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Instructional Control: Role of Instructional History and Feedback in a Human Conditional Discrimination Task

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Abstract

The main aim was to evaluate the effects of instructional history as a determinant of the control exerted by instructions and feedback on the performance of a conditional discrimination task. The 40 college students who participated were trained in a first-order, matching-to-sample procedure. One group (n= 10) was exposed to three phases with congruent instructions, followed by a fourth phase in which the instruction given was incongruent (Congruent Instruction Group). The second group (n= 10) was exposed to four phases but always received incongruent instructions (Incongruent Instruction Group). Both groups received feedback for each response. In the other two groups, minimal instructions were used, but subjects in one received feedback (Feedback Group), and the other did not receive it (No feedback Group). For all groups, after each experimental phase, a test session with different stimuli, minimal instruction, and no feedback was introduced. Correct responses were recorded. Data showed an instructional control in the Congruent and Incongruent groups compared to the control exerted by feedback. Nine of the ten participants from the Feedback Group showed markedly better performance than participants from the No feedback Group. The role of interaction between instructional history and current contingencies in controlling human behavior on conditional discrimination tasks and the functional property of instructional control is discussed.
Key words: instructional history, contingencies, feedback, matching-to-sample, humans.

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Novelty and Significance

What is already known about the topic?

- Instructional history shapes insensitivity to changes in reinforcement contingencies.
- Feedback reinforces discrimination in tasks with minimal initial instruction.

What this paper adds?

- Conditional discrimination procedures can be a key to assessing whether behavior is under the control of instructions or direct contingencies in a competitive situation.
- Incongruence between instructions and direct reinforcement contingencies produces changes in behavioral control.

It is widely recognized that not all human behavior is controlled directly by reinforcement contingencies (Skinner, 1957). Unlike other species, human behavior is susceptible to control by discriminative stimuli in the form of verbal descriptions. Such verbal behavior has been called rule-governed behavior or instructional control about the verbal description of the behavior expected and its consequences (Hayes, Brownstein, Haas, & Greenway, 1986; Harte, Barnes-Holmes, Barnes-Holmes, & Kissi, 2020; O'Hora, Barnes-Holmes, & Roche, 2001). As Skinner (1969) acknowledged, operant human behavior may be controlled by two sources: a) shaped by contingencies or b) controlled by prior verbal stimuli. Although this distinction has proven theoretically and empirically

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valuable for identifying the source of human behavioral control, it is not always evident because topographically identical behaviors may have been established by either of these two forms of control. Shimoff, Catania, & Mattheus (1981), in their attempt to resolve the problem of identifying the source of control, pointed out that comparing a person's pattern of performance with those developed by non-human species could help determine when behavior is under the control of contingencies or instructions. Another method used to differentiate the source of control consists in providing participants verbal descriptions of a pattern distinct from the reinforcement schedule, i.e., by using an incongruent instruction, the researcher can identify more precisely the origin of the source of control of the observed behavior (Baron & Galizio, 1983; Hayes *et alii*, 1986; Martínez & Ribes, 1996; Martínez & Tamayo, 2005).

It has been reported that when a response is established through instruction, programmed contingencies often exert only weak control over it (Baron & Galizio, 1983). This phenomenon, in which instructional control is more strongly exerted than control produced by direct exposure to contingencies, is known in the literature as insensitivity to contingencies, i.e., when contingencies change, human performance continues to correspond to the pattern described by the instruction (Hayes *et alii*, 1986; Joyce & Chase, 1990; Podlesnik & Chase, 2006; Shimoff *et alii*, 1981). According to Hayes *et alii* (1986), the type of rules or instructions provided plays an important role when insensitivity to contingencies is produced: (a) more general rules (e.g., respond correctly) often result in behavioral variability and, therefore, higher sensitivity to contingencies; b) in the case of illogical rules, the impossibility of following them often encourages higher sensitivity to contingencies; and, (c) rules that describe precise forms of contact with the differential consequences generate less insensitivity to contingencies within their domain, but produce an insensitivity to contingencies outside of it. For Vaughan (1989), the main features of rules and instructions are: a) that the acquisition of appropriate behavior is faster than in the case of shaped behavior, and b) they facilitate generalization among similar contingencies, making them especially valuable when contingencies are complex or unclear. For Buskist and Miller (1986), all human behavior is under control by the interaction of instructions and contingencies. Rules and contingencies control behavior independently but also interact at different levels to govern behavior. Ultimately, all behaviors make contact in some way with central aspects of contingencies, such as reinforcement, which, in turn, produces effects on instructions by confirming them.

In turn, the control exerted by contingencies once the behavior has been established through instruction depends mainly on two characteristics: a) the extent to which the response patterns described by the instruction maximize obtaining reinforcer, and (b) the variability in response rates that enables differential reinforcement, thus contacting the subject with current contingencies (Baron & Galizio, 1983). However, research on instructional control has focused on the manipulation of variables such as the amount of information provided in the instruction (Baron & Galizio, 1983; O'Hora & Barnes-Holmes, 2004); the frequency of feedback (Martínez & Ribes, 1996); the consistency of instructions with feedback (Buskist & Miller, 1986; Hayes *et alii*, 1986; Ribes & Martínez, 1990), and the history of reinforcement achieved by following instructions (Baron & Galizio, 1983; Martínez & Tamayo, 2005).

According to Baron and Galizio (1983), following instructions depends on the reinforcement that an individual has received to do so during pre-experimental history. However, it may be necessary to reinforce such instruction-following behavior throughout

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the experiment so that the instructions never lose control over performance. Baron and Galizio (1983) also have suggested that feedback can have a molar effect (on following instructions) and a molecular effect (on the particular response). Therefore, one possibility is that the molar effect of consequences during the instructional history phases is stronger than the molecular one, so that even when reinforcing following instructions, participants continue to be controlled by an incongruent instruction, demonstrating resistance to control by contingencies.

Several studies have shown that when a subject has been exposed to an experimental history in which instruction-following was not reinforced, the likelihood that the participant will maintain the performance described by the instruction decreases (Martínez & Tamayo, 2005; Okouchi, 1999). For example, Galizio (1979) demonstrated that following instructions behavior can be influenced by reinforcement contingencies. In a series of experiments using a loss-of-money avoidance procedure, Galizio (1979) manipulated inaccurate instructions on the assumption that they would lead to loss of reinforcement and, therefore, instruction following should cease to occur. Another experiment in the series using the same avoidance procedure demonstrated discriminative control of instructions and contingencies; when instructions are accurate and inaccurate, participants should show instructional control in the first situation and control by the contingencies in the second. In Martínez and Tamayo's (2005) study, four instructional histories were trained in a matching-to-sample procedure: a) three phases delivering a congruent instruction, then in a fourth phase, the instruction changed but remained congruent; b) after exposure to an incongruent instruction, the instruction was different but remained incongruent; c) after exposure to a congruent instruction, the instruction changed to incongruent; d) after exposure to an incongruent instruction, the instruction changed to congruent. Results confirmed that instructional history has differential effects on matching-to-sample tasks even before novel instructions, showing evidence that responding preceded by instructions, not only a response but also instruction-following behavior, is reinforced (Baron & Galizio, 1983). These authors interpreted data regarding molecular and molar reinforcement effects and concluded that false instructions help explore interactions between the control exerted by the instructions or contingencies.

Some dependent variables have been explored to study instructional control and control by contingencies. For example, insensitivity to contingencies resulted in the transition between fixed-ratio to fixed-interval or variable-ratio to variable-interval schedules (Baron *et alii*, 1969). Participants' responses to variable-ratio schedules are less sensitive to false instructions (which induce low response rates) than to variable-interval schedules (Raia, Shillingford, Miller Jr, & Baier, 2000). Buskist and Miller (1986) suggest that imprecise instruction exerts control over behavior until it makes contact with optimal differential reinforcement. In their study, they applied a 30-second fixed-interval schedule (FI30"). Hayes *et alii* (1986) provided two accurate and two false instructions. The task consisted of alternating a fixed ratio 18-second schedule (FR18) in the presence of a yellow rectangle and a 6-second low-rate differential reinforcement schedule (DRB6") in the presence of a blue rectangle. In the final phase, without instructions and reinforcement. Thus, the interest of this study focused on evaluating the performance produced by exposure to the same incongruent instruction in two experimental conditions: a) when preceded by a congruent instruction, or b) when preceded by an incongruent instruction. For this purpose, participants were exposed to a conditional discrimination task that provided congruent or incongruent instructions in three phases to produce experimentally different instructional histories. In phase four, all subjects in

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both groups received the same incongruent instruction to evaluate possible differential effects due to instructional history on instrumental behavior. Additionally, to confirm the effectiveness of the feedback in the form of right or wrong, new participants were exposed to the same experimental task with minimal instruction; one group without feedback (No feedback Group) and the other receiving feedback from each response (Feedback Group).

Method

Participants

Forty male college students (aged 17-29) volunteered to participate in this experiment. Forty percent of participants were graduate students, while the remainder were undergraduates. All participants were experimentally naive, with no prior experience with conditional discrimination procedures, no visual or hearing impairments, and no diagnosed learning or psychological disabilities. They received no compensation for their participation and were recruited from different local public universities to avoid prior interactions. The study was conducted in compliance with applicable laws and the Declaration of Helsinki. The study was approved by the *Comité de Ética* of the *Instituto de Neurociencias* of the *Universidad de Guadalajara* (ET112010-91). All participants read and signed the informed consent form before participating in the study. We did not request additional information from participants beyond that presented here. We also did not indicate the sex of the participants, as we have no evidence to suggest gender differences in these tasks.

Apparatus and Materials

A Pentium III laptop with 512 Mb of RAM, a 15.4” HD widescreen display (1024 x 800), and other computer equipment provided by the university was used to display stimuli and instructions and to record responses. All experimental sessions were conducted in a room lit by artificial light. The programs for the conditional discrimination task and data collection were performed by E-Prime version 1.1 software. All instructions appeared on the screen, and subjects responded by pressing one of three keys on the keyboard.

Design

The baseline session was followed by four experimental phases, with a test session after each. Each experimental phase consisted of four sessions, and each session, test, and baseline consisted of 36 trials each. Two groups were designed to evaluate the effects of the prior instructional history, and participants were randomly assigned to each one. The Congruent Instruction Group (CI Group; n= 10) received a congruent instruction during the first three phases, followed by an incongruent instruction in the fourth phase. In contrast, the Incongruent Instruction Group (II Group; n= 10) was given incongruent instructions during all four phases. Feedback for each response was provided during all experimental sessions for both groups. Another two groups were designed to evaluate the effects of feedback, so minimal instructions remained along the four phases. The difference between both was that the participants of the Feedback Group (n= 10) received feedback (the word “right” in green, or “wrong” in red) with each response emitted during experimental sessions, and the participants from the No feedback Group (n=

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10) did not receive any feedback after their responses. The purpose of the test sessions was to evaluate the effects of removing the instructions and the contingencies of the experimental phases; participants were not informed of their performance and received minimal instructions during those sessions. Because of previous and recent instructional history, we expected participants would keep responding in correspondence with the behavior shown in the last experimental phase.

Procedure

The procedure, experimental design, and instructions were similar to those reported by Martínez and Ribes (1996) and Martínez and Tamayo (2005). A simultaneous first-order, matching-to-sample procedure was used as the experimental task (Silveira, Mackay, & de Rose, 2017). As Figure 1 illustrates, each trial consisted of one stimulus sample in the center of the screen and three comparison stimuli aligned horizontally at the bottom of the screen. Two sample stimuli appeared in 50% of the trials, and the order of presentation was randomly assigned. The comparison stimuli were related to the stimulus sample as follows: one was identical (in shape and color), a second was similar (in shape or color), and the third was different (in shape and color). The position of these stimuli on the screen changed on each trial. The location of the similar comparison stimulus on the screen was in 33% of the trials on the left, center, or right. The positions of the comparison stimuli that were different and identical to the sample stimulus were also randomly assigned, and 50% of the similar stimuli were alike in shape, while the remaining 50% were in color. The comparison stimuli that were different and identical were balanced using the colors and shapes described above. After the first sequence of trials was programmed, three more sequences were programmed by reversing or mixing the trials of the first sequence. The second sequence contained the trials in reverse order to the first, and only the first and last trials were swapped in the third sequence. Finally, the fourth sequence reversed the order of all trials of the third sequence. The subjects had to vary their responses on every trial to select the same type of relationship between the sample and the comparison stimulus.

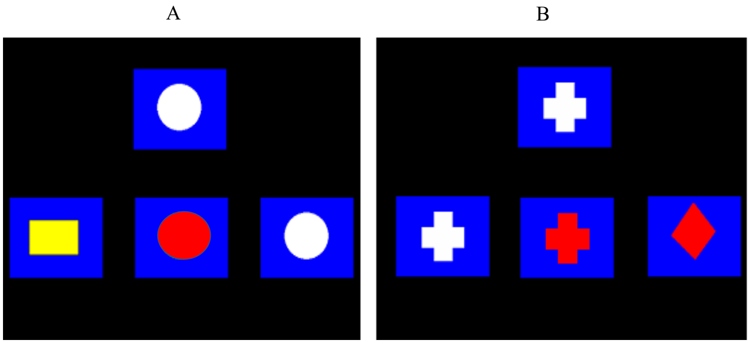

Figure 1. Example of the image that appeared on the screen during the experimental sessions (A) and the tests (B). In both cases, the figure in the upper part was the sample stimulus, and those in the lower part were the comparison stimuli that had a relationship of identity, difference, or similarity with the sample stimulus.

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The figures used in the experimental phases were circles, triangles, squares, and rectangles of different colors (red, white, yellow, and gray); whereas crosses, diamonds, pentagons, and horizontal lines of the same colors were used for the baseline and test sessions. To avoid possible differences in the presentation of the stimuli and the sequence of trials, all participants were exposed to the same order of presentation during the trials. In all trials, the correct response consisted of choosing the comparison stimulus that was similar in either shape or color to the sample, but not at the same time.

In the experimental sessions with feedback, after each response, the word "right" in green color or "wrong" in red appeared in the center of the screen for one second; then feedback disappeared, and the next trial began. When feedback was not presented after each response, a black screen appeared for one second, and the subsequent trial started. In baseline and test sessions, every trial began immediately after each response, without feedback or black screen delay.

Upon completing 36 consecutive trials per session, a message appeared on the screen indicating that the subject should inform the experimenter that the session was over. When each session ended, the experimenter manually activated the program that started the next one. All sessions were conducted consecutively on a single day with an approximate duration of 60 minutes, depending on the participant's performance, as there was no time limit for responding in each trial. Upon completing 21 sessions with each participant, the study was terminated.

Instructions

Participants entered the experimental room, sitting in front of the personal computer without contact with other participants. After that, the baseline began, and following minimal instructions appeared on the screen:

> Thank you for your participation. Please read the instructions carefully about the task you will be doing.
> Four figures will appear on the screen: one at the top and three more at the bottom. You must choose one of the three figures at the bottom. To make your choice, you should press keys 1, 2, or 3 as follows: to choose the left figure, press key 1; to choose the central figure, press key 2; to choose the right figure, press key 3.
> You will not receive any information about correct or incorrect responses in this session. If you have any questions, please consult the experimenter now because once the session starts, you will not be allowed to do so. Press the space bar to continue.

This instruction was used on baseline and tests for all groups and experimental phases for the Feedback Group; for the No Feedback Group, the instruction was identical except for the feedback information. Participants in the Congruent instruction group received the following instruction written on the screen at the beginning of each experiential session:

> The session will now begin. Four figures will appear on the screen: one at the top and three more at the bottom. You must choose the figure at the bottom that is most SIMILAR only in shape or color (but not both) to the one at the top. To make your choice… (except for the feedback information, all other instructions were as before).

Aside from the content of the paragraph indicating the type of relation-difference vs. similarity, the instructions to the incongruent group were the same as those given to the congruent:

> The session will now begin. Four figures will appear on the screen: one at the top and three more at the bottom. You must choose the figure at the bottom that is DIFFERENT in shape and color from the one at the top. To make your choice...

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Results

Figures 2a and 2b and 3a and 3b show the total number of correct responses for each participant per session from all four groups. Open circles show the correct responses during the baseline and test sessions, and black circles represent the correct responses during the experimental phases. The vertical line marks where the fourth experimental phase started and the change to incongruent instructions for the Congruent instruction group, while for the Incongruent instruction group, the instructions remained incongruent. For groups, no feedback and Feedback, minimal instructions remained unchanged, and the vertical line was maintained for visual comparison between the four groups.

Figure 2a show the correct responses of the Incongruent instruction group participants. During baseline, the number of correct responses for all participants was zero or near zero; in no case did it exceed eight correct responses. Except for S1, who immediately ascertained the correct response, the rest of the participants in this group showed a performance with very few correct responses during all experimental sessions. Only one participant (S3) showed a stable but low response pattern of correct responses by scoring around ten correct responses per session. In test sessions, only participants S1, S2, S3, and S6 showed some correct responses in more than one session. Except for S9, who got 100% correct responses in the second test session, the remaining participants had zero or close to zero.

The individual graphs in Figure 2b also show the number of correct responses for the Congruent instruction group. As in the Incongruent group, during the baseline, the number of correct answers was zero or almost zero for all participants except for S13. Then, with slight variations in the first three experimental phases, all participants showed optimal performance, very few errors, when they received congruent instructions. Only two participants (S11 and S20) obtained fewer correct responses in the first session (eight and zero, respectively), stabilizing their high performance from the second session. When the congruent instruction was changed to the incongruent in the fourth experimental session, we identified three patterns of performance: (a) six participants showed an immediate decrease in the average number of correct responses; (b) for three participants (S11, S15, and S20), the change of instructions had a reduced effect on the first session of the fourth experimental phase, as they obtained around 25 correct responses, though, during the following three sessions, the number of correct responses was zero or close to zero; and, (c) a different pattern was exhibited by only one participant (S18), who during the first session of the last phase had a few errors, but quickly regained the high level of performance of the previous phases.

During the first three test sessions, only three participants (S12, S15, and S18) achieved higher scores than in the previous experimental sessions. Two of them (S12 and S18) maintained their performance during the fourth test session. The rest of the participants had low scores or showed variability in their performance.

Figure 3a show the correct individual responses of the participants of the group No Feedback that did receive no feedback under minimal instruction. Except for participants S21 and S26, who in one or two sessions exceeded half of the correct responses, the rest showed poor performance. In the test sessions, all participants performed as during the four experimental phases.

Figure 3b also show the correct individual responses of the group Feedback to which feedback was provided under minimal instruction. Only one participant (S35) never exceeded the third part of the correct ones, and performance decreased. In contrast,

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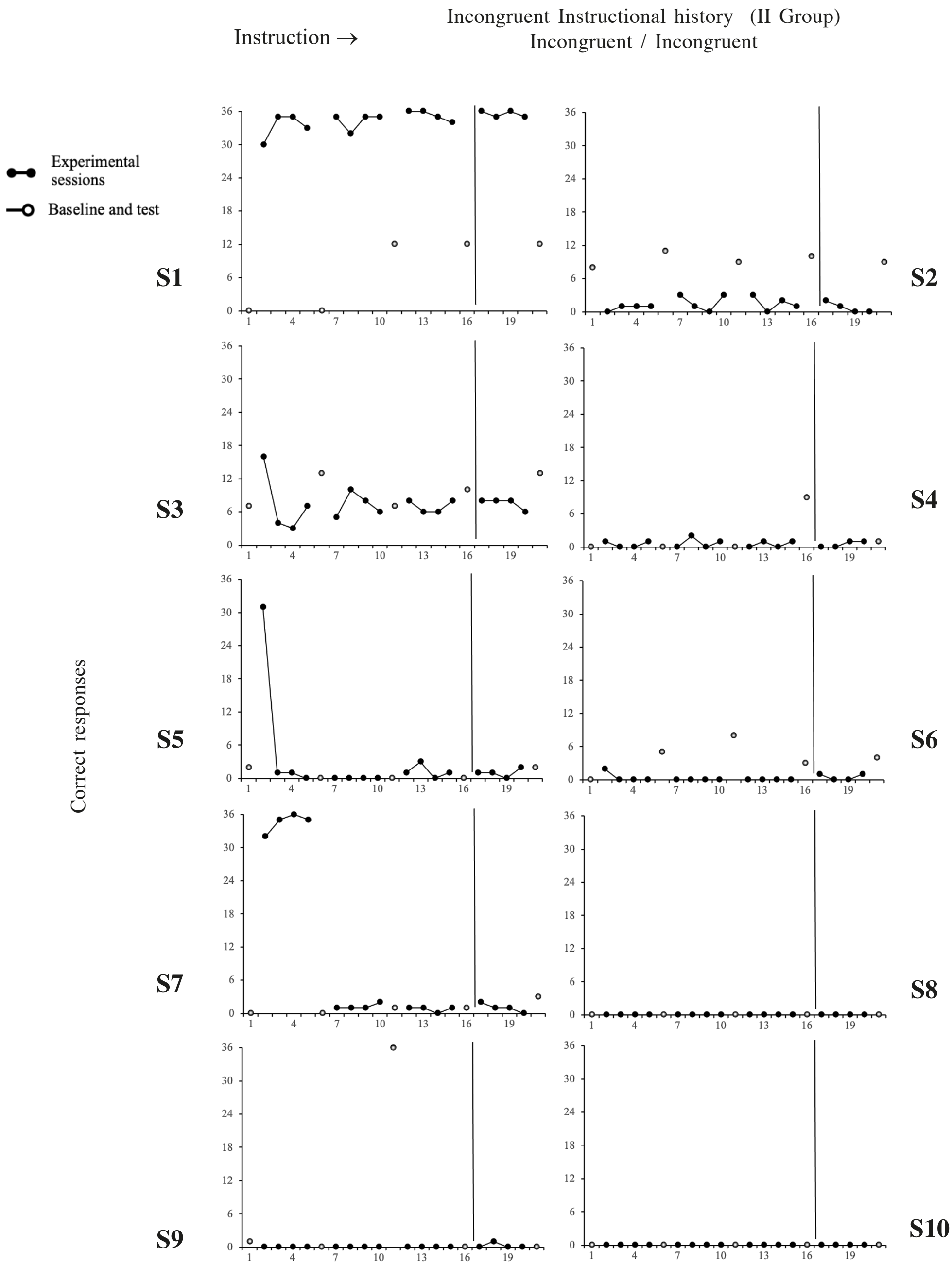

Figure 2a. Individual data on the number of correct responses (Y-axis) in each session (X-axis) for the Incongruent Instruction Group. The instructions given (congruent/incongruent) are shown at the top. The vertical line indicates the beginning of the last phase when incongruent instructions were presented.

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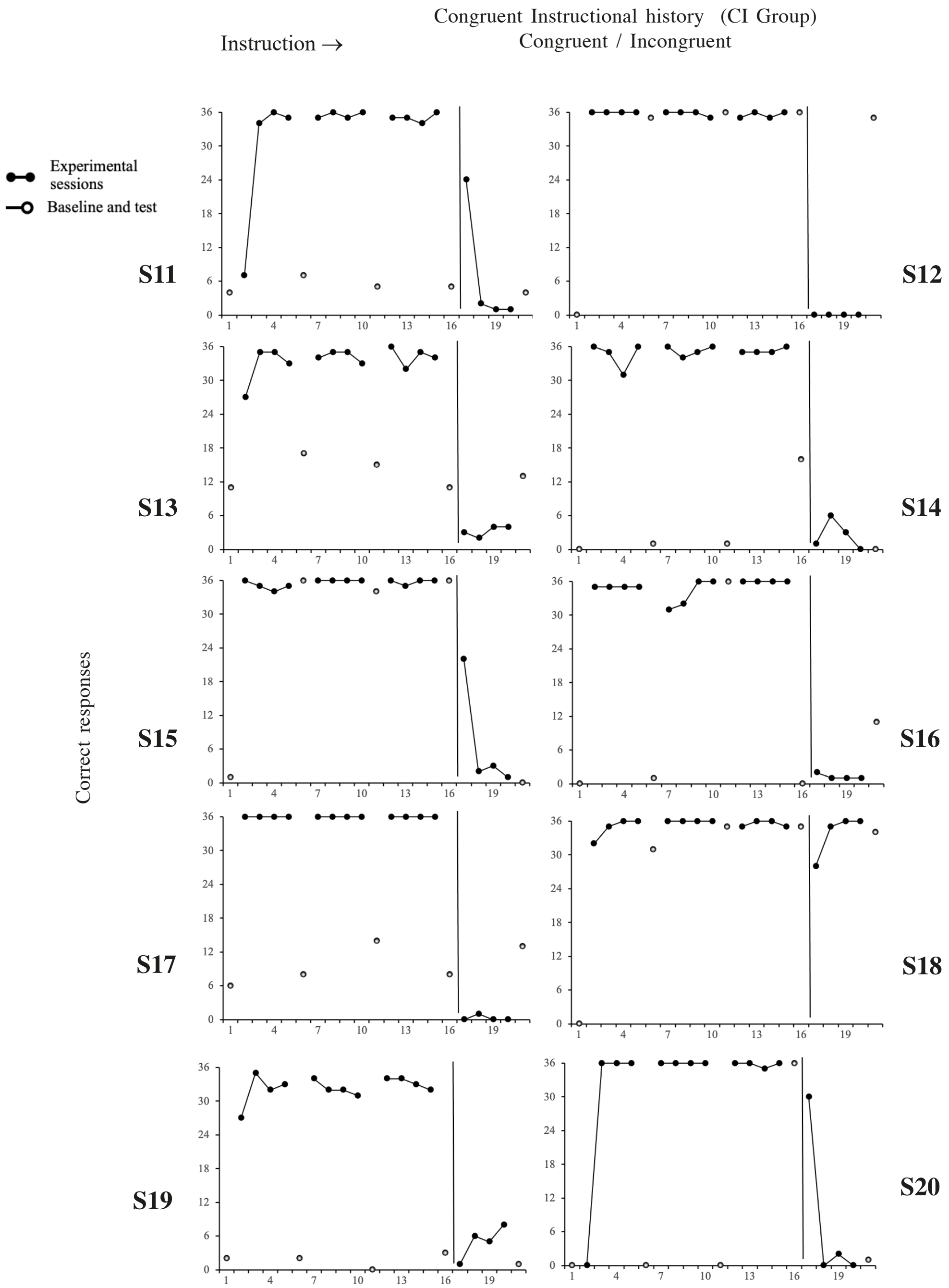

Figure 2b Individual data on the number of correct responses (Y-axis) in each session (X-axis) for the Congruent Instruction Group. The instructions given (congruent/incongruent) are shown at the top. The vertical line indicates the beginning of the last phase when incongruent instructions were presented.

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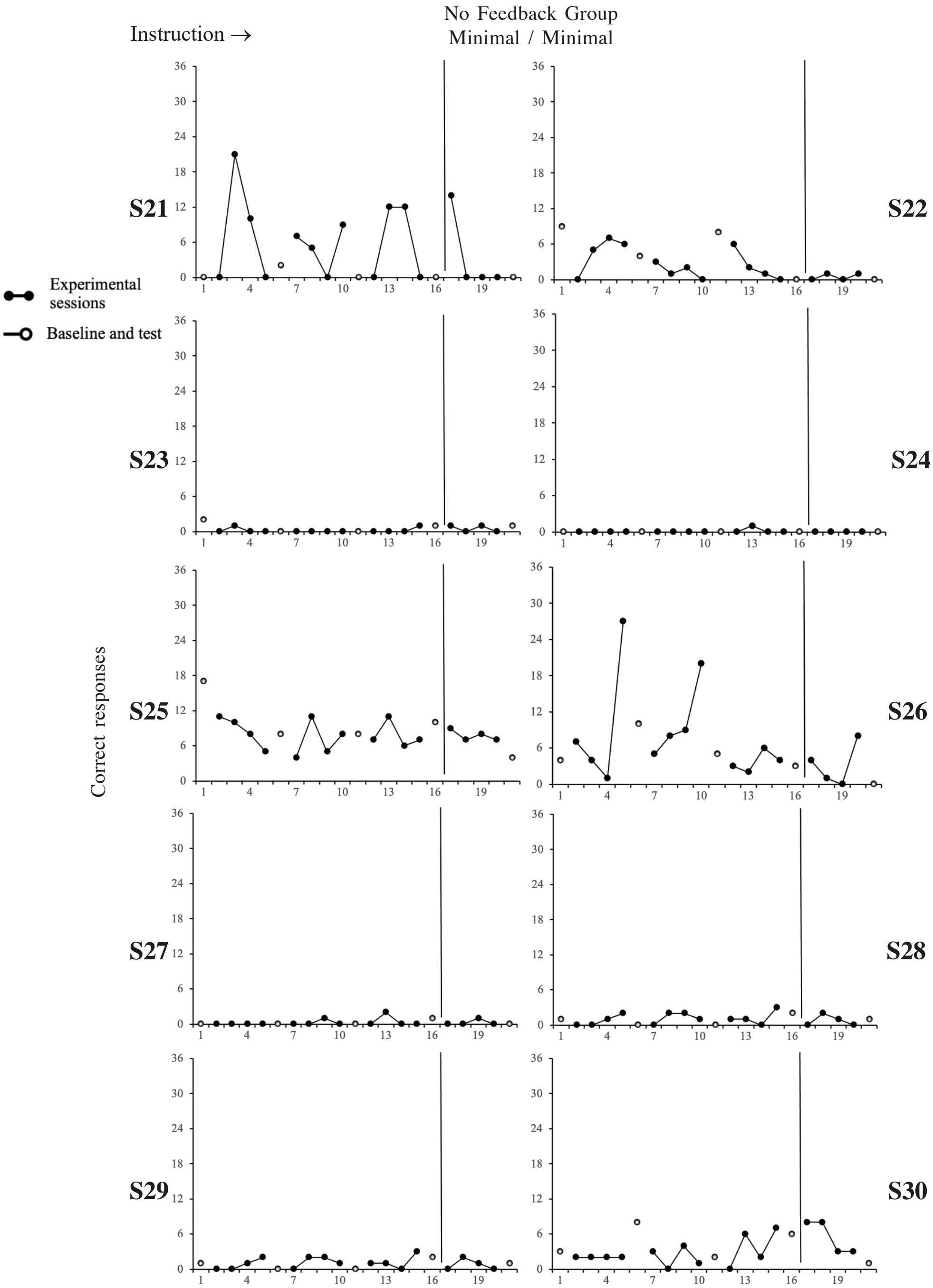

Figure 3a. Individual data on the number of correct responses (Y-axis) in each session (X-axis) for the No Feedback Group. Black circles indicate experimental sessions, the baseline, and tests by open circles. The instructions given (minimal) are shown at the top. The vertical line is just for comparison purposes.

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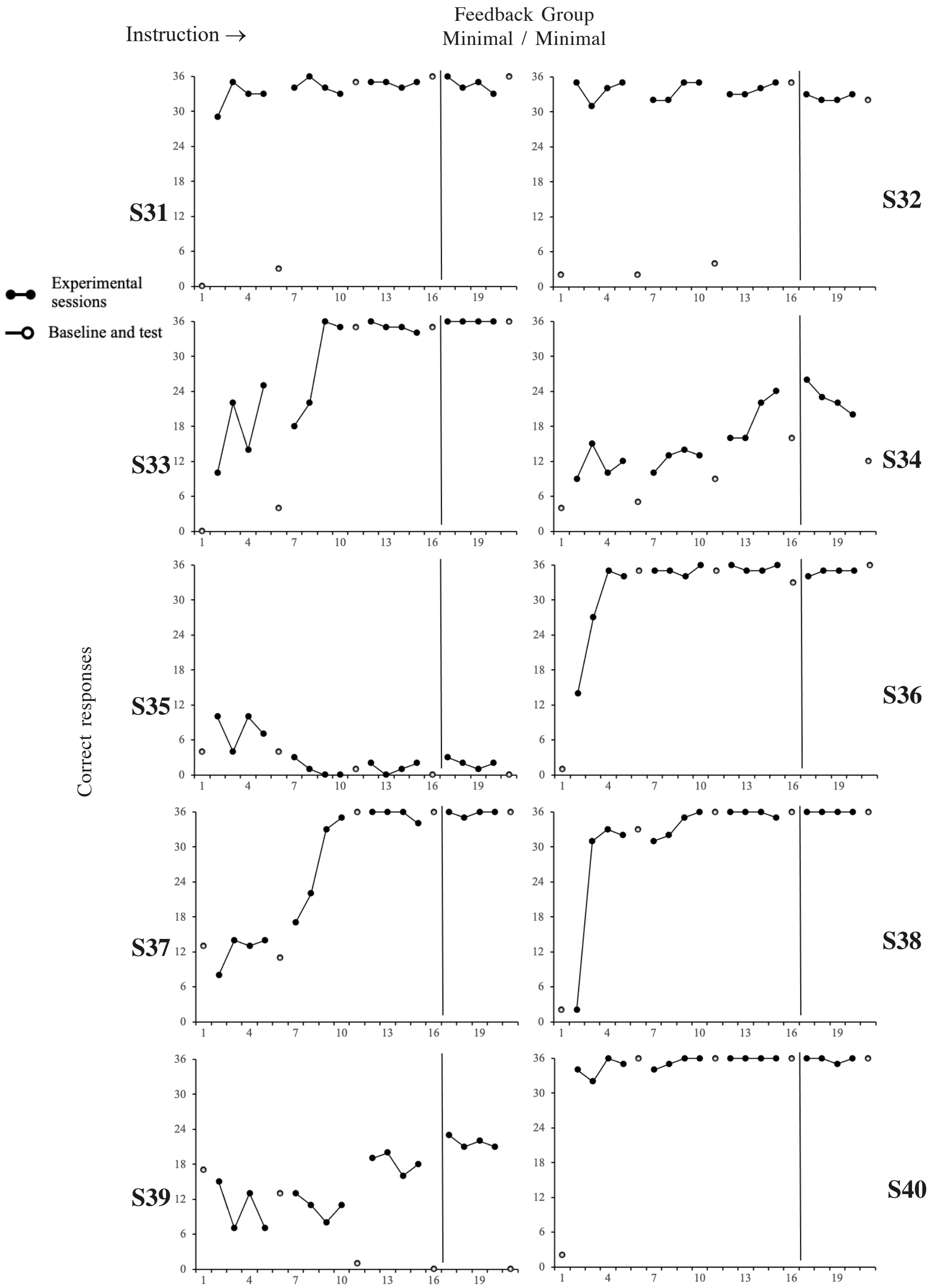

Figure 3b. Individual data on the number of correct responses (Y-axis) in each session (X-axis) for the Feedback Group. Black circles indicate experimental sessions, the baseline, and tests by open circles. The instructions given (minimal) are shown at the top. The vertical line is just for comparison purposes.

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seven participants achieved optimal performance, although S33 and S37 participants took around six sessions to reach the maximum correct. Participants S34 and S39 recorded a maximum of 27 and 24 correct responses in the last four sessions. Except for participant S39, for the rest of the participants, there was a correspondence between their performance in the ultimate tests concerning the experimental phases.

Discussion

This study was based on the assumption that it might be valuable to consider instructions with contingencies as relevant variables related to the control of human behavior (Baron & Galizio, 1983; Hackenberg & Joker, 1994; Martínez, Ortiz, & González, 2007). The purpose was to evaluate whether, after a congruent or incongruent instructional history, behavior to follow instructions is affected by changes in the instructions provided in a conditional discrimination task. Data showed two main effects: a) congruent or incongruent instructions override control on discriminative behavior as compared to the control exerted by contingencies; b) same contingencies (right or wrong) were effective for controlling the performance of the discriminative task with minimal instructions compared when those contingencies were omitted. Data from this study confirm that the correspondence between instructions and consequences promotes early acquisition and maintenance of high performance on first-order, matching-to-sample tasks (Buskist & Miller, 1986; Martínez & Ribes, 1996; Martínez & Tamayo, 2005). In the first three phases, participants in the Congruent instruction group immediately established a high level of performance that corresponded to the instructions and consequences, thus replicating data reported by Martínez and Tamayo (2005). In contrast, but in agreement with other results using the same contingencies ("right" or "wrong"), the participants exposed to incongruent instructions exhibited few correct responses, reflecting control of the instructions that overrode the control exerted by contingencies. However, one difference concerning previous results was that the instructional control shown in the fourth experimental phase was exerted regardless of whether the earlier instructional history was congruent or incongruent.

Martínez and Tamayo (2005) documented evidence for the notion posited by Baron and Galizio (1983) that reinforcement can act on both a particular response to an instance of instruction (molecular interpretation) and instruction-following as a general class of behavior (molar view). The data from the Congruent instruction group would support this explanation of the dual role of reinforcement since, during congruent instruction, the dual function of reinforcement strengthens both instruction-following behavior and the particular choice made in each trial. The molar view was especially apparent in the last phase when participants continued to follow the instruction despite the change from a congruent to an incongruent one. This suggests that instructional history predominated over reinforcement during the last phase, the one that included the incongruent instruction.

In the case of the group exposed to the congruent instructional history, having made contact with the reinforcing consequences during the first three phases, instruction-following behavior persisted even though the instruction was changed to incongruent and although subjects received negative outcomes as a consequence of their responses. These findings reveal that they did not stop following the incongruent instruction. One possibility is that participants in this group were not exposed to the incongruent instruction during enough trials to manifest a gradual loss of control exerted by the

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instructions. The persistence of instructional control under the new incongruent instruction condition could be explained by the action of the molar function of reinforcement as a result of the prior instructional history. Following this reasoning, the molar function of reinforcement action to follow instructions during the pre-experimental history could exert greater control that overrides the molecular function of negative feedback on task performance when the incongruent instruction is introduced.

It has been documented that exposure to incongruent instruction may cause a delay -or even prevent- effective contact with the contingencies (Galizio, 1979). Martínez and Ribes (1996) study showed such a delay in contact with contingencies as participants gradually ceased to respond according to the incongruent instruction to produce a performance according to the feedback they received. In contrast to these findings, in our study, participants exposed to incongruent instruction achieved very few correct responses throughout all phases. In other words, when participants maintain their responses under the control of the incongruent instruction, their performance becomes a clear demonstration of instructional control. This predominance of instruction over current contingencies could be explained by the phenomenon known as insensitivity to contingencies, which occurs when the response has been acquired via instructions and programmed contingencies tend to exert only weak control over behavior (Hayes *et alii*, 1986; Joyce & Chase, 1990; Shimoff *et alii*, 1981).

Drake and Wilson (2008) had already warned about the possibility that these verbal consequences would be weaker in controlling the performance in matching-to-sample tasks. These authors reported that by including in the instructions the molar consequences for the correct responses in matching-to-sample tasks, the sensitivity of contingencies, in this case, to the feedback increased. The molar consequences refer to reinforcing by participating in the study, in addition to the feedback trial-by-trial during training. In their experiment, even after supplied feedback (“Correct”, “Good job!” or “Wrong”) on each response, they reported a level of performance that appeared to be at the level of chance, which led them to stress the importance of providing instructions specifying the molar consequences to respond correctly and their impact on human conditional discrimination tasks.

In our study, the results of the groups that received congruent or incongruent instructions could also be explained as insensitivity to the available contingencies, or that for the participants of those groups, the verbal consequences of right or wrong were not effective in prompting participants to stop responding to the incongruent instruction. However, data from the group that received feedback from minimal instruction would not support this interpretation since, except for one participant, the remaining nine were sensitive to the consequences of right or wrong. Additionally, the group with minimal instructions that did not receive feedback did not respond correctly throughout the sessions. Regardless of whether the performance was controlled by instruction or feedback, the low performance during the experimental phases in the test sessions remained at that level, and, by contrast, the high performance along those same phases was followed by variability in the test sessions. These data suggest that congruent instructions might promote, but not ensure, the maintenance of good performance without specific instructions and feedback.

Some limitations of the present study should be mentioned. For example, it would be interesting to program contingencies into participants’ latencies to assess their effects on performance under accurate and inaccurate instructions. Despite the diversity of dependent variables used to evaluate instructional control, we did not find

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records of latencies under different experimental conditions to determine it. A temporal measure, like response latency, may be valuable in evaluating some properties of behavior in studies using matching-to-sample procedures in conditional discrimination tasks (Bentall, Dickins, & Fox, 1993; Bentall, Jones, & Dickins, 1998; Spencer & Chase, 1966). Although in our study contingencies were not scheduled on latencies, including a temporal dimension could be a sensitive measure of behavior that allows for increasing the accuracy in determining a discriminative response. The potential difference in response latencies could help establish more clearly the source of control between topographically identical responses; additionally, it might be possible to expand performance analysis by recording the latency of each response (Spencer & Chase, 1996; Weinstein, Wilson, Drake, & Kellum, 2008). Sidman (1960) has argued that latency is not a strictly behavioral measurement because it has been shown that reductions in latency as training progresses are typical. Latency is commonly interpreted as a measure of task complexity. In equivalence relation tasks, latency increases as the type of relationship between stimuli becomes complex. Data confirm a constant decrease in latencies as the sessions progress, and the participant acquires more practice in the task (Tomanari, Sidman, Rubio, & Dube, 2006). Wulfert and Hayes (1988) reported differences between baseline latencies and symmetry trials using equivalence class tasks, although performance precision showed no notable differences. Baron and Menich (1985) have argued that latency is an evaluable dimension of behavior. In this direction, for example, some procedures allow isolating the response latency to a discriminative stimulus from the time required by a subject to make a preparatory response (Stebbins & Lanson, 1961). It has also been used as a criterion to evaluate the complexity of instructions that indicate a particular type of relationship between stimuli (e.g., before/after) (O'Hora, Roche, Barnes-Holmes, & Smeets, 2002). In our study design, the consequences for responding correctly or incorrectly did not include latencies. Thus, feedback was only provided if the selection was correct or not. Therefore, the feedback provided could indirectly affect the duration of the latencies from trial to trial. A study analyzing the reinforcing effects of changing from one trial to another, irrespective of response accuracy (right or wrong) in conditional discrimination tasks, would provide more empirical support for this explanation.

Other studies in which instructional histories with different degrees of precision, without being accompanied by any feedback, and being varied in the last phase, could contribute to helping us gain an understanding of the control that instructions exert on human discriminative performances. Although conditional discrimination tasks such as matching-to-sample have proven useful, other experimental setups could be explored to extend the findings reported here. For example, Aguirre *et alii* (2019) taught three autistic children to respond intraverbally to auditory discriminative stimuli using conditional discrimination. Carp, Peterson, Arkel, Petursdottir, Ingvarsson, (2012) used pictures as stimuli within a stimulus sequence to teach visual and auditory conditional discriminations integrated into a stimulus sequence with autistic children. These authors also used picture stimuli within a stimulus sequence to teach visual and auditory conditional discriminations embedded in a stimulus sequence for autistic children. Sunberg and Sunberg (2011) have highlighted the role of conditional discrimination in children's acquisition of the intraverbal repertoire. The oral instruction modality is a common way of emitting this verbal behavior. In our study, we used written instructions. In the future, it will be interesting to explore the effectiveness of different modalities of instructions as discriminative stimuli (e.g., written, oral, pictorial) in terms of the control

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they can exert on the behavior. Coon and Miguel (2012), studying intraverbal behavior, have emphasized the role of reinforcement history in the acquisition of verbal behavior. Finally, more potent feedback in addition to social praise could be tested to assess both instructional and contingency control. Other studies in which instructional histories with different degrees of precision, without being accompanied by any feedback, and being varied in the last phase, could contribute to helping us gain an understanding of the control that instructions exert on human discriminative performances, thus opening up a new avenue of research in this field.

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