandri et al., 2017; Donadeli & Strapasson, 2015; Kroger-Costa & Abreu-Rodrigues, 2012).

An explanation of why instruction generates more insensitivity to changes in contingencies than no instruction, can be decreased variability. When an instruction is presented and individuals follow it, their responses have very little variability. The reason for this is because instructions describe a specific contingency. There is not a lot of variable

responses when individuals follow a specific pattern. When there is little variability in their response, an insensitivity to changes in the contingency might occur. Little variability decreases contact with outcomes for alternate response pattern. When there are no instructions to suggest a pattern of contingency, there is increased variability in the responses and increased sensitivity to changes in contingencies (Fox & Pietras, 2013; Hayes, Brownstein, Zettle, et al., 1986; Joyce & Chase, 1990).

Why self-generated rules resulted in more contingency-governed behavior might be because their private talk is changed. Previous research has suggested that nonverbal behaviors becomes more linked to contingency sensitive behavior. Self-rules can lead to self-observation where new behavior may gain control over the target behavior. It was also demonstrated that varied self-rules lead to varied patterns which resulted in less rule-governed behavior. This also links to the suggestion that increased variability leads to increased sensitivity to changes in contingencies (Baumann et al., 2009; Catania et al., 1982; Rosenfarb et al., 1992).

When reading a literature review, there are some weaknesses to be aware of. Literature reviews has a risk of leaving out relevant articles, which increases the risk for a bias in the review. Another weakness that could occur is publication bias, where researchers and editors could leave out research that did not have an expected effect. Publication bias was not controlled for in the search which could weaken the method in this literature review. The words used in this search was searched individually in several journals as an attempt to strengthen the search. This was done because the words are seldom used together, where one of the words can be preferred over another in an article. An example of this is that the words "instruction" and "rule" is usually not used together because the word are synonymous. To search the words individually could avoid the risk of leaving relevant articles out.

In this review we have learned that when individuals get an instruction, their behavior demonstrated insensitivity when there was a change in the contingency, due to social contingencies and decreased variability in responses. However, there are some variables that could lead to more sensitivity to these changes. The variables that could lead to more sensitivity to the changes in the contingencies is variability and self-observation. To make sure of variability in the overall responses of the individuals and make sure of changes in their private talk with self-observation, could result in more sensitivity to the changes. This can possibly be done by having the instructions on multiple schedules or change the instructions to be more non-directive. Making the individuals being more self-observant by having them change their private talk could be done by putting the individuals in groups. In this way we allow the group members to reflect and discuss possibilities of different patterns of responses among themselves.

Because it is suggested that self-generated rules might be more sensitive to changes in contingencies, due to changes in their private talk, future research might take this into consideration. It would also be interesting to make this private talk public, by having individuals in groups to analyze their verbal behavior. Investigating rule-governed behavior and the insensitivity to changes in contingencies in groups allows us to study this issue on a cultural level to see whether rules have an effect on cultures in groups and how it affects cultures in groups. By investigating this we could learn more about the importance of rule-governance in groups, the selection of their cultural patterns, and learn about the variables that leads to superstitious behavior in cultures.

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Figure 1

Flowchart of search result.
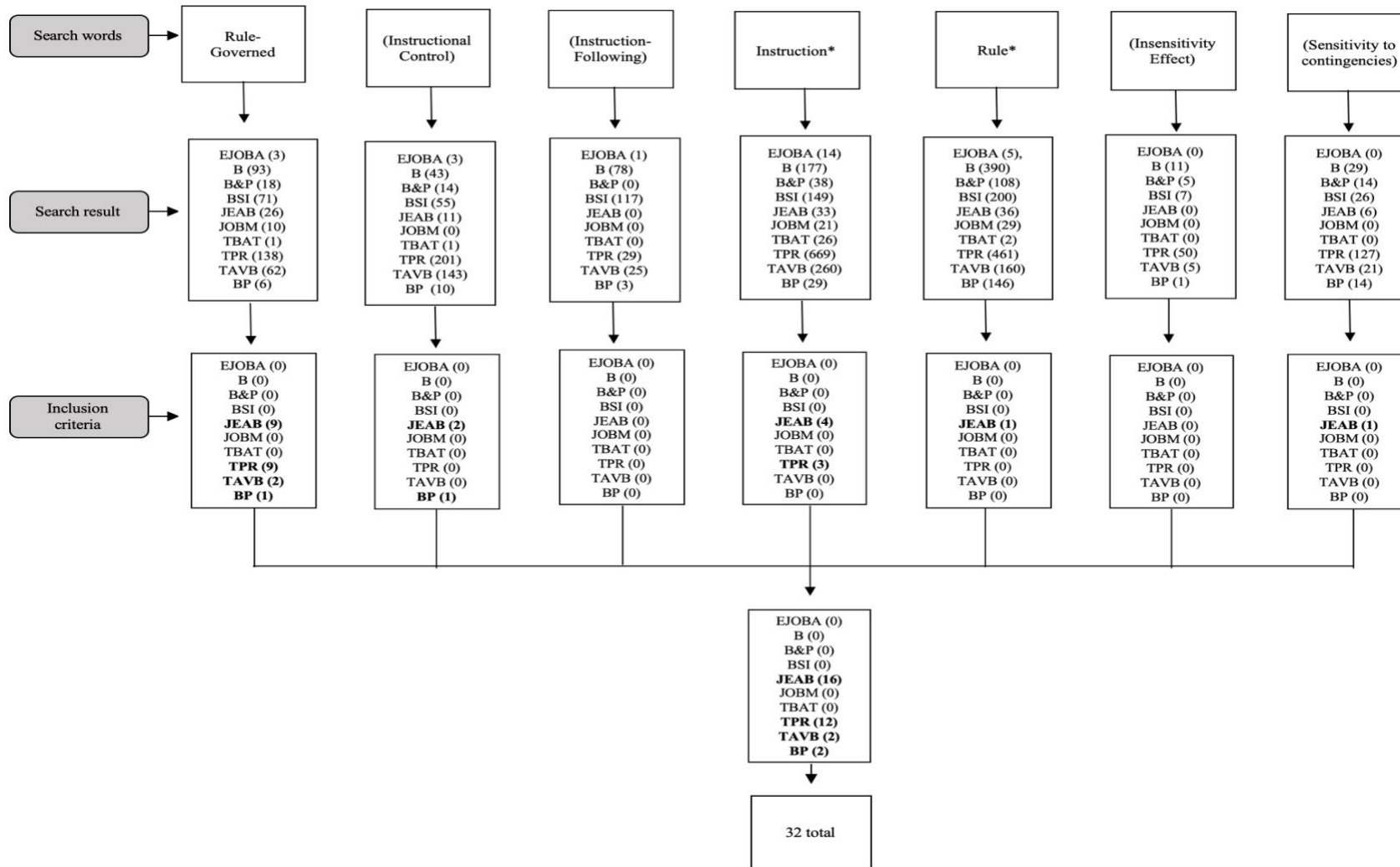
Note. The flow-chart shows the steps of the literature search. The search words is listed with the number of search results in every journal.

The number of articles included based on the inclusion criteria from each journal is marked with bold text.

Table 1

Journals reviewed.

Journal	Period	Accurate vs. Inaccurate	Instruction vs. No Instruction	With vs. Without Observer	Self-Rule
Behavior and Philosophy	1990 – 2020	0	0	0	0
Behavior and Social Issues	1991 – 2020	0	0	0	0
Behaviorism	1972 – 1989	0	0	0	0
Behavioural Processes	1976 – 2020	1	0	1	0
European Journal of Behavior Analysis	2000 – 2020	0	0	0	0
Journal of Experimental Analysis of Behavior	1958 – 2020	8	7	0	1
Journal of Organizational Behavior Management	1977 – 2020	0	0	0	0
The Analysis of Verbal Behavior	1985 – 2020	2	0	0	0
The Behavior Analyst Today	2000 – 2020	0	0	0	0
The Psychological Record	1937 – 2020	4	3	2	3

Note. The journal and the time period of each journal is listed in the table. The number of articles included from each journal, in each category is also listed in the table.

Table 2

Accurate vs. inaccurate category.

		Accurate vs. inaccurate instruction			
Author	**Journal**	**Topic**	**Participants**	**Procedure**	**Conclusion**
Galizio (1979)	Journal of Experimental Analysis of Behavior	Contingency-shaped and rule-governed behavior: instructional control of human loss avoidance	15	Four experiments. Conditions with accurate and inaccurate instruction, no instruction, contact (loss) and no contact (no loss).	Participants showed rule-governed behavior and the participants reinforcement history do influence subsequent rule-governed behaviors.
Hayes et al. (1986)	Journal of Experimental Analysis of Behavior	Rule-governed behavior and sensitivity to changing consequences of responding	42	Two experiments. Exp.1, four groups. Minimal, partially inaccurate "go fast" and "go slow" instruction (not accurate category), and accurate instructions (accurate category). Exp.2, six groups, "go fast" and "go slow" in different number of sessions.	Exp.1, without instruction, none of the subjects made extensive contact with both types of programmed consequences. Exp.2, the removal of the instruction light (Group 1, 2, 3 and 4) ("Go Slow" and "Go Fast") did not result in increased control by the different schedules of programmed consequences (not in contact with contingency).
Hayes et al. (1986)	Journal of Experimental Analysis of Behavior	Instructions, multiple schedules, and extinction: Distinguishing rule-governed from schedule-controlled behavior.	55	Four groups. Minimal, partially inaccurate "go fast" and "go slow" instruction (no accurate category), and accurate instructions (accurate category).	In no accurate groups, 25 of 39 showed high contingency sensitivity. In accurate group, 15 of 16 showed high contingency sensitivity.

DeGrandpe & Buskist (1991)	The Psychological Record	Effects of accuracy of instructions on human behavior: Correspondence with reinforcement.	16	Four groups with CRF reinforcement schedule, going through three conditions with different percentage of accuracy.	Instruction following was highly correlated with the accuracy of the instruction.
Hackenberg & Joker (1994)	Journal of Experimental Analysis of Behavior	Instructional versus schedule control of humans' choices in situations of diminishing returns.	4	One group. Conditions with accurate rule (concurrent schedule), and inaccurate rule with diminishing returns.	As the instructions became less accurate, instructional control eventually was extinguished, giving way to patterns more appropriate to the programmed contingencies. However, the behavior did not always change in accordance with the contingency. Increased choice variability made the behaviors more sensitive to changes.
Newman et al. (1995)	The Psychological Record	The effects of schedules of reinforcement on instruction following.	18	Six groups with different reinforcement schedule. Five conditions with different instruction accuracy.	Instruction following is a function of the schedule of reinforcement that reinforcers instruction following or noncompliance.
Schmitt (1998)	Journal of Experimental Analysis of Behavior	Effects of consequences of advice on patterns of rule control and rule choice	50	Three experiments, two groups in two experiments (gain and loss), and four group in the third experiment(Gain and loss, overstated and understated consequences).	All the experiments demonstrated that discrimination was poorer (i.e., lower sensitivity) with instructions that understated losses, than with instructions that overstated gains.

Kudadjie-Gyamfi & Rachlin (2002)	Behavioural Processes	Rule-governed versus contingency-governed behavior in a self-control task: Effects of changes in contingencies	8	Two groups, no hint (contingency-governed), hint (rule-governed). On concurrent schedule.	The HINT (Rule-Governed) groups choices were insensitive to a change from the self-control contingency to a simple choice between short and long delayed reinforcement. The NO HINT (Contingency-Governed) groups choices were more sensitive to change from the self-control contingency to a simple choice between short and long delayed reinforcement.
Martinez & Tamayo (2005)	The Psychological Record	Interactions of contingencies, instructional accuracy, and instructional history in conditional discrimination	40	Two experiments. Four groups, true-true, false-false, true-false, false, true instructions.	Across both experiments, 31 of 40 subjects showed zero or almost zero correct responses during the test sessions.
Baruch et al. (2007)	The Psychological Record	The differential effect of instructions on dysphoric and nondysphoric persons.	29	Two groups, Tracking (reading instruction private) and Pliance (reading instructions to the experimenter). Both groups going through two conditions with accurate instruction and inaccurate instruction.	Diagnosed dysphoric individuals demonstrated greater schedule sensitivity (less rule-governed behavior) than did nondysphoric persons. No other differences were found.
Fox & Pietras (2013)	Journal of Experimental Analysis of Behavior	The effects of response-cost punishment on instructional control during a choice task	7	Two groups, penalty and no penalty. Conditions with accurate rule (concurrent schedule), and inaccurate rule with diminishing returns.	Choices were more consistent with instructions during the Penalty phase than during the No Penalty phase, suggests that the penalty (response-cost) contingency punished responding inconsistent with the rule.

Miller et al. (2014)	The Analysis of Verbal Behavior	Effects of mands on instructional control: A laboratory simulation	6	Two groups, directive and non-directive instructions	Directive group exhibited greater adherence to the instruction than the non-directive group when instruction following was less profitable. Directive group showed rule-governed behavior. Non-directive group showed contingency-governed behavior.
O'Hora et al. (2014)	Journal of Experimental Analysis of Behavior	Antecedent and consequential control of derived instruction-following	9	Two experiments. Conditions with pre-training, baseline, punishment, reinforcement and probes.	Understanding instructions and following them may be subject to independent sources of stimulus control. Derived instruction-following is sensitive to direct contingency control.
Fox & Kyonka (2017)	Journal of Experimental Analysis of Behavior	Searching for the variables that control human rule-governed "insensitivity"	22	Two experiments. Conditions with accurate rule (concurrent schedule), and inaccurate rule.	Approximately half of participants followed an inaccurate rule and half did not. All of the participants followed the accurate rule.
Henley et al. (2017)	The Analysis of Verbal Behavior	Function-altering effects of rule phrasing in the modulation of instructional control	16	Four groups, control, directive, non-directive and generic instructions	Directive and generic groups responded in accordance with the instructions even when schedules of reinforcement favored deviation from the instructed pattern. Non directive group responded toward an optimal pattern. Control group participants appears to be controlled by the reinforcement.

Note. The table sums up the articles included in the accurate vs. inaccurate category. Each journal is listed in an order by year.

Table 3

Instruction vs, no instruction category.

			Instruction vs. no instruction		
Author	**Journal**	**Topic**	**Participants**	**Procedure**	**Conclusion**
Ayllon & Azrin (1964)	Journal of Experimental Analysis of Behavior	Reinforcement and instructions with mental patients	38	Two experiments. Conditions with instructions and no instructions.	Exp.1, the outcome of this experiment strongly suggested that the reinforcement procedure could not be effective without recognition of the major role played by the existing verbal repertoire. Exp.2, the results of this study demonstrated that it was necessary to arrange consequences for the patients in addition to providing instruction
Catania et al. (1982)	Journal of Experimental Analysis of Behavior	Instructed versus shaped human verbal behavior: Interactions with nonverbal responding.	50	Three groups, shaping, no contingencies arranged, instructed.	Consistent control of pressing rates by guesses occurred when guesses were shaped but not when they were instructed; unlike the shaping of guesses, instructing guesses sometimes produced pressing rates that were sensitive to the contingencies.

Shimoff et al. (1986)	Journal of Experimental Analysis of Behavior	Human operant performance: Sensitivity and pseudosensitivity to contingencies	3	Two conditions, multiple schedules with instruction.	All three participants showed contingency sensitive behavior.
LeFrancois et al. (1988)	Journal of Experimental Analysis of Behavior	The effects of a variety of instructions on human fixed-interval performance	90	Six groups, variety, specific and minimal instruction with different schedules.	Instructing button-pressing under a variety of reinforcement schedules was sufficient to bring about sensitivity to changing conditions, whereas training by the other conditions was not. Variety training may, therefore, be effective in generating sensitivity to changing contingencies.
Joyce & Chase (1990)	Journal of Experimental Analysis of Behavior	Effects of response variability on the sensitivity of rule-governed behavior	25	Two experiments. Four groups in Experiment 1, complete or incomplete instructions, with and without stability criterion. Two group in Experiment 2, complete or incomplete instruction.	Exp.1, no subject in the two stability trained groups responded efficiently under the first or subsequent test sessions. Exp. 2, no subject in either group responded efficiently in the initial baseline sensitivity session. However, in the first strategic instruction session, all 6 subjects response rates decreased sharply under the FI 10s schedule. The second presentation of the baseline sensitivity test produced a reversal in the efficiency of responding in all 6 subjects. The second presentation of the strategic instruction again produces responding that was efficient under the FI 10s schedule

Horne & Lowe (1993)	Journal of Experimental Analysis of Behavior	Determinants of human performance on concurrent schedules	30	Six experiments. Two conditions. Differential schedule and different instructions.	Exp. 1, All five were stable with the rules. Exp.2, three of five had a decreasing trend in contingency sensitivity. Exp.3, two of five had a slight decreasing trend in contingency sensitivity. Exp.4, one of five had a slightly decreasing trend in contingency sensitivity. Exp.5, All five were stable with the rules. Exp.6, two of five had a slightly decreasing trend in contingency sensitivity, one of five had an increasing trend in contingency sensitivity.
Otto et al. (1999)	The Psychological Record	An operant blocking interpretation of instructed insensitivity to schedule contingencies.	287	Two experiments. Experiment 1; Four groups, low/competing low/congruent, high/competing and high/congruent going through two conditions. Experiment 2: Three groups, Sds-points, points only, control. All groups went through three conditions.	Experiment 1: Instructional control was maintained during second phase under all four conditions. The participants appeared to not have discriminated the inaccuracy of the response rate instructions. Experiment 2: the data support an account of instructional control in terms of failing to discriminate the relevant schedule features.
Okouchi (1999)	Journal of Experimental Analysis of Behavior	Instructions as discriminative stimuli	12	Three groups, contractionary instruction history (inaccurate instruction), no history (inaccurate instruction), and no history (no instruction).	If behavior is differentially reinforced in the presence of an instruction, the behavior can be controlled by the instruction even though the behavior is dissimilar to that specified by the instruction. Instructions that are

					structurally identical can be functionally different.
Hojo (2002)	The Psychological Record	Effects of instructional accuracy on a conditional discrimination task.	23	Three groups; accurate, partially accurate and minimum instruction. Two conditions, first given an instruction of a specific pattern to follow, then no instruction with a new pattern.	Partially accurate instruction interfered with acquisition of an optimal responding under new contingencies, suggesting that performance depends upon not only current contingencies, but also the history of the subject.
Podlesnik & Chase (2006)	The Psychological Record	Sensitivity and strength: Effects of instructions on resistance to change	6	Two groups, minimal instruction, complete instruction. Four conditions, differential schedules.	Instructed behavior is more insensitive to change in contingencies.

Note. The table sums up the articles included in the instruction vs. no instruction category. Each journal is listed in an order by year.

Table 4

With vs. without observer category.

			With vs. without observer		
Author	**Journal**	**Topic**	**Participants**	**Procedure**	**Conclusion**
Kroger-Costa & Abreu-Rodrigues (2012)	The Psychological Record	Effects of historical and social variables on instruction following.	21	Three groups; control, with observer and without observer. All the groups was going through two conditions, DRL or FR, and FI schedule.	Instruction following was affected by the presence of the experimenter despite a history of no reinforcement for such behavior, and they suggest that instructional control may be strengthened by social contingencies.
Donadeli & Strapasson (2015)	The Psychological Record	Effects of monitoring and social reprimands on instruction-following in undergraduate students.	24	Three experiments. Experiment 1: two groups, Contingency-Varied and Instruction-Varied where in the conditions, the contingency or the instruction changes. Experiment 2: same as the first, except less money per point. Experiment 3: same as the second, except that the observer reminded them of the instruction when present in phases "No Conflict" and "Conflict".	The results support the proposition that social control is important for maintaining instruction-following. No difference in instruction vs. contingency change

Alessandri et al. (2017)	Behavioural Processes	Effects of reinforcement value on instruction following under schedules of negative reinforcement.	14	Two groups, with low and high force requirement, with and without observer present.	12 of 14 participants showed instruction following. The presence or absence of the experimenter in the room did not have an effect on instruction following.

Note. The table sums up the articles included in the with vs. without observer category. Each journal is listed in an order by year.

Table 5

Self-Rule category.

	Self-Rule				
Author	**Journal**	**Topic**	**Participants**	**Procedure**	**Conclusion**
Rosenfarb et al. (1992)	Journal of Experimental Analysis of Behavior	Effects of self-generated rules on the development of schedule-controlled behavior	29	Three groups, self-generated rules, yoked rules/yoked time, and no rules/yoked time. Conditions with multiple schedules with and without instructions and extinction.	All subjects immediately changed responding in response to the change in the contingency (contingency-governed behavior)
Ninness & Ninness (1998)	The Psychological Record	Superstitious math performance: Interactions between rules and scheduled contingencies	16	Three experiments. Groups with accurate, fallacious and no rule. Conditions with multiple schedules, extinctions, and delays.	Self-generated rules and instruction to follow proposed by others, appeared to promote the acquisition of schedule-appropriate behavior; however, their results also suggested that rules may have impeded subjects sensitivity to extinction.
Baumann et al. (2009)	The Psychological Record	Rules and self-rules: Effects of variation upon behavioral sensitivity to change	67	Four experiments, with multiple groups including varied or specific self-rule, rule, and control.	The varied rules promote greater sensitivity than specific rules, as long as the variable behavior pattern were obtained.
					The increased sensitivity was obtained as long as the exposure to Varied Self-Rules and Rules generated response-rate variability (Experiment 1-3), and independently of the number of

					reinforcers previously obtained (Experiment 4)
Kissi et al. (2018)	The Psychological Record	Examining the moderating impacts of plys and tracks on the insensitivity effect: A preliminary investigation	45	Three groups, ply, track, and no instruction.	The non-instructed contingency reversal, participants adhered more to 1) socially as opposed to self-generated rules and 2) ply compared to tracks.

Note. The table sums up the articles included in the self-rule category. Each journal is listed in an order by year.

Article II: The effect of changes in contingencies on rule-governed behavior in groups

Artikkel II: Effekten av endringer i kontingenser på regelstyrt atferd i grupper

Anita Tootoonchi Poursharif

Abstract

The effect of changes in the contingency on rule-governed behavior in groups and microcultures was studied. The groups verbal behavior and transmission of the rule throughout generations was also studied. Two experiments with groups that had to choose between two concurrent time schedules of reinforcement. The two alternatives were a progressive time schedule and fixed time schedule. The groups went through two conditions, a history training phase where the instruction was accurate according to the direct contingency, and a testing phase where the contingency changes and the instruction was inaccurate according to the direct contingency. The changes in the contingencies was with diminishing returns in Experiment 1. The members of the groups in Experiment 2 was exchanged by a new member every other session to create generations and microcultures. Two groups showed sensitivity to changes in the contingency, and one group showed insensitivity to changes in the contingency in Experiment 1. One group showed sensitivity to changes in the contingency, and one group showed insensitivity to changes in the contingency in Experiment 2.

Keywords: rule-governance, instructional control, insensitivity effect, sensitivity to contingencies, verbal behavior

The effect of changes in contingencies on rule-governed behavior in groups

An important aspect that makes human behavior different from other species behavior is verbal behavior. In laboratory settings, humans often get an instruction before the experiments start which is not the case when animals are put in laboratory settings. Research has shown that human behavior may be less sensitive to contingencies of reinforcement and changes in the contingencies than laboratory animals. Because of this, research has been done to study verbal behavior in the form of rules, to see if it has an effect on the sensitivity to changes in contingencies of reinforcement (Fox & Kyonka, 2017; Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986; Hojo, 2002).

A verbal description of a future contingency is called a rule. A rule can be a description of an experience from the individual themselves or by another person. Rule-governed behavior is under control of commands, instructions or rules that works as an antecedent stimulus. When a behavior is shaped by the environment, the behavior is called contingency-shaped behavior. Contingency-shaped behavior is controlled by the functional relation between behavior and the consequences (Cerutti, 1989; Fox & Pietras, 2013; Hayes, 1989).

When a rule inaccurately describes the contingency and does not match the direct contingency, the behavior could either follow the rule or break the rule by behaving in a way that indicates that they came in contact with the direct contingency. Studies have been done on rule-governed behavior and contingency-shaped behavior where sensitivity to changes in the contingency was examined when an instruction was presented. Most of the studies found that individuals that have been given an instruction to follow, showed more insensitivity to the changes in the direct contingencies. This insensitivity effect tells us that the behavior is more controlled by the instruction than the direct contingency (Cerutti, 1989).

Hayes, Brownstein, Zettle, et al. (1986) studied rule-governed behavior and the subsequent insensitivity to changes in the contingency. The participants had to press on buttons where they earned points according to a multiple fixed ratio (FR) and differential reinforcement of low rate (DRL) schedules. The participants were instructed to either press slow and fast, only slow or only fast on the buttons. The instruction was signaled by lights that directed the participants to press fast or slow. Two experiments were performed, where the first experiment had four groups. One of the groups got minimal instruction, the other group got partially inaccurate instruction either to press only slowly or only fast on the buttons, and the last group got an accurate instruction on the pattern of pressing. The findings in the first experiment demonstrated that when the instructions did not ensure contact with the contingency, the participants showed more insensitivity to the contingency. The second experiment had six groups with the instructions "go fast" and "go slow" in different number of sessions. The findings in the second experiment demonstrated that when the instruction light was removed, the contingency did not control the behavior, which means that they were insensitive to the changes in the contingency.

Hayes, Brownstein, Haas, et al. (1986) also investigated rule-governed behavior and the insensitivity to changes in the contingency with multiple schedules and extinction. The procedure in this study was very similar to the first experiment done by Hayes, Brownstein, Zettle, et al. (1986) with an exception of extinction in one session. The participants were divided in four groups; minimal instruction, partially inaccurate rules either to press only slowly or only fast on the buttons, and accurate but later inaccurate instruction on the pattern of pressing. The findings demonstrated that when the instruction was inaccurate, 25 of 39 participants showed sensitivity to the changes in the contingency. When the participants got

an instruction that was accurate in the beginning but later inaccurate, 15 of 16 participants

showed sensitivity to the changes in the contingency.

Other types of research have also been done with similar methods used to study the

possible insensitivity (Hackenberg & Joker, 1994). Hackenberg and Joker (1994) had four

participants choose between two colored squares on a computer. The choices were to either

click on a red square and a blue square that was determined randomly. The red square was on

a fixed time schedule (FT 60s) and the blue square on a progressive time schedule (PT 4s). If

the participants chose the red square, then they had to wait 60 seconds before getting a point.

If they chose the blue square, then their waiting time to get a point was dependent on how

many consecutive times it was clicked as the time progressed with four seconds for each time

it was clicked. It was the consecutive clicks that increased the time in seconds. Clicking the

red square restarted the progressive time schedule of the blue square.

The instruction told them that the optimal way to choose points was to select the blue

square (PT 4s) five consecutive times, and then the red square (FT 60s) one time. This

instruction was accurate according to the direct contingency in the first condition, but in the

second condition the contingency changed with diminishing returns, so this instruction was

now inaccurate. If the participants continued to follow the instruction, they would lose points.

Their findings demonstrated less instructional control when the instruction became less

accurate. The participants showed more insensitivity until it was an increase in the variability

of choices, which made the participants more sensitive to the changes in the continency.

Other studies that was also examining the insensitivity effect has been done with a

similar procedure (Fox & Kyonka, 2017; Fox & Pietras, 2013; Kudadjie-Gyamfi & Rachlin,

2002). Kudadjie-Gyamfi and Rachlin (2002) also studied rule-governed behavior and the

effects of changes in contingencies, but in a self-control task. The participants were divided in

two groups. One of the groups was called the rule-governed group where the participants was given a verbal hint about the pattern of the contingency. The other group was called the contingency-governed group where the participants were not given a hint. Similar to Hackenberg and Joker (1994), the participants had to choose between two concurrent schedules. They had to choose between the letter "A" and "B" on a computer. The letter "A" was on PT 1 s but started on three seconds. The letter "B" was also on a PT 1 s but started on zero seconds. The self-control task was based on the control the participants had on choosing a larger distributed reward and not the smaller immediate reward. When they chose "A" the delay was longer and they earned more points, but when they chose "B" the delay was shorter, but they got less points. Choosing "B" was a better immediate alternative, but choosing "A" was a better alternative overall. Choosing "B" after choosing 10 repeated "A", the delay on "B" restarted on 0 seconds. The findings demonstrated that the participants in the group who got a hint was insensitive to the changes in the contingency. The participants in the group who did not get a hint was sensitive to the changes in the contingency.

Fox and Pietras (2013) studied the effects of punishment compared to no punishment when given a rule. They used the same procedure as Hackenberg and Joker (1994) where the participants had to choose between two concurrent schedules and the contingency changed with diminishing returns in the second condition. If the participants continued to follow the instruction, they would lose points. The only difference was that instead of choosing between a red or a blue square, the participants had to choose between the letter "A" or "C", and that the progressive time schedule was depended on the conditions. Some of the participants went through first a penalty phase and then a no penalty phase, while others went first through a no penalty phase, and then a penalty phase. In the penalty phase the participants got a punishment for responding in another way than what was described in the instruction given

and the response-cost punishment was in a form money-loss. The findings demonstrated that during the phase were the participants got punished for not following the instruction, the behavior showed more insensitivity to the changes in the contingency, than in the phase where they did not get punished.

Fox and Kyonka (2017) also studied variables that control rule-governed behavior and insensitivity to changes in contingency. They implemented two experiments where one was presented with an instruction that was accurate according to the direct contingency in the beginning, but later became inaccurate and the other one was presented with an instruction that was inaccurate to the direct contingency. The procedure was similar to Hackenberg and Joker (1994) and Fox and Pietras (2013). The participants had to choose between two concurrent schedules. In these experiments, the participants also had to choose between the letters "A" and "C" that also was on either FT 60s schedule, or a PT 4s schedule. The results that was found in these experiments was that their choices showed insensitivity for more than half of the participants when the instruction was inaccurate in the first experiment. When the instruction was accurate, all of the participants showed insensitivity in the second experiment.

Other studies have demonstrated that individuals shows more insensitivity when they get accurate instruction that becomes inaccurate, compared to inaccurate instructions or no instruction, also when they are given more directive instructions compared to when they are not getting directive instructions, and when the consequences are more overstated than understated. Reinforcement history has been found to influence rule-governed behavior (DeGrandpre & Buskist, 1991; Galizio, 1979; Henley et al., 2017; Hojo, 2002; Horne & Lowe, 1993; Martinez & Tamayo, 2005; Miller et al., 2014; Newman et al., 1995; Otto et al., 1999; Podlesnik & Chase, 2006; Schmitt, 1998). Behavior has also been found to be more insensitive when there has been a stability in the responding to an accurate instruction that

initially becomes inaccurate, and if the behavior was more differentially reinforced (Joyce & Chase, 1990; Okouchi, 1999). Another variable that can make the individuals insensitive to changes in contingencies, is social control. It has been found that the individuals shows more insensitivity to changes in the contingency when an observer was present (Alessandri et al., 2017; Donadeli & Strapasson, 2015; Kroger-Costa & Abreu-Rodrigues, 2012).

Other studies have demonstrated more contingency sensitivity when individuals got reinforced or punished for instruction following (O'Hora et al., 2014), and contingency sensitivity occurs more with dysphoric individuals than with non-dysphoric individuals (Baruch et al., 2007). It has been found that contingency sensitive behavior occurred more when the individuals got instructed when they had to guess the contingency and when they were presented with a variety or multiple schedules (Catania et al., 1982; LeFrancois et al., 1988; Shimoff et al., 1986). It has also been found that when rules are set to be self-generated, individuals shows contingency sensitivity (Baumann et al., 2009; Kissi et al., 2018; Ninness & Ninness, 1998; Rosenfarb et al., 1992).

All of these findings suggest that when an individual has an history of instruction being accurate, that they remain insensitive to changes in the contingency. It suggests that humans are also very sensitive to social contingencies (Hayes, Brownstein, Zettle, et al., 1986). When a rule is presented, it is describing a specific contingency, which leads to a decrease in variability. According to Fox and Pietras (2013) a decrease in variability also decreases contact with outcomes for alternate response pattern, that again decreases the chances to be sensitive to changes in contingencies. Why self-generated rules resulted in more sensitivity to changes in contingencies could be that their private talk changed and that they became more self-observant (Rosenfarb et al., 1992).

Because self-generated rules may be a way to make the behavior more sensitive to the changes in contingencies due to the changes in their private talk, it would be interesting to make the private talk more public to analyze their verbal behavior. One way to do that could be to put individuals in groups where they have to work together to solve a task with an instruction. By doing this with groups, it could also be interesting to see what kind of an effect it would have to the culture of a group when an instruction is presented.

There are different theories about the effect on verbal behavior in culture. To figure out how much effect verbal behavior has on culture, it is necessary first to look at cultural selection. Cultural selection is based on contingencies that are maintained by developed social environments (Glenn, 1989). According to Glenn (1989), culture only exists in the interlocking behavioral patterns made by members in a group. When a response of an individual is functioning as an antecedent or a consequence for another individuals response, it is called interlocking behavioral contingencies (IBC). It is when an element for a consequence or an behavioral contingency is functioning as an element for another behavioral contingency (Sampaio et al., 2013). A prosses where cultural consequences are selecting patterns of interactions that is continued throughout generations is called metacontingency. When interlocking behavioral contingencies produces products, it is called an aggregate product. Cultural consequences has the function of selecting the interlocking behavioral contingencies and its aggregate product (Costa et al., 2012).

There has been research done on the effect of rule-governance and rule-governed behavior in groups. How verbal behavior affects metacontingencies and how communication and cultural consequences is affecting choices made in a group have been studied. Just like how behavior can be affected by environmental consequences, a group dynamic can be affected by cultural consequences. It has been suggested that cultural transmission could be

genetically programmed, but there is a chance that cultural transmission could be a result of cultural evolution (Ghirlanda et al., 2006).

One of the studies done on cultural evolution investigated how traditions of rule-governance and rule-governed behavior is done in groups (Baum et al., 2004). In the research done by Baum et al. (2004), the participants was divided in to groups where the groups had to agree on how to solve an anagram. Their choices were between a red or a blue card with different payments. One of the cards had more payments that had a longer delay, while the other card had less payments but a shorter delay. To create generations in the groups, the participants were exchanged one by one. It was therefore possible to observe how the participants transmitted their choices to the new member of the group. The findings demonstrated that the groups found a tradition of choice that was the most efficient, which also led to a stronger choice-tradition. The previous members also transmitted the rules to the newer members, for them to cooperate so the group could earn more.

Sampaio et al. (2013) studied the effect of verbal behavior in new tasks, to study metacontingencies. Participants were divided into groups where they had to choose one of 24 figure each. The consequences of the interlocking behavioral contingencies were manipulated. The participants had to go through three conditions where first one was a baseline with no manipulation, the second phase was with a possibility for bonus points and the third phase was where they were not allowed to talk. The findings demonstrated that with rule-governance, the members could instruct other members on how to behave more efficiently. They could verbally describe the relations between the interlocking behavioral contingencies and the metacontingencies. Because of this, Sampaio et al. (2013) concluded that communication between members in groups does influence the effect of cultural consequences on interlocking behavioral contingencies.

Costa et al. (2012) studied the effect of communication and cultural consequences on choice combination in a prisoner's dilemma game. Participants were divided in groups where they had to choose between a green or a red card individually. The participants that had chosen the green card would get the best outcome only if the rest of the participants had chosen the red card. If all of the participants would have chosen the green card then all of the participants would have gotten the worst outcome. One group was allowed to talk to each other while the other group was not. The findings demonstrated that cultural consequences do select combination of choices (IBC), even if the participants did not communicate to each other. Another study done on pigeons found the same results. The study was investigating cooperation and metacontingencies on pigeons where they were divided in groups. The interaction between the pigeons on simultaneous demands of behavior was observed. Their interlocking behavior was observed in an operant condition box where they could see each other. The findings suggested that selection of metacontingencies could happen, even without verbal behavior (Velasco et al., 2017).

The group dynamic has an influence on cultural consequences, but whether verbal behavior does have an influence is hard to say. Some studies suggest that it does, while other studies suggest that it does not. According to Baum et al. (2004) and Sampaio et al. (2013), verbal behavior does have an effect on cultural consequences because it helps the members in the group to transmit the rules so their behavior would be more efficient, more rapidly. However, Sampaio et al. (2013) would not suggest that metacontingencies could only be reduced to rule-governed behavior, but that it could be helpful to modify the members behavior that could be necessary for the selection of the interlocking behavior contingencies cultural consequences. Both Costa et al. (2012) and Velasco et al. (2017) suggested that verbal behavior is not necessary for the selection of the cultural consequences. This could

mean that verbal behavior could have some effect on the cultural consequences, but that it is not necessary in all cases. Transmission of cultural features is mediated in different forms of social learning that could play a big role in theories about cultural group selection (Molleman et al., 2013).

How the rules are transmitted among members in a group are also interesting, as there are different ways that rules can be transmitted (Glenn, 1986). A rule can either be transmitted technological or ceremonial. According to Glenn (1986) technological contingencies involve behavior that is maintained by arranged changes in the environment, and ceremonial contingencies involve behavior that is maintained by social reinforcers. Technological control is when behavior enters into natural contingencies of reinforcements, and then the relations between behavior and the outcome is mediated to others. When a rule is transmitted technologically in groups throughout generations, it means that previous members had an experience with the consequences of that specific rule themselves. When a rule is transmitted ceremonially in groups throughout generations, it means that previous members did not experience the consequences of that specific rule themselves but has been told how to do it by members that has been there before them.

The present study had similar procedures as Hackenberg and Joker (1994), Fox and Kyonka (2017) and Fox and Pietras (2013) where participants had to choose between concurrent schedules to earn points, got presented an instruction accurate according to the direct contingency on optimal ways of earning the most points, and then the contingency changed so the instruction was not describing the optimal way of earning. This was done to see if the participants were sensitive to these changes. The present study had participants in groups, one experiment with exchanges in participants to create generations similar to Baum et al. (2004), and one experiment without generations. The groups verbal behavior was also

recorded and analyzed to see how the rules was transmitted, either technological or

ceremonial (Glenn, 1986). The present study was done to investigate sensitivity or

insensitivity to changes in the contingencies when presented an instruction, and how it will

affect the verbal behavior in groups and how it was transmitted throughout generations.

Experiment 1

Experiment 1 were conducted to investigate sensitivity or insensitivity to changes in

the contingencies when presented with an instruction. The instruction that was given to the

participants was not going to match the contingencies after baseline. In this study it was

investigated if groups are sensitive or insensitive to the contingencies. The experiment was

done with three different groups. Nine participants divided in three groups, where each group

went through the same procedure. The three groups in Experiment 1 was called Group 31, 32

and 33.

Method

Participants

Three groups with 9 participants in each group in Experiment 1. The participants were

between 18-30 years old, 4 females and 5 males. The participants were recruited through

social media advertisements and during lectures. The only requirement was that the

participants had to be fluent in English. Ethical issues were taken into consideration when

conducting the experiment. It was applied for approval from the Norwegian Center for

Research Data (NSD) before recruiting participants. The study was approved by NSD in

2019, and the reference number for approval was 896173. All of the participants was adults

who volunteered to be in the experiment. All the participants read an informed consent form which they signed before the experiment started. The participants were ensured that their personal information and privacy would not be revealed. After completing the experiment the participants filled out post-experiment questionnaires, and was debriefed, paid, and then dismissed.

Setting

The experiments where done in Oslo Metropolitan University. The experiments were held in a larger meeting room where each participant had their own table. Each participant also had their own computer mouse to click on during the experiments. A big screen was placed in front of the participants. The screen was big enough for them to clearly see what was happening on it, even if they were sitting apart from each other. Each participant had a different colored card placed on the upper right corner of their table that represented them in the experiment.

Apparatus

The program that was used was Visual Studio 2019 on a computer that was connected to a tv-screen. Participants only had a computer mouse available in front of them.

Procedure

The participants were sitting in the room without the experimenters present while the program was running. The experimenters were only present when the instructions were read out loud to them in the beginning of the experiment and when the program had to be restarted

every session. While the experimenters restarted the program, the participants had a small

break. The participants were told not to talk about the experiment during the break. Questions

asked to the researchers about the experiment were not answered before the experiment were

done.

The groups were sitting in front of a computer where they got the choice of clicking

"A" or "B". When the experiment started, the group was given a paper to read with an

instruction which was also read to them in the beginning. The instruction was removed before

session 2 started. This instruction was accurate according to the contingency in the first phase.

The instruction given to the participants were:

INSTRUCTIONS.

To begin a choice, click the "Start a new choice" button. You earn points by clicking

on the letter icons that appear on the screen. Select one of the two options, "A" or "B"

by clicking the letter on the screen. The choices made should be decided by the group.

The background color indicates who should perform the clicking on the letters.

THE BEST WAY TO EARN POINTS IS TO

SELECT THE FLASHING "A" BUTTON AND

THEN SELECT THE "A" OPTION FOUR MORE CONSECUTIVE TIMES,

THEN SELECT THE "B" OPTION.

General information

Your communication during sessions should **only** be about the experiment.
Please do not talk about anything not related. During the breaks we ask that
you do not talk about the experiment. In order to facilitate the video analysis,
we ask that you please speak clearly and try not to interrupt each other.

Each session will last for 15 minutes and then you may have a 2-minute break.
Of course, you may leave anytime in the event of an emergency or if you wish
to withdraw from the experiment.

The alternatives "A" and "B" was a concurrent interval schedule of reinforcement.
The instruction that was given in the baseline matched with the contingency because clicking
five times on "A" and then one time on "B" was the most optimal way of earning points. This
was the optimal way to earn points because getting points by clicking on "A" was on a
progressive time schedule of two seconds (PT 2 s). The time increased with two seconds after
every click on "A". Getting points by clicking on "B" was on a fixed time schedule of 30
seconds (FT 30 s). By clicking on "B", they also restarted the progressive time on "A" to its
minimum value of 0 s. Because clicking "B" restarts the progressive time on "A", a new
sequence starts, and we call it a switch point.

Choosing five times on "A" then switching to choosing one time "B" is the most
optimal pattern in the molar contingency because it also restarts the progressive time of "A".
Because "A" is on a PT 2 s, and "B" is on a FT 30 s, it could be perceived that choosing "A"
more than five times before switching to "B" to be more optimal, which is the most optimal in
the molecular contingency. To respond according to the molar contingency is overall more

optimal because they would get the reward more distributed, but the reward is eventually

larger and responding according to the molecular contingency is overall less optimal because

they would get the reward more immediate but the reward is eventually smaller.

Table 1 shows how the time operates in Experiment 1. The table shows the number of

"A" before clicking "B", and the progressive time on "A". The table also shows the maximum

points per session for the number of "A" before clicking "B" under the history training phase.

The maximum points per session in the history training phase was 59 points. The instruction

and the most optimal way to earn points in the history training phase is represented with the

darker gray line.

In each session, the program always started with a "Start a new session" button. By

clicking this, the session started and after 7 seconds the "Start a new choice" button appeared.

When the participants clicked on the "Start a new choice" button, the buttons "A" and "B"

appeared immediately. After the participants made a choice, and they had either chosen "A"

that was on a PT 2 s schedule before receiving a point, or "B" that was on a FT 30 s schedule

before receiving a point. To show the participants that they have gotten a point after their

choice, a yellow box appeared on the screen with the previous points they had earned. After

the appropriate schedule time had elapsed the yellow box with the previous points turned

green and 0.5 s later 1 point was added for the participants to see that they got a point added

after their choice. After receiving the point, the participants waited an inter-trial interval (ITI)

of 6.5 s before the "start a new choice" appeared on the screen again. Each session took 15

minutes before it ended.

The history training phase lasted in minimum 5 sessions, until they reached steady

state in three of the sessions. Steady state was when the participants were exposed to a

condition until they showed a pattern of responding before introducing them to a new

condition to control external influences on the behavior (Cooper et al., 2013). The steady state was defined by the median. After the history training phase, the contingency changed so the instruction was no longer accurate according to the direct contingency. This phase was called the testing phase, where the group was tested to see if they would contact the direct contingency after it had changed, even with the history they had with the instruction that was given. In the testing phase, "A" was still on a PT 2 s schedule, but "B" was now changed from a FT 30 s to PT 6 s.

The maximum points to earn per session in the testing phase is also demonstrated in the table. Clicking one time on "A" before clicking "B" has the same amount of seconds to make it the most optimal way to earn points every session. Because of this, every session in the testing phase starts on 6 s when "A" was clicked one time. When "A" was clicked two times, the time on "A" gets added with one second in the first session of the testing phase. In the second session in the testing phase, the time on "A" was added with two seconds. In the third session in the testing phase, the time on "A" was added with three seconds. In the fourth session in the testing phase, the time gets added with four seconds. In the fifth session in the testing phase, the times gets added on with five seconds. This continues until the last session in the testing phase, so the maximum points will decrease for every time they click "A". In this way they will earn less amount of maximum points for every session, for every time they click "A" more than one time. Because the experiment was with diminishing returns, the participants, earned less total points per session when they continued to follow the rule. The diminishing accuracy was noticeable for the participants while they were responding according to the instruction as they were losing points.

Dependent and independent variable

In Experiment 1 the independent variable was the change of the contingencies after baseline. The instructions that was first given to the groups was accurate relative to the direct contingency in baseline that was the history training phase, and then in the testing phase the contingency was changed so the instruction was inaccurate relative to the direct contingency. The dependent variable was instruction following or breaking, measured by switch points. If the participants choose to follow the instruction rather than the contingencies then we can say that they were insensitive to changes in the contingency. If they choose to respond according to the direct contingencies rather than then the instruction that was given we can say that they were sensitive to changes in the contingency.

Analysis of data

The data was collected by the program where the choices the participants made was registered by how many times "A" and "B" was clicked in sequences, every session. The median for every switch point in each session was then calculated. Percentages of how many switch points that was consistent with the instruction and the direct contingency was also calculated. The video was first transcribed word by word, but kept anonymous where each participant where coded as a color whenever they talked. The transcription was divided minute by minute in each session so the participants statements would be counted and sorted in to four different categories. The categories were "following", "breaking", "other related", "other non-related".

The "following" category was defined as whenever they were talking about the instruction and choosing according to the instruction they were given in the beginning. The "breaking" category is defined as whenever they were talking about other methods except the

method described in the instruction and clicking related to other patterns. This also included if

they were talking about the direct contingency in testing phase that was optimal to get points.

The "other related" category was defined as everything else about the experiment or the

program that was talked about. The "other non-related" category was defined as everything

they talked about that was not related to the experiment or the program. The number of

statements that was categorized for each minute was added and summed up for each session,

and then divided on 15, which was the number of minutes per session.

Results

   The groups response of choosing and how the group members talked in the sessions is

shown in Figure 1, 2 and 3.

Choice

   Figure 1 shows the median switch points for Group 31, 32 and 33 in Experiment 1. In

the history training phase, the instruction was accurate according to the contingency which

means that it was the most optimal way to get points. In the testing phase, the instruction was

no longer accurate according to the contingency which means that the pattern suggested in the

instruction was no longer the most optimal way to get points. How many switch points that

was consistent with the instruction and the direct contingency was also calculated in

percentages. The history training phase in Group 31 was from session 1 to 6, and the testing

phase was from session 7 to 12. As shown in Figure 1, Group 31 was mostly following the

instruction given to them in the history training phase. Group 31 was choosing different

methods especially in session 3. The number of switch points in session 1 were 100%

consistent with the instruction, in session 2 they were 43% consistent with the instruction, in

session 3 they were 20% consistent with the instruction. In both session 4 and 5, the number

of switch points were 50% consistent with the instruction, and in session 6, which was the

final session of the history training phase, they were 62,5% consistent with the instruction.

In the testing phase where the instruction was inaccurate according to the direct

contingency, the participants in Group 31 did try both the instructed method and also a variety

of different methods. The participants responded as if they had contacted the direct

contingency in the last sessions, 11 and 12. The number of switch points in session 7 were

67% consistent with the instruction and 0% consistent with the direct contingency. In session

8, the number of switch points were 9% consistent with the instruction and 36% consistent

with the direct contingency. In session 9 they were 87,5% consistent with the instruction, and

0% consistent with the direct contingency. In session 10 they were 33% consistent with the

instruction, and 0% consistent with the direct contingency. In session 11 the number of switch

points were 13% consistent with the instruction and 87% consistent with the direct

contingency. Finally, in session 12 which was the last session of the testing phase, they were

0% consistent with the instruction and 92% consistent with the direct contingency.

In Group 32, the history training phase was from session 1 to 5, and the testing phase

was from session 6 to 10. As shown in Figure 1, Group 32 were mostly not following the

instruction given to them in the first two sessions of the history training phase. The group was

choosing different methods up to the third session. From session 3 to session 5, the group

responded according to the instructions and mostly followed it. In the testing phase were the

instruction inaccurate according to the direct contingency, the participants in Group 32 first in

session 6, continued to follow the instructed pattern. The number of switch points in session 1

were 22% consistent with the instruction, in session 2 they were 28,5% consistent with the

instruction, in session 3 they were 43% consistent with the instruction. In session 4 the

number of switch points were 62,5% consistent with the instruction, and in session 5, which was the final session of the history training phase, they were 100% consistent with the instruction.

In the three last sessions of the testing phase, Group 32 responded as if they had contacted the direct contingency. The number of switch points in session 6 were 14% consistent with the instruction and 0% consistent with the direct contingency. In session 7, the number of switch points were 0% consistent with the instruction and 85% consistent with the direct contingency. In session 8, 9 and 10, which was the three last sessions in the testing phase the number of switch points were 0% consistent with the instruction, and 100% consistent with the direct contingency.

In Group 33, the history training phase was from session 1 to 9, and the testing phase was from session 10 to 12. Group 33 reached steady state in session 8, but the program didn't change to the testing phase in session 9 by mistake. The history training phase continued until session 9 and the testing phase started in session 10. Group 33 therefore had steady state in four sessions instead of three. As shown in Figure 1, Group 33 were mostly following the instruction given to them in the history training phase. Group 33 was choosing different methods, especially in session 1 and session 5. In the testing phase were the instruction inaccurate according to the direct contingency, the participants in Group 33 did only follow the pattern suggested in the instruction. The number of switch points in session 1 were 18% consistent with the instruction, in session 2 they were 71% consistent with the instruction, in session 3 they were 100% consistent with the instruction. In session 4, the number of switch points were 67% consistent with the instruction. In session and in session 5 they were 0% consistent with the instruction and in session 6 to 9, which was the final sessions of the history training phase, they were 100% consistent with the instruction.

The participants in Group 33 responded as if they had not come in contact with the direct contingency in the testing phase. From session 10 to 12, which was all of the sessions in the testing phase, the number off switch points were 100% consistent with the instructions and 0% consistent with the direct contingency.

Verbal response

Figure 2 shows the groups verbal response of instruction following and breaking. In Group 31 session 1 to 6 was the history training phase, and session 7 to 12 was the testing phase. Group 31 talked about both instruction following and breaking in the history training phase, but they talked more about following the instruction in session 1. In the testing phase they talked more about breaking the pattern suggested in the instruction, than following it specially in session 8 and 12. In Group 32, session 1 to 5 was the history training phase, and session 6 to 10 was the testing phase. In Figure 2 its shows that Group 32 talked about both following the pattern and breaking the pattern suggested in the instruction, in the history training phase. In the testing phase, Group 32 talked almost nothing about following the instruction anymore and a bit more about breaking it. In Group 33, the history training phase was from session 1 to 6, and the testing phase was from session 7 to 12. Group 33 talked more about the following the instruction but also little about breaking it in the first sessions of the history training phase. After session 3 the group talked little about both following the instruction and breaking it. This also continued throughout the testing phase.

Figure 3 shows the groups verbal response of other related and other non-related topics. It shows that Group 31 talked a lot about related topics and less about other non-related topics in the beginning of the history training phase. Except for session 6 were they talked more about non-related than related topics. In the testing phase they talked mostly

about other related topics. Group 32 mostly talked about other related tings and almost nothing about other non-related topics in the history training phase. In the testing phase, Group 32 continued to talk more about other related topics and almost nothing about other non-related topics except from the two last sessions. Group 33 talked mostly about other related topics and almost nothing about other non-related topics in the history training phase. This also continued in the testing phase where they talked a lot more about other related topics and a little more about other non-related topics, except in session 10 where they talked more about other non-related topics.

Discussion

The present experiment was done to investigate sensitivity or insensitivity to changes in the contingencies when presented an instruction, and the effect of verbal behavior in groups. Both choice and the verbal behavior was investigated. Looking into the choices, Group 31 mostly followed the instruction in the history training phase but did not follow the instructions a few times where the group responded as if they were testing to see if the instruction actually was accurate. In the testing phase where the instruction inaccurate due to changes in the contingency, the group responded as if they were not sensitive to the change in the contingency, except for the two last sessions. In the two last sessions their response was highly consistent with the direct contingency and almost not consistent with the instruction. This can indicate that the group was sensitive to the changes in the contingency in the two last sessions.

Group 32 did not follow the instructions in the two first sessions but did follow the instruction in rest of the sessions in the history training phase. The group responded in the first two sessions as if they were testing to see if the instruction was accurate or not, but in the

rest of the sessions the group responded consistent with the instructions in the history training phase. In the testing phase, the group responded as if they were insensitive to the changes in the contingency in the first session but responded as if they were sensitive to the changes in the contingency in the rest of the sessions. In most of the sessions in the testing phase, the group responded as if they were sensitive to the changes in the contingency as they responded highly consistent with the direct contingency and not consistent with the instruction. This means that they were contingency sensitive.

Group 33 mostly followed the instruction in the history training phase, except in session one and five, where they responded as if they were testing to see if the instruction was accurate or not. In the testing phase the group continued to follow the instruction where all of their responses were consistent with the instruction and not consistent with the direct contingency. This indicates that the group was insensitive to changes in the contingency, but because the history training phase lasted longer than planned because of an error, it could have affected their responses to continue to follow the instructions. After this error was made, in session 10, the first session in the testing phase the group decided to follow the pattern suggested in the instruction only one time during the whole session and stopped responding during the rest of the session. This also decreased their chance to come in contact with the direct contingency.

Group 31 and 32 responded as if they were sensitive to the changes in the contingency, which indicates that their behavior was more sensitive to the changes in the contingency. Group 32 showed sensitivity almost immediately, but Group 31 showed sensitivity in the last sessions. These finding does correspond with most of the findings in previous studies, but the responses in Group 33 does not correspond with the previous findings where individuals that was given an accurate instruction in the first phase continued to follow this instruction even

when the contingency had changed (DeGrandpre & Buskist, 1991; Galizio, 1979; Henley et

al., 2017; Hojo, 2002; Horne & Lowe, 1993; Martinez & Tamayo, 2005; Miller et al., 2014;

Newman et al., 1995; Otto et al., 1999; Podlesnik & Chase, 2006; Schmitt, 1998). The

responses in Group 33 corresponds to the findings in previous studies that suggested that

stability in responses in accordance with the instructions leads more to insensitive behavior

(Joyce & Chase, 1990; Okouchi, 1999).

The findings in Group 31 and Group 32 also corresponds to the findings in previous

studies where individuals had to self-generate their rules, showed contingency sensitive

behavior (Baumann et al., 2009; Kissi et al., 2018; Ninness & Ninness, 1998; Rosenfarb et al.,

1992). According to Rosenfarb et al. (1992) the results showed contingency sensitive

behavior when they had to self-generate their rules because their private talk changed and the

individuals got more self-observant. Putting individuals in groups might cause the same

effect, because they might get more self-observant with their choices when in a room with

other individuals in the same situation. When a group talks among each other, it could also

give them the chance to openly discuss the possibilities of earning points if they variate their

responses.

The groups verbal behavior was investigated in two ways, one way was to investigate

if the groups talked about instruction following or breaking. Group 31 and Group 32 talked

about both following and breaking the pattern suggested in the instruction in the history

training phase, but more about breaking it in the testing phase. This corresponds with their

responding of choices where both of them eventually showed sensitivity to changes in the

contingency. This can indicate that their verbal behavior could influence their choices of

responding in the group. Group 33 talked more about following the instruction and a little bit

about breaking it in the first sessions, but talked about both following and breaking the pattern

suggested in the instruction in rest of the history training phase. They continued to talk about both following and breaking the pattern suggested in the instruction in the testing phase. Group 33 talked less about breaking it compared to Group 31 and 32. Talking more about following the instruction corresponds with their responses of choice where they showed insensitivity to the changes in the contingency and continued to follow the rule in the testing phase.

The other way to investigate their verbal behavior was to see if the groups talked about topics relevant to the choices or about topics not related to the choices. Group 31 and Group 33 talked more about related topics in the history training phase and more about non related topics in the testing phase, except for in session 10 for Group 33. The reason for this could be that they decided to only respond once according to the pattern suggested in the instruction, and not respond in the rest of the session. Because they did not respond to the program in the rest of the session, they had more time to talk about other non-related topics. However, Group 32 did the opposite to Group 31 and Group 33, where they talked more about nonrelated topics in the history training phase and more about related topics in the testing phase.

Experiment 2

Experiment 2, had two groups of nine participants with generations. The participants where changed out one by one every two sessions. The two groups in Experiment 2 was called Group 91 and 92.

Method

Participants

Two experiments were done with 18 participants in Experiment 2. The participants were between 18-30 years old, 7 females and 11 males. The requirement, how the participants were recruited and the ethical issues that was taken into consideration was done in the same way as in Experiment 1.

Setting

The setting in Experiment 2 was the same as in Experiment 1.

Apparatus

The program used in Experiment 2 was the same as in Experiment 1.

Procedure

The instruction and the procedure in Experiment 2 was identical to Experiment 1, except for the following. In Experiment 2, steady state was not required. The participants were changed out one by one to make generations. Another addition that were done in Experiment 2 was to investigate how the rules were transmitted to each other in the groups throughout the generations, to see if the previous members was transmitting the rules to the newer members technological or ceremonial.

The participants were changed out with a new participant, one by one every two sessions. The first participant was changed out with a new member in session 6, the second member was changed out in session 8, and the third member was changed out in session 10.

After session 10 where all of the original members where changed out to new members, one by one.

Table 2 shows how the program operates in Experiment 2. The history training phase is the same as in Experiment 1. In the history training phase was where they got an instruction to follow, and the instruction was accurate according to the direct contingency. They got points by following the pattern suggested in the instruction by clicking five times on "A", and then one time on "B". The instructions were removed before session 4. The first three participants went through this phase until the end of session 6. From session 7, they went to the testing phase where the contingency changed, just as in Experiment 1, so the instruction was inaccurate according to the direct contingency. The optimal amount of points was earned when the participants clicked one time on "A", and then one time on "B" just as Experiment 1, but in the testing phase in Experiment 2 they did not earn less points per session as seen on Table 2. Experiment 2 did not have diminishing accuracy where the points lost per session was noticeable like it was in Experiment 1. In Experiment 2 the correctness of the instruction also diminished, but if the participants continued to respond according to the instructions, they would not notice any difference.

Dependent and independent variable

The dependent and the independent variable in Experiment 2 was the same as in Experiment 1. In addition, a dependent variable in Experiment 2 was also how the previous members transmitted the instruction to the new members, if it was transmitted technological or ceremonial.

Analysis of data

The analysis of the data was done in the same way as in Experiment 1. In addition, how the rule was transmitted throughout the generations was also analyzed. How the previous members transmitted the rule to newer members were categorized either technological or ceremonial. The rule they are transmitting is either the instruction the group got in the beginning of the experiment or a rule they made themselves. The category "technological" is defined as when the previous members were transmitting a rule to the newer members, and had experienced the consequences of that specific rule themselves. The category "ceremonial" is defined as when the previous members were transmitting a rule to the newer members, but did not experience the consequences of that specific rule themselves, but was informed by the rule given by previous members (Glenn, 1986).

Results

The groups response of choosing, how the group members talked in the sessions and how the previous members transmitted the rule is shown in Figure 4, Figure 5 and Figure 6 and in Table 3.

Choice

Figure 4 shows Group 91 and 92 in Experiment 2. In the history training phase, the instruction was accurate according to the direct contingency which means that it was the most optimal way to get points. The history training phase was from session 1 to 6, and the testing phase was from session 7 to 18. Session 1 to 6 was the first generation, session 7 to 8 was the second generation, session 9 to 10 was the third generation, session 11 to 12 was the fourth

generation, session 13 to 14 was the fifth generation, session 15 to 16 was the sixth generation and finally session 17 to 18 was the seventh generation.

In session 1, 2, and 5 in the history training phase, Group 91 were mostly following the instruction given to them, but they were choosing different patterns, especially in session 3 and session 4. The number of switch points in both session 1 and session 2 were 100% consistent with the instruction, in session 3 and 4 they were 0% consistent with the instruction. In session 5 the number of switch points were 100% consistent with the instruction, and in session 6, which was the final session of the history training phase, they were 89% consistent with the instruction.

In the testing phase were the instruction was no longer true to the contingency, the participants in Group 91 did try both the pattern suggested in the instruction and also a variety of different patterns. The group responded as if they had not come in contact with the direct contingency. The number of switch points in session 7 were 100% consistent with the instruction, in both session 8 and 9 they were 0% consistent with the instruction, in session 10 they were 89% consistent with the instruction. In session 11 they were 9% consistent with the instruction, in session 12 they were 0% consistent with the instruction, in session 13 they were 20% consistent with the instruction, in session 14 they were 87,5% consistent with the instruction. In both session 15 and 16 the number of switch points were 0% consistent with the instruction, in session 17 thy were 11% consistent with the instruction. Finally, in session 18 which was the last session of the testing phase, they were 0% consistent with the instruction. From session 7 to 18, which was all of the sessions in the testing phase, the number of switch points were 0% consistent with the optimal pattern of the direct contingency.

Group 92 were mostly following the instruction given to them in the history training phase except in session 2 and session 6. The number of switch points in session 1 were 50% consistent with the instruction, in session 2 they were 37,5% consistent with the instruction. In session 3, 4 and 5 the number of switch points were 100% consistent with the instruction, and in session 6, which was the final session of the history training phase, they were 0% consistent with the instruction.

In the testing phase where the instruction was inaccurate according to the direct contingency, the participants in Group 92 did try both the pattern suggested in the instruction and also a variety of different patterns. The group responded as if they had come in contact with the direct contingency. The number of switch points in session 7 were 43% consistent with the instruction and 0% consistent with the direct contingency. In session 8, the number of switch points were 100% consistent with the instruction and 0% consistent with the direct contingency. In session 9 they were 87,5% consistent with the instruction, and 0% consistent with the direct contingency. In session 10 and 11 they were 0% consistent with the instruction, and 0% consistent with the direct contingency. In session 12 the number of switch points were 0% consistent with the instruction and 78% consistent with the optimal pattern of the direct contingency.

In session 13 the number of switch points were 0% consistent with the instruction and 100% consistent with the direct contingency. In session 14 the number of switch points were 0% consistent with the instruction and 72% consistent with the direct contingency. In session 15 the number of switch points were 0% consistent with the instruction and 84% consistent with the direct contingency. In session 16 the number of switch points were 0% consistent with the instruction and 100% consistent with the direct contingency. In session 17 the number of switch points were 0% consistent with the instruction and 90% consistent with the

direct contingency. Finally, in session 18 which was the last session of the testing phase, they were 0% consistent with the instruction and 100% consistent with the direct contingency.

Verbal response

Figure 5 shows the groups verbal response of instruction following and breaking. Group 91 talked a lot about both instruction following and breaking in the history training phase. In the first session they talked mostly about following the instruction and almost nothing about breaking it, but from session 2 to 4 they talked more about breaking the pattern suggested in the instruction, than to following it. In the testing phase they continued to talk about both instruction following and breaking, except for the two last sessions in the last generation, where they mostly talked about breaking it and almost nothing about following it. In Group 92, session 1 to 6 was the history training phase, and session 7 to 18 was the testing phase. Figure 5 shows that Group 92 talked about both instruction following and breaking in the history training phase. Due to a program error the program stopped halfway in session 8, so this session lasted 7 minutes instead of 15. Because of this, the number of median switch point was divided by 7 instead of 15 for this session. They talked mostly about following the instruction in session 1 and 3. In the testing phase they started to talk a lot about following the instruction and a little about breaking it from session 7 to 9. But from session 10 and throughout the rest of the testing phase they talked a lot about breaking the pattern suggested in the instruction, except from session 16, and almost nothing about following the instruction.

Figure 6 shows the groups verbal response of other related and other non-related topics. Group 91 talked a lot about other related topics and almost nothing about other non-related topics throughout the history training phase. They continued to talk a lot about other related topics throughout the testing phase and a little more about other non-related topics.

Group 92 talked a lot about other related topics in the beginning and less about the non-related topics in the history training phase. This also continued throughout the testing phase where they talked mostly about related topics and less about non-related topics.

Transmission of rules

Table 3 shows how the previous members transmitted the rule they made themselves or the instruction they got, to new members in Group 91 and 92. The table shows session 7, 9, 11, 13, 15 and 17 where new members came in and created a new generation. In each session it is shown how the previous members transmitted the rules, which was coded either technological or ceremonial. In Group 91, every time a new member came in the previous members transmitted the rule mostly technological except for session 11 and 13 where they transmitted the rules in both ways. In session 11 and 13, the previous members were transmitting the rule technological to describe the rule about the pattern of clicking in the beginning.

In the end of each session, the members were told to click only "A" after reaching 40-50 points. They did this ceremonial where they had not experienced if the rule made up were accurate according to the direct contingency or not, themselves. The previous members in Group 91 mostly transmitted the rules technological specially in session 7, 9, 15, and 17, however they transmitted the rules a few times ceremonial. Because it was very few times in these sessions, the sessions were categorized as technological. In Group 92, the previous members mostly transmitted the rules technological especially in session 7 and 9, however they transmitted the rules a few times ceremonial. The few times was in session 10, 13 and 17. Because it was only a few times where they transmitted the rule ceremonial, the sessions were categorized as technological.

Discussion

The present experiment was done to investigate sensitivity or insensitivity to changes in the contingencies when presented with an instruction, the effect of verbal behavior in groups and how rules are transmitted throughout generations. Choice, verbal behavior and transmission of rules was investigated. Looking into the choices, Group 91 mostly followed the instructions in the history training phase, except in two sessions. In the testing phase where the instruction was inaccurate due to changes in the contingency, the group responded as if they did not come in contact with the direct contingency. Their responding could indicate that the group was not sensitive to the changes in the contingency.

The response of the group was not consistent with the direct contingency and sometimes was highly consistent with the instructions. Even if responding was sometimes highly consistent with the instruction, for the most time it was not. This indicates that the group did not follow the pattern of clicking suggested by the instruction, and they did not respond in the optimal way. Instead of following the rule by clicking five times "A" and then one "B", they clicked four times "A" and then one "B". The reason for this could be that they would earn more points by trying to click "A" fewer times. When they clicked "A" four times, they earned more points than if they would have clicked on "A" five times before clicking "B".

Group 92 mostly followed the pattern suggested in the instruction in the history training phase, except in two sessions. In the testing phase where the instruction was inaccurate due to changes in the contingency, the group continued to follow the instruction in the first sessions, but after session 10, the group responded as if they were sensitive to the changes in the contingency. The responses in the last sessions were not consistent with the

instruction, and highly consistent with the direct contingency. This indicates that the behavior was sensitive to the changes in the contingency. In Experiment 2, the findings in Group 92 in the present experiments does not correspond with most of the previous findings, but it does correspond to the findings where individuals had to self-generate their rules, showed more contingency sensitivity. This could indicate that participants gets more self-observant when they are put in groups that could also give them the chance to openly discuss the possibilities of earning points if they vary their responses (Baumann et al., 2009; Kissi et al., 2018; Ninness & Ninness, 1998; Rosenfarb et al., 1992).

The groups verbal behavior was investigated in three ways, one way was to investigate if the groups talked about following the rule or breaking the rule. Group 91 talked about both instruction following and breaking in the history training phase and continued with this in the testing phase except in the two last sessions where they talked more about breaking the pattern suggested in the instruction. This corresponds with the responding of choice where the group showed that the group was not rule-governed. This can indicate that their verbal behavior could influence their choices of responding in the group. Group 92 also talked about both instruction following and breaking in the history training phase. In the beginning of the testing phase, the group talked more about following the instruction, but towards the end of the testing phase the group talked more about breaking it. This corresponds with the responding of choice where the group showed sensitivity to the changes in the contingency, which also could indicate that their verbal behavior influenced their choices of responding in the group.

The other way to investigate their verbal behavior was to see if the groups talked about topics relevant to the choices or about topics not related to the choices. Group 91 talked more about related topics in the history training phase and continued with that in the testing phase

but talked a little more about other non-related topics. Group 92 also talked more about related topics in the history training phase and continued with that in the testing phase. The groups in this experiment talked more about related topics than non-related topics than the groups in Experiment 1. The reason for this could be that the participants got exchanged every two sessions, which limited the time where they could talk about other topics that was not relevant to the experiment.

The groups verbal behavior was also investigated to see how the rules were transcribed throughout the generations. When a new member joined the group and created a new generation, the transmission of the rule from previous members was categorized to being either technological or ceremonial as described by Glenn (1986). The previous members in Group 91 transmitted the rule mostly technological except for in two sessions where they did transmit the rule both technological and ceremonial. The previous members in Group 92 also transmitted the rule mostly technological. When the previous members in both groups transmitted the rule mostly technological, it means that they had an experience with the consequences of the rules they were transmitting themselves. In both groups, the previous members allowed the newer members to try out the program themselves to check if the rule they transmitted was accurate according to the direct contingency or not. Because new members were allowed to experience the consequences of the rule themselves, when they transmitted the rule to the members that came in after them, their transmission of the rule became more technological.

General Discussion

The differences in the experiments was that Experiment 1 did not have generations, the groups had to reach steady state before the testing phase was presented, and diminishing

return was included in the testing phase. Experiment 2 had generations, the group did not have to reach steady state before the testing phase was presented, and diminishing return was not included in the testing phase. In Experiment 1, Group 31 and Group 32 responded as if they came in contact with the direct contingency, which indicates that they were sensitive to the changes in the contingency. Group 33 did not respond as if they came in contact with the direct contingency, which indicates that the group was insensitive to the changes in the contingency. In Experiment 2, Group 91 did not respond as if they came in contact with the direct contingency, which indicates that the group was insensitive to the changes in the contingency, but they still did not respond according to the instruction. Group 92 responded as if they came in contact with the direct contingency, which indicates that they were sensitive to the changes in the contingency.

It could be many possible reasons for why Group 33 in Experiment 1 and Group 91 in Experiment 2 was insensitive to the changes in the contingency. Joyce and Chase (1990) suggested that stability in responses in accordance with the instructions leads more to insensitivity to changes in the contingency. Only the groups in Experiment 1 had to reach steady state which meant that their responses had to show stability in the responses in accordance with the instructions.

Group 33 was the only group that showed insensitivity to the changes in the contingency that also had to reach steady state in their responses. This can indicate that the stability in the responses led to their behavior being insensitive to the changes in the contingency, but it does not explain why Group 31 and Group 32 which also had a stability criteria, responded as if they were sensitive to the change in the contingency. Group 91 in Experiment 2 also showed insensitivity to the changes in the contingency without a stability

criterion. This suggests that stability in responses may lead to more insensitivity to changes in contingencies, but it's not certain that it leads to it.

Another explanation for why Group 33 and Group 91 showed insensitivity to the changes in the contingency could be that their behavior was under the influence of socially mediated reinforcement history. This type of rule following is called pliance (Hayes, Brownstein, Haas, et al., 1986; Hayes, Brownstein, Zettle, et al., 1986). It could also be because an instruction decreases the variability of responses. An instruction describes a specific contingency, and when individuals follows this instruction it leads to very little variability in their responses. Decreased variability in responses leads to a decreased chance for the group to get in contact with the direct contingency (Fox & Pietras, 2013; Hayes, Brownstein, Zettle, et al., 1986; Joyce & Chase, 1990).

It could be many possible reasons for why Group 31, Group 32 and Group 92 was sensitive to the changes in the contingency. The procedure in this present study was similar to the procedure in the experiment done by Hackenberg and Joker (1994), included diminishing returns. They demonstrated that when the instruction became less accurate and the participants experienced diminishing returns that was programed in the experiment, the participants behavior became more sensitive to the changes in the contingencies. The results in Group 31 and Group 32 with diminishing return corresponds with the findings in Hackenberg and Joker (1994). This suggests that by diminishing the accuracy of the instruction, it could decrease the instructional control and increase the chance to be sensitive to changes in the contingency.

The results of Group 31, Group 32 and Group 92 corresponds with the findings of Baumann et al. (2009), Kissi et al. (2018), Ninness and Ninness (1998) and Rosenfarb et al. (1992) where individuals also showed contingency sensitive behavior because they had the

individuals self-generate the rules which led to changes in their private talk and self-observation. This could also be another explanation, by putting individuals in groups and making them discuss among each other, it could make the individuals more self-observant with their choices, more so than if they would have to make choices alone by themselves. By making the participants talk among each other, it might also lead to the chance of discussing variations of possible ways to respond and earn more points.

The verbal behavior in all of the groups in both experiments corresponded with their choices. The groups that followed the rule also talked more about following the instruction, and the groups that broke the pattern suggested by the instruction also talked more about breaking it. This suggests that verbal behavior may have an effect on the choices made in groups. Group 91 and Group 92 in Experiment 2 transmitted their rules mostly in a technological way, which means that the previous members had experienced the consequences of the rule that was transmitted to newer members themselves (Glenn, 1986). This also suggest that verbal behavior does have an effect on choices in group, and especially for transmitting their rule to newer generations. This is also suggested by Baum et al. (2004) and Sampaio et al. (2013) where the findings in their studies showed that verbal behavior does affect the cultural consequences, because verbal behavior in the group have demonstrated to help the members to transmit the rules for their behavior more efficiently.

The original members in Group 92 did eventually respond in the most efficient way and transmitted it to the newer members so they also would respond in the most efficient way. With verbal behavior, the culture in the group benefitted them to get the optimal consequences. Group 91 did not respond in the most efficient way but did respond in a way that resulted in more points per session than the way suggested by the instruction that was

given. Even though it was not the most optimal way of earning points, the previous members of the group did transmit their way of responding to the new generations.

By investigating how rules affects behavior when the contingency changes and how verbal behavior influences the culture of a group, it allows us to reflect about this on a cultural level. A rule in a verbal community describes how the members should behave according to a specific contingency. When a response of a member in a group functions as an antecedent or a consequence for another members response we call this interlocking behavioral contingencies (IBC). Interlocking behavioral patterns made by members in a group can also be described as cultural practices. Interlocking behavioral contingencies can produce aggregate product which can also be described as the function in the group. Cultural consequences have the function to select the interlocking behavioral contingencies and its aggregate product. This prosses where cultural consequences is selecting patterns of interactions that is continued throughout generations is called metacontingency (Costa et al., 2012; Glenn, 1989; Sampaio et al., 2013).

According to Sampaio et al. (2013), metacontingencies should not only be reduced to rule-governed behavior, but it could be helpful to modify the members behavior which could be necessary for the selection of the interlocking behavior contingencies cultural consequences. When a group is following a rule that is no longer accurately describing the direct contingency due to changes in it, it may not be beneficial for the group to continue to follow this rule. When the rule is no longer describing the direct contingency, it modifies the members behavior in a way that is not beneficial if they follow it which could lead the group to not be selected between other groups. This could lead to superstitious behavior in cultures, where the members follow and continues with a ritual which is not accurate according to the direct contingency, which is common to see in many cultures. According to Ninness and Ninness (1998), humans appear to be more at risk for developing superstitions because their

performances often are under the influence of rules which is a verbal descriptions of contingencies. If the members contacts the direct contingency and they are not following the rule anymore, it means that the groups behavior is contingency sensitive and that the cultural practice described by the rule may no longer be selected within the group. When cultural consequences selects a cultural practice, it can be continued throughout generations by transmitting it through verbal behavior to new members of the group.

More studies should be conducted to see how rules affects behavior in groups with changing contingencies. It is interesting to look in to why some cultures continue their practices when it is no longer beneficial to them within the group but also between other groups. Some possible changes in the procedure of future studies could be to also include a control group with no instruction to compare the difference. It would also be interesting to add punishments for not following the instructions and reinforcements for following the instructions as this is common in many societies. If a law is not followed in a society, a punishment would usually be arranged as a consequence in a society. Also believing in fake news and theories are sometimes reinforced in societies. In this case, they follow a rule that is not accurate according to the direct contingency which could lead to superstitious behavior in cultures. Similar future studies with generations should if possible, include even more generations and maybe more changes in the contingency to see if the groups behavior changes according to it more than once.

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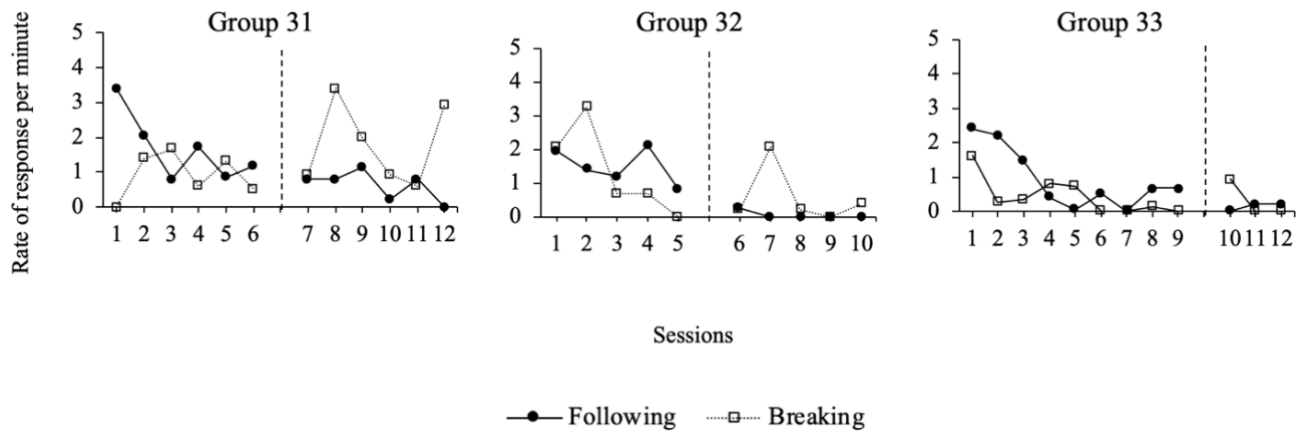
Figure 1

Median switch points and points per session for group 31, 32, and 33.
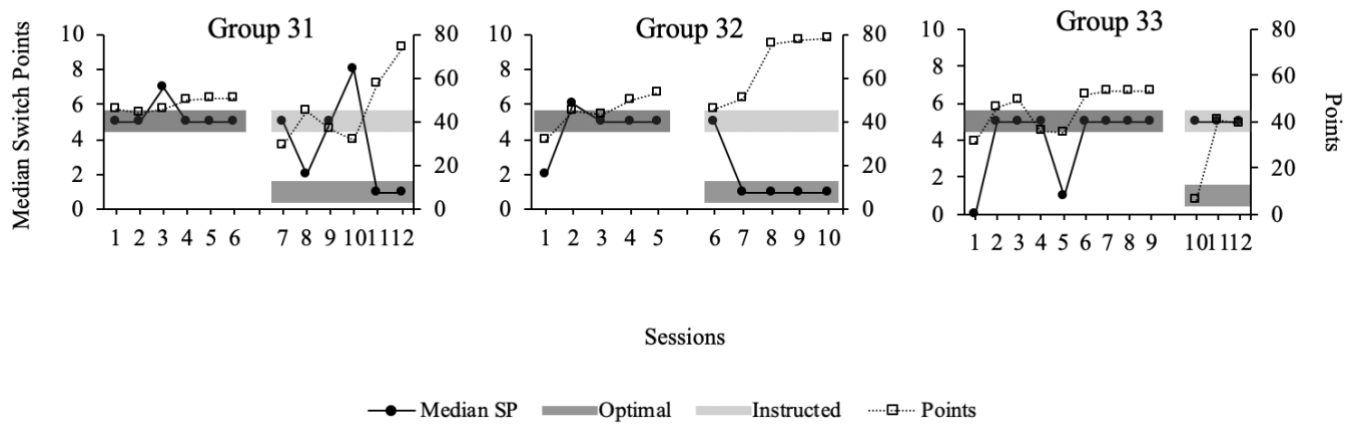
Note. Experiment 1 for Group 31, 32 and 33. The Primary Y- axis shows number of switch points for number of clicking A before clicking B. The secondary Y-axis shows number off points earned. The X-axis shows number of sessions. The darker gray line represents optimal responding according to the direct contingency and the lighter gray line represents the instruction given.
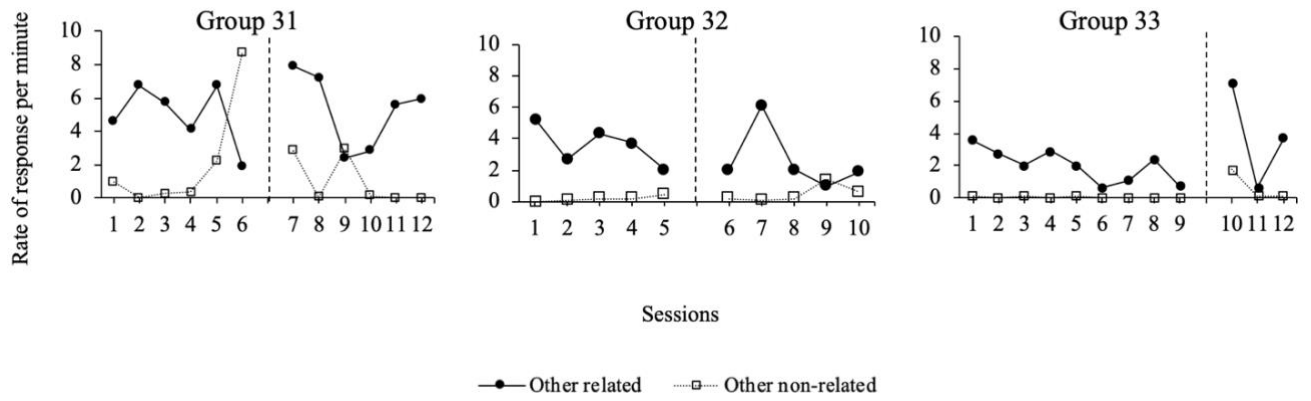
Figure 2

Rate of response per minute for group 31, 32, and 33 – Following and breaking.

Note. The figure shows the verbal responses of following and breaking the response-pattern suggested in the instruction in Experiment 1 for Group 31, 32 and 33. The Y- axis shows the rate of verbal responses per minute. The X-axis shows number of sessions.
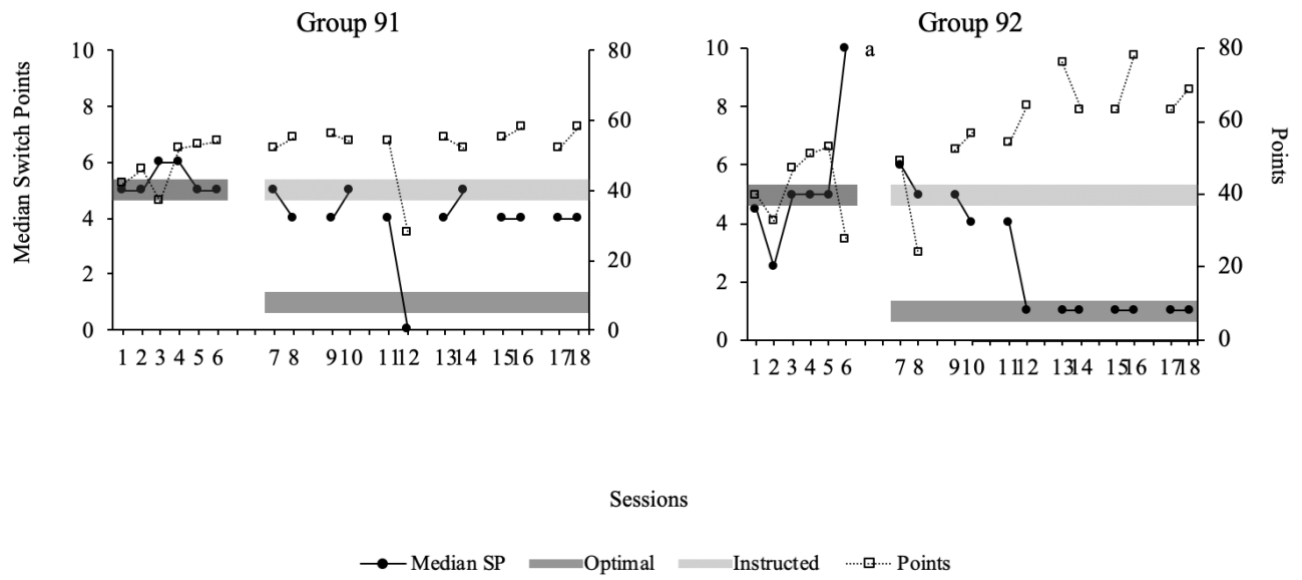
Figure 3

Rate of response per minute for group 31, 32, and 33 – Other related and other non-related.

Note. The figure shows the verbal responses of other related topics and other non-related topics in Experiment 1 for Group 31, 32 and 33. The Y- axis shows the rate of verbal responses per minute. The X-axis shows number of sessions.

Figure 4

Median switch points and points per session for group 91 and 92.
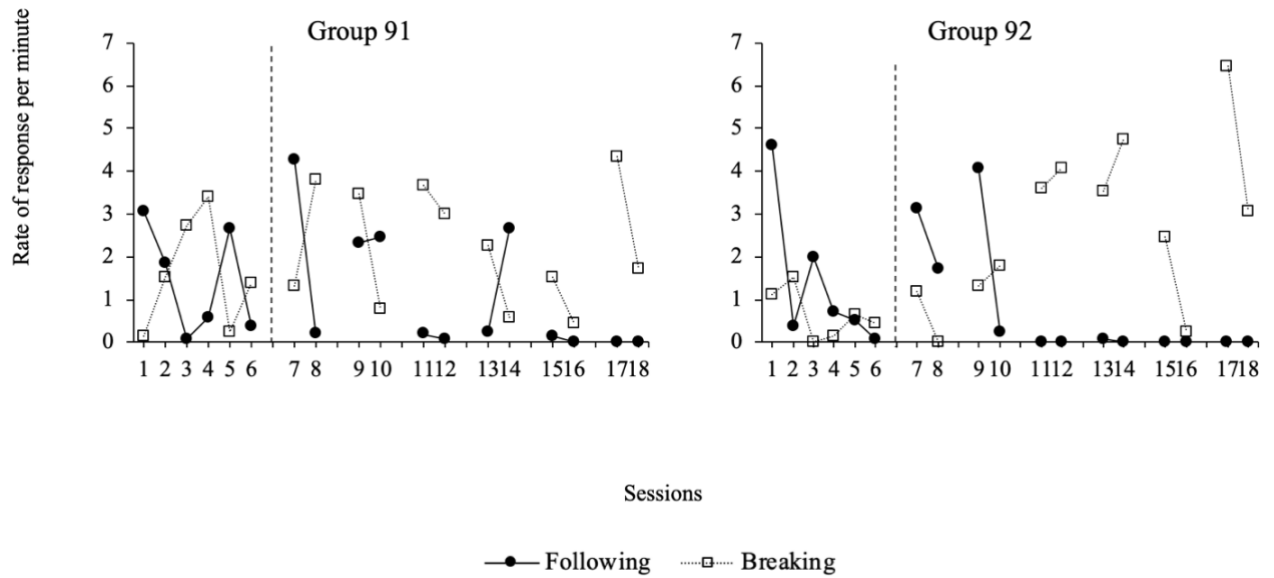

Note. The figure shows data from Experiment 2 with generations for Group 91 and 92. The Primary Y- axis shows number of median switch points. The secondary Y-axis shows number off points earned. The X-axis shows number of sessions. The darker gray line represents optimal responding of the direct contingency and the lighter gray line represents the instruction that was given.

[a] The median switch point for session 6 in Group 92 has the point value of 27. It is put on point value 10 which is the highest value in the vertical axis in the graph. The purpose of this is to make the rest of the point values more visible.
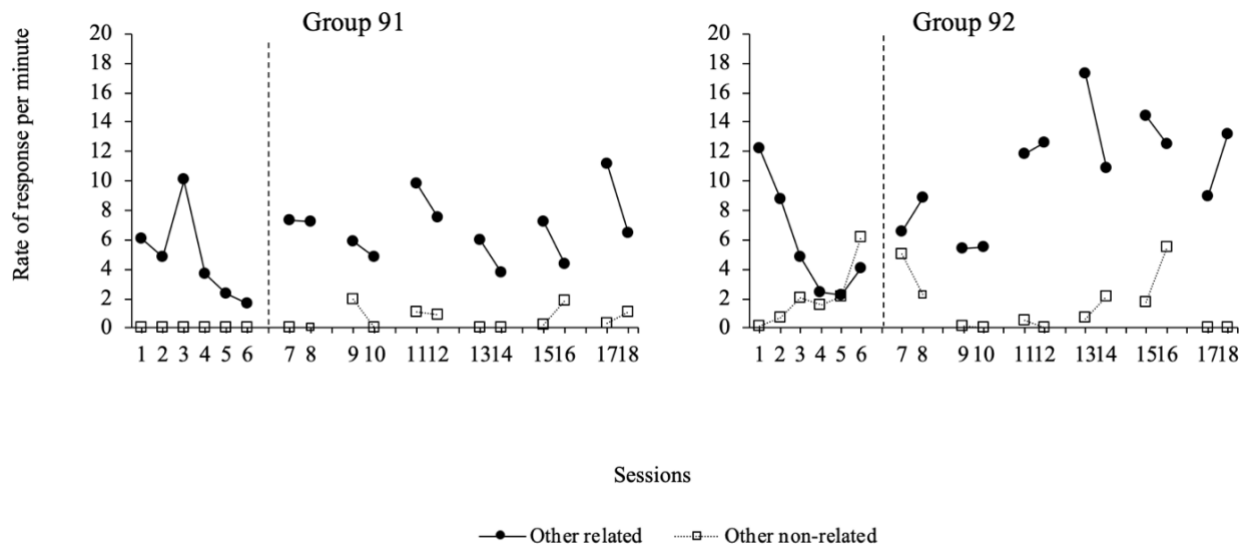
Figure 5

Rate of response per minute for group 91 and 92 – Following and breaking.

Note. The figure shows the verbal responses of following or breaking the response-pattern suggested in the instruction in Experiment 2 with generations for Group 91 and 92. The Y-axis shows the rate of verbal responses per minute. The X-axis shows number of sessions.

Figure 6

Rate of response per minute for group 91 and 92 – Other related and other non-related.

Note. The figure shows the verbal responses of other related topics and other non-related topics in Experiment 2 with generations for Group 91 and 92. The Y- axis shows the rate of verbal responses per minute. The X-axis shows number of sessions.

Table 1

Program in Experiment 1.

		History training phase		Testing Phase				
No. of "A" before "B"	"A" PT 2 s	"B" FT 30 s	Points /session	Points /session +1	Points /session +2	Points /session +3	Points /session +4	Points /session +5
0		30	24	24	24	24	24	24
1	0	30	41	90	90	90	90	90
2	2	30	51	75	73	71	69	68
3	4	30	56	65	62	59	56	54
4	6	30	58	58	54	51	47	45
5	8	30	59	53	48	44	41	38
6	10	30	58	48	43	39	36	33
7	12	30	56	45	40	35	32	29
8	14	30	54	42	36	32	29	26

Note. How the program operated in Experiment 1. The progressive time for the number of "A" before clicking "B", and the maximum amount of points per session is demonstrated under the History Training Phase. In the Testing Phase, clicking one time on "A" before clicking "B" has the same amount of seconds to make it the most optimal way to earn points every session. When "A" is clicked one time the time is set on 6 s to make it the most optimal way in every session in the Testing Phase. Every time "A" is clicked more than one time, the amount of seconds gets added with one more second in the first session, with two seconds in the second session, three seconds in the third session etc., so the maximum amount of points when "A" is clicked more than one time, will be less every session. The darker gray line represents the optimal way to earn points, and the lighter gray represents the instruction given.

Table 2

Program in Experiment 2.

		Experiment 2		
		History training phase		Testing Phase
No. of "A" before "B"	"A" PT 2 s	"B" FT 30 s	Points /session	Points /session
0		30	24	24
1	0	30	41	90
2	2	30	51	77
3	4	30	56	69
4	6	30	58	63
5	8	30	59	59
6	10	30	58	55
7	12	30	56	51
8	14	30	54	49

Note. How the program operated in Experiment 2. The progressive time for the number of "A" before clicking "B", and the maximum amount of points per session is demonstrated under the History Training Phase. The darker gray line represents the optimal way to earn points, and the lighter gray represents the instruction given.

Table 3

Rule transmission in the generations.

Session	Group 91	Group 92
7	Technological	Technological
9	Technological	Technological
11	Technological / Ceremonial	Technological
13	Technological / Ceremonial	Technological
15	Technological	Technological
17	Technological	Technological

Note. The table shows the sessions where a new member came in and created a new generation in Group 91 and 92. In each session it is shown how the previous members transmitted information, either technological or ceremonial.