Article

A Systematic Review of Pliance, Tracking, and Augmenting

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Abstract

Within relational frame theory, a distinction has been made between three types of rule-governed behavior known as pliance, tracking, and augmenting. This review examined whether there is support for the concepts of pliance, tracking, and augmenting in the experimental analysis of behavior; whether these concepts refer to distinct functional classes of behavior; and how these concepts have been operationalized in experimental (behavioral-analytic) research. Given that the concepts of pliance, tracking, and augmenting were first defined by Zettle and Hayes, we confined our review to studies published in or after 1982. Our results indicate that (a) experimental research investigating pliance, tracking, and/or augmenting is extremely limited; (b) it is difficult to determine the extent to which the concepts of pliance, tracking, and augmenting allow for relatively precise experimental analyses of distinct functional classes of behavior; and (c) pliance and tracking have been operationalized by using a limited set of procedures.

Keywords

pliance, tracking, augmenting, rule-governed behavior, relational frame theory

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Over the past six decades, the topic of how verbal rules affect human behavior has been a mainstay of the behavior-analytic tradition. Relatively early on, researchers discovered that the learned ability to generate and follow verbal rules or instructions (what is commonly referred to as "rule-governed behavior") often produces very different patterns of behavior, relative to when people would follow "non-verbal" contingencies in the environment (commonly referred to as "contingency shaped behavior"; see Buskist & Miller, 1986; Catania, Matthews, & Shimoff, 1982; Galizio, 1979; Hojo, 2002; Kroger-Costa & Abreu-Rodrigues, 2012; Ribes & Rodriguez, 2001; Weiner, 1970; Zimmerman, Zimmerman, & Russel, 1969). For instance, rules or instructions allow people to set and achieve goals, profit from the experience of others, and even deal with events before they occur. Yet under certain circumstances, rule-following can also have detrimental effects. For instance, once behavior falls under the control of a verbal rule, people often rigidly adhere to that rule even in situations where the contingencies specified by the rule no longer apply (e.g., Matthews, Shimoff, Catania, & Sagvolden, 1977; Otto, Torgrud, & Holborn, 1999; Podlesnik & Chase, 2006; Shimoff, Catania, & Matthews, 1981). This tendency to rigidly adhere to verbal rules (even when they contradict other contingencies) is usually labeled the "insensitivity effect."

Parallel to this empirical work, attempts have been made to conceptualize rules and rule-governed behavior in functional (analytic-abstractive) terms. For instance, Skinner (1969) took the perspective that rules were "contingency specifying stimuli." Cerutti (1989) viewed rules as recombinations or sequences of previously encountered discriminative stimuli. Schlinger (1993), on the contrary, argued that rules could be viewed as "function-altering" stimuli. In each case, the conceptual focus centered on the effects of verbal stimuli on human behavior. Others sought to determine what it meant to verbally "specify" a contingency, or how rules came to acquire their "function altering" properties, and instead focused their attention on those response classes that may be described as falling under instructional control (Zettle & Hayes, 1982).[1]

A number of researchers have approached the topic of rule-governed behavior from the viewpoint of relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001). They too have taken the stance that rules represent "contingency specifying" and "function altering" stimuli. However, unlike the aforementioned accounts, they provide a clear functional definition or specification of how and why rules come to influence behavior. Without going into too much detail, rules are viewed as verbal stimuli which involve "transformations of function in accordance with multiple stimulus relations" (O'Hora & Barnes-Holmes, 2004, p. 276). According to RFT, "understanding" a rule or

an instruction involves a relatively complex relational network coordinating with a contingency or set of contingencies that may occur between behavior and environmental regularities. Note that the emphasis here is on rule-*understanding* rather than rule-*following*, in that an individual may understand a rule but not follow it.

Moreover, in RFT, an account of rule-following has also been provided that adopts three concepts that predated the theory itself (see Zettle & Hayes, 1982). Specifically, three types of rules (plys, tracks, and augmentals) have been identified that govern three distinct classes of rule-governed behavior (pliance, tracking, and augmenting). The first type of rule-following, pliance, is defined as "rule-governed behavior under the control of apparent socially mediated consequences for a correspondence between the rule and relevant behavior" (Hayes, Zettle, & Rosenfarb, 2004, p. 203). To illustrate, consider the following example. Imagine a child is told the following by her parent: "You can only have your dessert after you eat all your vegetables." If the behavior of the rule-follower—in this case eating vegetables—is under the control of socially mediated consequences (i.e., access to dessert), then we would expect to observe an increase in the child's vegetable consumption. The rule in this case would be said to function as a ply (Hayes et al., 2001; Hayes et al., 2004; Zettle & Hayes, 1982).[2]

The second type of rule-governed behavior, tracking, is defined as "rule-governed behavior under the control of the apparent correspondence between the rule and the way the world is arranged" (Hayes et al., 2004, p. 206). For example, being told "take the bus until the next stop and you will find the library" may function as a track, if the behavior (i.e., taking the bus) of the rule-follower is under the control of an apparent correspondence between the rule and how to actually get to the library. A rule that functions in this way is labeled a track (Hayes et al., 2001; Hayes et al., 2004; Zettle & Hayes, 1982).

Finally, augmenting is defined as "rule-governed behavior under the control of apparent changes in the capacity of events to function as reinforcers or punishers" (Hayes et al., 2004, p. 206). When a rule establishes/alters the reinforcing/punitive consequences of behavior, it is viewed as an augmental (Hayes et al., 2001; Hayes et al., 2004; Törneke, 2010; Zettle & Hayes, 1982). This class of behavior is usually carved into two types: motivative and formative augmentals. Motivative augmentals are argued to temporarily alter the degree to which a previously established consequence functions as a reinforcer or punisher (Hayes & Wilson, 1993; Törneke, 2010). For instance, imagine that it is a hot summer day and a friend turns to you and says, "Wouldn't an ice cold beer be great right now?" If this verbal stimulus increases or decreases the probability of drinking an ice cold beer, then it is said to function as a motivative augmental. In contrast, imagine that your

friend turns to you and says "this paper in my hand is last night's winning lottery ticket." This phrase will likely alter the reinforcing functions of a previously arbitrary piece of paper (e.g., people may fight over or engage in many different behaviors to claim ownership of that ticket). The above example highlights a subtype of augmenting known as formative augmenting, wherein a rule establishes a reinforcing or punitive function for a stimulus in the first instance (Hayes & Wilson, 1993; Törneke, 2010).

Note that plys, tracks, and augmentals are often considered to be rules that are provided by others. Zettle and Hayes (1982), however, argued that this is not always the case and that in many instances, rules can also be self-generated. We therefore believe that a more accurate definition of pliance is the one initially described by Zettle and Hayes (1982), that is, "pliance is rule-governed behavior primarily under the control of apparent *speaker*-mediated consequences for a correspondence between the rule and the relevant behavior" (p. 80). By using the term *speaker*, it is made clear that the rule-giver can either be the same person as the rule-follower or someone else.

Moreover, a cursory glance at the RFT and acceptance and commitment therapy (ACT) literatures reveals that pliance, tracking, and augmenting have enjoyed widespread theoretical and therapeutic appeal (for a recent review, see Hughes & Barnes-Holmes, 2016). For instance, pliance, tracking, and augmenting are argued to be implicated in various mental health problems (e.g., Törneke, 2010; Törneke, Luciano, & Valdivia-Salas, 2008), lead to distinct levels of contingency insensitivity (e.g., Hayes, Brownstein, Haas, & Greenway, 1986), be differently influenced by certain environmental moderators (e.g., Zettle & Hayes, 1982), and bring about distinct therapeutic outcomes (e.g., Hayes, 1993; Villas-Bôas, Meyer, Kanter, & Callaghan, 2015).

With this in mind, we set out to systematically review the behavior-analytic literature to determine whether there is sufficient empirical work to support the utility of these concepts; the extent to which they refer to distinct functional classes of behavior; and how they have been operationalized in experimental research to date.

Method

Information Sources and Search Strategy

The search terms used in this review were iteratively developed with experts on systematic reviews and on rule-governed behavior. These terms were subsequently presented to other experts in the field of learning psychology who were not associated with the project. To ensure that all relevant records were identified, we searched through multiple databases (i.e., "Web of Science,"

"PsychINFO," "PsychArticles," and "PubMed (Medline)"). The search was conducted by one of the authors of this review (A.K.) in July 2015 and consisted of two steps. In the first step, records on rule-governed behavior were identified by using the following search terms: "rule governed behavior," "rule-governed behavior," "verbal regulation," "instructional control," "verbal rule," "instructed behavior," "instructed learning," "instruction following," "instruction-following," "rule following," or "rule-following," This search yielded 1,310 records. In the second step, these 1,310 records were further examined for records that referred to pliance, tracking, and/or augmenting, or rules that govern such behavior, in their abstract, title, or keywords. This was done by using the search terms "pliance," "ply," "track*," and "augment*." Given that, to our knowledge, pliance, tracking, and augmenting were first defined by Zettle and Hayes (1982), this search was restricted to records published in or after 1982. This search yielded 135 records. Two other records were furthermore included to this set of records via a further search on Google Scholar and by contacting experts in the field for additional studies that might be relevant. In those cases where a record was considered to be relevant, we examined the reference list to identify other potentially useful records. This search did not yield additional records. As such, the final set of records that were assessed for eligibility was 137.

Eligibility Criteria

With regard to the study characteristics, a study was included if it used an experimental design, centered on operant learning in humans (i.e., the body of research concerned with the study of changes in behavior that are due to contingencies between a given behavior and its consequences), and clearly stated in the abstract or introduction that it aimed at investigating pliance, tracking, and/or augmenting. Concerning the report characteristics, a report was included if it was written in English and was published in a peer-reviewed journal.

Study Selection

Two of the authors of this paper (A.K. and G.M.) independently assessed the eligibility of the 137 records. Agreement between the two raters was 100% (kappa= 1.00). Both reviewers initially excluded 128 records because they were not published in English ($n = 8$), they consisted of book chapters or dissertations ($n = 21$), they dealt with a topic that did not meet our inclusion criteria ($n = 91$), and although referring to pliance, tracking, and/or augmenting they were not experimental in nature ($n = 8$). This resulted in a final

sample of nine journal articles, describing 14 experimental studies. However, after reading these papers, both reviewers discarded five studies (i.e., Gaschler, Marewski, Wenke, & Frensch, 2014; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986; McAuliffe, Hughes, & Barnes-Holmes, 2014, Experiment 1; Ninness, Ninness, Sherman, & Schotta, 1998) because they did not state in the abstract or introduction that their aim was to investigate pliance, tracking, and/or augmenting. In total, nine independent experimental studies were included (Figure 1).

Data Collection Process and Coding Items

Two reviewers (A.K. and G.M.) independently coded each of the nine experimental studies included in this review. Initial agreement between the reviewers was 74%. Disagreement was discussed between the reviewers. After discussion, the agreement between the reviewers rose to 84%. If disagreement persisted, two other reviewers (G.C. and S.H.) were consulted to make a final decision.

All studies were scrutinized using the following coding procedure. First, we coded the source and sample characteristics of a study. Source characteristics refer to the year and country of publication. Sample characteristics entail the sample size, the mean age of the sample, the overall proportion of women, the sample selection procedure, and the population from which the sample was drawn. Second, we rated general characteristics of the task and specific characteristics of the rules. The general characteristics of the task encompass the exact rules that were used, how the rules were generated (self- vs. socially generated), the reinforcement schedules (continuous vs. intermittent reinforcement schedules) that were used, the type of behavioral responses—discrete simple response (e.g., button/key pressing), discrete choice response (e.g., discrimination between two, three, or more events), continuous response (e.g., video game) or other response types—that were required, and the type of the consequences that were delivered. The specific characteristics of the rules that were coded differed as a function of the rule-type (i.e., ply, track, or augmental). For plys, the following items were coded: the extent to which the rules specified or implied a contingency between a behavior and speaker-mediated consequences for compliance with the rules, whether reinforcement for compliance with the rules was delivered by the speaker, and whether a functional analysis was conducted (i.e., whether the behavioral history that gave rise to a given behavior was examined). For tracks, the following items were coded: the extent to which the rules described or implied a contingency between a behavior and natural consequences (i.e.,

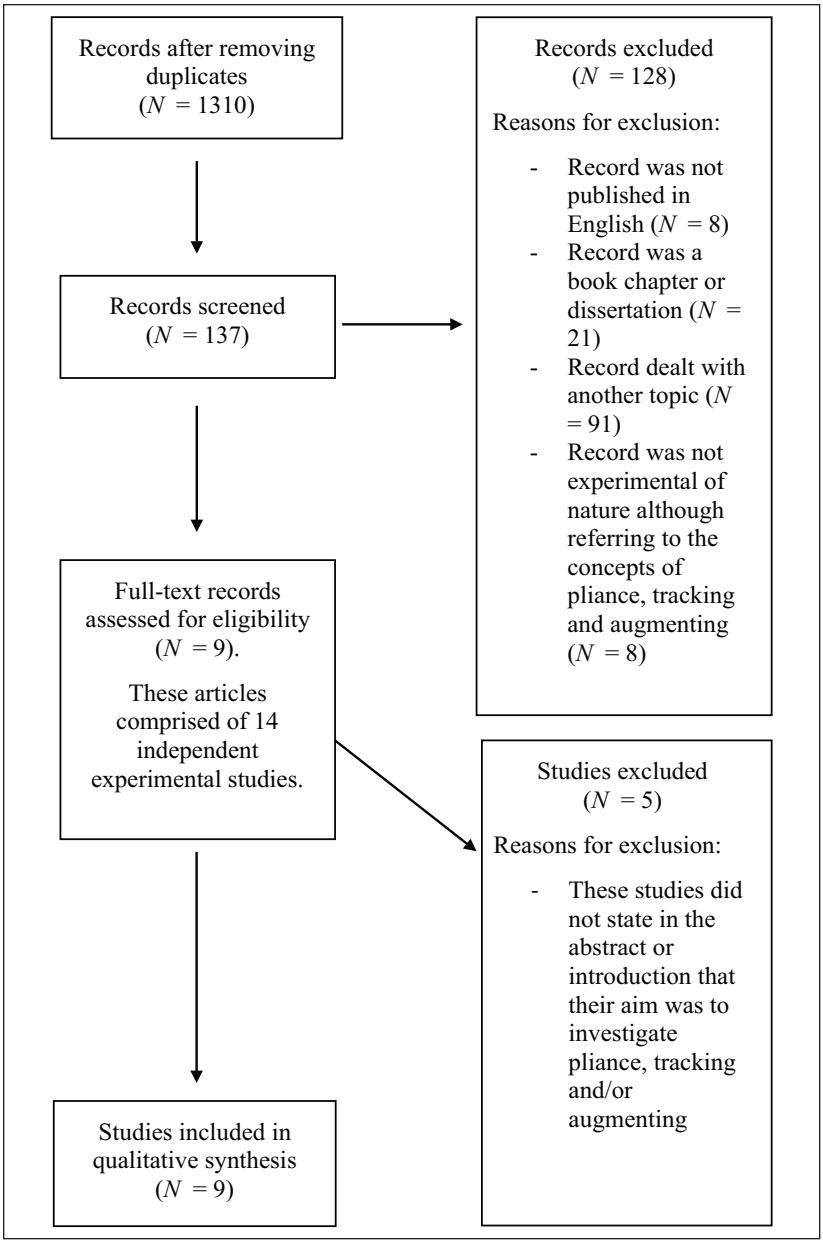

Figure 1. Flow diagram of study selection process.

consequences which, in a given situation, are always contingent upon a certain behavior); if a correspondence existed between the consequences specified in, or implied by the rules, and the actual consequences presented in the task; and whether a functional analysis was conducted. For motivative augmentals, the following items were coded: whether consequences were established prior to the presentation of the rules, the functions (i.e., punisher or reinforcer) of the consequences, the extent to which the rules altered the functions of the consequences, the functions of the transformed consequences, and whether a functional analysis was conducted. For formative augmentals, the following items were coded: if the rules referred to initially neutral stimuli, if the rules established initially neutral stimuli as reinforcers or punishers, and whether a functional analysis was conducted. Appendices A, B, and C provide the coding of the specific rule characteristics. The coding of the general rule characteristics can be found in a full report which is available upon request from the first author.

Risk of Bias

Finally, we investigated the methodological quality of the included studies using the Cochrane Collaboration tool for assessing risks of bias (Table 8.5.a in Higgins, Altman, & Sterne, 2011). This tool covers the following biases: selection, performance, detection, attrition, and reporting bias. Selection bias refers to distortions in the interpretation of findings due to an inadequate use of a random allocation procedure and/or an inadequate concealment of allocation before participants are assigned to one or more conditions. Performance bias refers to distortions in the interpretation of findings resulting from differences in how participants are treated and/or how participants behave due to inadequate blinding of, respectively, researchers, and/or participants. Detection bias refers to distortions in how outcomes are measured due to inadequate blinding of the outcome assessors. Attrition bias refers to distortions in the interpretation of findings due to difference between groups with regard to the amount, nature, and/or handling of missing outcome data. Reporting bias refers to discrepancies between outcomes that were specified prior to the study and the findings that were actually reported. For each study included in this review, a judgment in terms of "high risk" or "low risk" of bias was made for each of the five categories. In case there was insufficient information to determine a risk of bias, we judged a risk of bias as "unclear." Judgments were made by two review authors (A.K. and G.M.) using the criteria for assessing potential risks of bias (see Table 8.5.d in Higgins et al., 2011).

Results

Study Characteristics: Source and Sample Characteristics

Seven out of the nine studies were published in the 2000s. Five out of the nine studies were published by authors from the United States. The average sample size was 14.38 (*SD* = 12.44; range = 4-36), with the exception of the field study of Berry, Geller, Calef, and Calef (1992) which included 785 observations of participants. Only four studies reported the mean age of their sample. Based on these studies, the average mean age was 20.05 years (*SD* = 0.9; range = 18.8-20.8). Only two studies reported gender proportions, and based on these studies, the total proportion of females was 0.51. Seven out of the nine studies made use of convenience samples. The remaining two studies selected students on the basis of self-reported symptoms of dysphoria.

Rule Characteristics

Two studies indicated that their objective was to investigate the differential consequences of pliance and tracking (i.e., Baruch, Kanter, Busch, Richardson, & Barnes-Holmes, 2007; McAuliffe et al., 2014, Experiment 2). Four studies stated that their research goal was to examine the effects of pliance (i.e., Berry et al., 1992, along with three studies reported in Donadeli & Strapasson, 2015). One study reported that it intended to investigate whether empirical evidence existed for the concept of tracking (i.e., Zettle & Young, 1987). Two studies were identified that stated that their primary focus was to examine formative augmenting (i.e., two studies in Whelan & Barnes-Holmes, 2004). In the following section, we will briefly describe these studies.

Experimental Work on Pliance and Tracking

Baruch et al. (2007) investigated whether dysphoric and nondysphoric undergraduate students enrolled in psychology courses displayed different levels of insensitivity to schedules of reinforcement as a function of tracking or pliance. Participants were randomly allocated to a pliance (n = 16) or tracking (n = 15) condition. In both conditions, participants completed a computerized matching to sample (MTS) task comprising of two halves. In the first half, participants were told to either select the comparison stimulus that was most (or least) like a given sample to receive points, and that each point earned increased their chances of receiving a monetary reward. In case participants followed the instruction that they received, this was always reinforced. In the second half, however, participants still received the same instructions but the contingencies

in the task reversed. That is, compliance with the instruction now led to a decrease in points and participants therefore had to select the least like comparison stimuli to receive points. The results revealed that when the instructions were accurate, all participants responded correctly during the majority of the trials. Yet when the instructions were made inaccurate, the behavior of participants in the dysphoric group became increasingly sensitive to the programmed (noninstructed) contingencies relative to their nondysphoric counterparts. Put differently, participants in the dysphoric group displayed less rule-following compared with participants in the nondysphoric group. No other significant differences were observed as a function of pliance or tracking.

Berry et al. (1992) examined the extent to which a sign requesting vehicle drivers to "buckle up" governed pliance in drivers leaving a university parking lot. This sign was either presented in the presence or absence of an observer. Compliance to this sign was always reinforced with the presentation of the message "Thank You for Buckling Up." The researchers also examined the effects of an observer alone on safety belt usage. There were in total 785 observations of vehicle drivers. The results indicated that the presentation of the sign increased safety belt usage. Furthermore, the additional presence of an observer further increased the beneficial effects of the sign. The mere presence of an observer, however, did not change existing seat belt behavior.

Donadeli and Strapasson (2015) reported three experiments in which presumed moderators of pliance were investigated. These moderators were (a) the ability of the speaker to monitor the rule-follower's behavior, (b) the speaker's capacity to deliver consequences for compliance and noncompliance, and (c) the nature of these consequences (see Zettle & Hayes, 1982). In Experiment 1, the authors examined whether monitoring affected the extent to which undergraduate students ($n = 8$) adhered to accurate versus inaccurate instructions. All participants were presented with two conditions: a contingency-varied and an instruction-varied condition. In both conditions, participants completed a computerized MTS task comprising four sessions. In Session 1, all participants were asked to select the comparison stimulus that belonged to the same category as the sample. If participants followed this instruction, they were always reinforced with a monetary reward (5 Brazilian reais). In Sessions 2, 3, and 4, participants received inaccurate instructions, that is, instructions that did not correspond with the task contingencies. Consequently, in these sessions, participants had to do the opposite of what was stated in the rule to receive their monetary reward. In the contingency-varied condition, the instructions were made inaccurate by encouraging participants to continue following the instructions while in reality the contingencies in the task were changed. In the instruction-varied condition, the inaccuracy of

the instructions was established by changing the instructions in the task while the programmed contingencies remained unaffected. During all sessions (except Session 3), the experimenter was present. Donadeli and Strapasson hypothesized that if participants adhered to the instructions in the presence, but not in the absence of the experimenter, then this may be regarded as an instance of pliance. The authors reported a seemingly perfect adherence to the instructions when they corresponded to the programmed contingencies. When the instructions contrasted the programmed contingencies, several patterns of findings were obtained: two participants gradually behaved in line with the scheduled contingencies during the remaining sessions; two other participants increasingly adhered to the instructions during all subsequent sessions; four participants started off following the instructions but began discarding them when the experimenter was absent and kept doing this even when the experimenter was present again; and one participant did not behave in a predictable manner during all subsequent sessions.

The objective of Experiment 2 of Donadeli and Strapasson (2015) was to examine whether the nature of a consequence affects the extent to which behavior falls under instructional versus programmed contingency control. Therefore, Experiment 2 adopted a similar design to Experiment 1 with one notable difference: in Experiment 2, participants were told that they would receive only 1 Brazilian real (rather than 5 Brazilian reais as in Experiment 1) for each point earned. Eight undergraduate students took part in Experiment 2. The authors found that whenever participants were given accurate instructions, they all followed the instructions. Yet, when these instructions were made inaccurate, a different pattern of results emerged. First, only two participants adhered to the inaccurate instructions. Second, one participant initially followed the instructions but failed to do so when the experimenter was absent. Even when the experimenter was present again, this participant continued disregarding the instructions. Third, five participants behaved in line with the programmed contingencies during all subsequent sessions.

Experiment 3 of Donadeli and Strapasson (2015) investigated the effects of verbal rebukes on the behavior of eight undergraduate students. A similar procedure to Experiment 2 was used, with one difference: If participants did not comply with the instructions on the first 10 trials, then the experimenter repeated the instructions. Based on their findings, the authors concluded that, similar to Experiments 1 and 2, systematic rule-following occurred whenever instructions were accurate. When instructions subsequently became inaccurate, three participants continued to behave in accordance with the instructions. The remaining five participants disobeyed the instructions during at least 10 trials of one of the blocks in which the instructions were inaccurate. Thus, these participants were verbally encouraged to remember to follow the

instructions that they received at the beginning of the task. Of these five participants, four followed the instructions again. One participant persisted in gaining points despite being asked to behave according to the instructions.

McAuliffe et al. (2014) investigated whether pliance or tracking resulted in different levels of insensitivity to schedules of reinforcement in adolescent males reporting high versus low levels of dysphoric symptoms. Participants were randomly assigned to either the pliance (n = 18) or tracking (n = 18) condition. All participants completed a computerized MTS task consisting of two halves. In the first half, participants were asked to select the comparison stimulus that was most like a sample stimulus in order to gain points. In the second half, the programmed contingencies reversed and selecting the least like comparison stimuli now led to an increase in points. The authors found that when the contingencies specified in the instructions corresponded with the contingencies programmed in the MTS task, participants responded accurately on the task. When a discrepancy existed between the two types of contingencies, the following pattern of results was obtained: low dysphoric participants in both the pliance and tracking conditions, as well as high dysphoric participants in the tracking condition, were more likely to behave in accordance with programmed contingencies. The high dysphoric participants in the pliance condition, however, persisted in following the inaccurate instructions.

Zettle and Young (1987) examined whether empirical evidence existed for tracking in 16 students from an introductory psychology class. Participants were randomly assigned to either the tracking (n = 8) or the yoked control (n = 8) condition. In each condition, participants were requested to complete a learning task in which they had to move a marker across the screen, from left to right, to receive points. They were also told that each point earned, equaled a ticket in a drawing for a $20 prize. Participants were, however, not informed about how the marker could be correctly moved. In the tracking condition, participants were asked to generate their own rules about the task contingencies. The task was manipulated in such a way that these rules initially corresponded with the contingencies in the task. However, during the last session of the task, these rules were no longer reinforced. In the yoked control condition, participants were not asked to report what they thought influenced the marker movements. These participants simply received the movements of the marker and points of those participants in the experimental condition with whom they were yoked. The results showed that during sessions in which the experimental group was reinforced for spacebar presses, the yoked control group pressed the spacebar more frequently. When spacebar presses were no longer reinforced, the experimental group emitted relatively more responses compared with the yoked control group.

Experimental Work on Formative Augmenting

Whelan and Barnes-Holmes (2004) reported two experiments in which they attempted to experimentally model formative augmenting. In both studies, they examined the extent to which consequential functions established for one stimulus within a relational network transformed the consequential functions of other initially neutral stimuli within that network. In Experiment 1 ($n = 4$ students), formative augmenting was investigated via coordination (Same) and opposition relations. Results indicated that if a stimulus was established as a punisher, this transformed the functions of other initially neutral stimuli, and that this transformation of function relied on the nature of the derived stimulus relation (Same/Opposite). Experiment 2 ($n = 4$ students) examined formative augmenting using comparative relating (More/Less). Results indicated that reinforcing functions established for a stimulus can transform the consequential functions of other initially neutral stimuli, and that this transformation of function depended on the nature of the derived (comparative) relation.

Assessments of Risks of Bias

In general, all studies did not report sufficient information to assess the potential risk of selection, performance, and detection bias (in case these biases could have affected the interpretation of the obtained results). The results did, however, reveal a low risk of attrition bias in all studies, as no missing outcome data were reported. An overall low risk of reporting bias was also found, given that in all studies, there was a correspondence between the outcomes described in the methods and results sections. See Table 1 for a schematic overview of the results of the risk of bias assessments.

Discussion

The current review sought to determine whether there is support for the concepts of pliance, tracking, and augmenting in the experimental analysis of behavior; the extent to which these concepts refer to distinct functional classes of behavior; and how they have been operationalized in experimental research. The results can be readily summarized as follows: (a) The experimental research investigating pliance, tracking, and/or augmenting is extremely limited; (b) it is difficult to determine the extent to which the concepts of pliance, tracking, and augmenting allow for relatively precise experimental analyses of distinct functional classes of behavior; and (3) pliance and tracking have been operationalized by using a limited set of procedures. Each of these findings will be discussed accordingly.

Table 1. Overview of Assessments of Risk of Bias for Each Reviewed Study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessors (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Baruch, Kanter, Busch, Richardson, and Barnes-Holmes (2007)	?	?	?	?	–	–
Berry, Geller, Calef, and Calef (1992)	NA	NA	?	?	–	–
Donadeli and Strapasson (2015), Experiment 1	NA	NA	?	?	–	–
Donadeli and Strapasson (2015), Experiment 2	NA	NA	?	?	–	–
Donadeli and Strapasson (2015), Experiment 3	NA	NA	?	?	–	–
McAuliffe, Hughes, and Barnes-Holmes (2014)	?	?	?	?	–	–
Whelan and Barnes-Holmes (2004), Experiment 1	NA	NA	?	?	–	–
Whelan and Barnes-Holmes (2004), Experiment 2	NA	NA	?	?	–	–
Zettle and Young (1987)	?	?	?	?	–	–

Note. "+" refers to a high risk of bias, "–" refers to a low risk of bias, "?" refers to an unclear risk of bias, and "NA" means that the risk of bias was not applicable. Reporting bias was assessed by comparing the outcomes reported in the method section with those in the results section of a study.

Only a limited number of experimental studies were identified that explicitly investigated pliance, tracking, and/or augmenting. This was unexpected given the theoretical and clinical ubiquity of these concepts in the RFT and ACT literatures. Specifically, we only retrieved nine studies that intended to experimentally investigate pliance, tracking, and/or augmenting. These studies included two studies that examined the differential consequences of pliance and tracking (i.e., Baruch et al., 2007; McAuliffe et al., 2014, Experiment 2), four studies that investigated pliance (i.e., Berry et al., 1992, along with three studies reported in Donadeli & Strapasson, 2015), one study (i.e., Zettle & Young, 1987) that examined tracking and two studies that explored formative augmenting (i.e., two studies in Whelan & Barnes-Holmes, 2004). No study was identified that investigated motivative augmenting. On balance, the small number of identified studies may be due to our search strategy and in particular our inclusion criteria: We only included experimental studies that explicitly stated in the abstract and/or introduction section that they investigated pliance, tracking, and/or augmenting. We did so because we reasoned that if these concepts genuinely drove, motivated, or guided research, then authors would use these concepts in the abstract and/or introduction rather than employing them in a post hoc fashion. As such, our inclusion criteria led us to discard studies that referred to their findings as instances of pliance, tracking, and/or augmenting in their discussion section. Finally, it is possible that much more experimental work on this topic has been conducted but simply has not been published due to null findings. If so, we recommend that studies that do not reveal expected findings also be published to avoid publication biases.

Unfortunately, the limited experimental evidence that is available suggests that it may be difficult to isolate functionally distinct classes of behavior using the concepts of pliance, tracking, and augmenting. Interestingly, none of the reviewed studies investigated pliance, tracking, and augmenting within a single experiment. In fact, we only retrieved two studies (i.e., Baruch et al., 2007 and McAuliffe et al., 2014, Experiment 2) that attempted to investigate the insensitivity effect as a function of pliance and tracking in low versus high dysphoric participants. Yet, the results of these two studies were inconsistent. Perhaps more importantly, none of the reviewed studies on pliance and tracking focused on developing a basic functional-analytic model of one or both of these types of rule-following (see O'Hora & Barnes-Holmes, 2004, for an example of a functional-analytic model of rule-following in general). Instead, these studies involved *operationalizing* pliance and tracking by manipulating, respectively, the public versus private contexts in which the rules were delivered. Although operationalizing pliance and tracking in this way may be useful, it does not provide the functional-analytic precision of rule-following based on a laboratory induced network of derived relations, as reported by O'Hora and Barnes-Holmes (2004). Perhaps in time, such laboratory-based

models of pliance and tracking may emerge in the literature, but until they do, it may be best to consider these concepts as middle-level terms. That is, terms that serve to orient the researcher toward a domain of interest rather than providing high levels of functional precision (for more on middle-level terms, see Y. Barnes-Holmes, Hussey, McEnteggart, Barnes-Holmes, & Foody, 2016). As an aside, it is worth noting that the studies reported by Whelan and Barnes-Holmes did provide a functional-analytic model of formative augmenting, but a similar model of motivative augmenting is currently lacking.

Given that the concepts of pliance, tracking, and motivating augmenting seem to lack high levels of functional precision, it may thus be useful to consider alternative conceptual developments in RFT that may do so. One such account is the multidimensional, multilevel framework for the analysis of the dynamics of relational framing (D. Barnes-Holmes, Barnes-Holmes, Hussey, & Luciano, 2016). This framework identifies four functional dimensions for relational networks and rules (i.e., relational coherence, complexity, derivation, and flexibility). The advantage of this framework is that it may aid in directing experimental research, as well as identifying and targeting those variables that increase or decrease specific instances of rule-following.

Notwithstanding the lack of precise functional-analytic models of pliance and tracking (and motivative augmenting), it is still useful to consider how these concepts have been operationalized. In the case of pliance and tracking, both have typically been operationalized as behavior governed by public versus private rules, and most studies in this domain have employed broadly similar procedures. For instance, in most cases, participants were asked to complete MTS tasks; continuous reinforcement schedules were used; points for rule-following that were exchangeable for monetary rewards were delivered; and socially, rather than self-generated rules were employed. We believe that the predominant use of such procedures has an advantage and a disadvantage. The advantage is that it may lead to a body of research with high internal validity. The disadvantage, however, is that it limits the extent to which one can generalize the findings to other contexts. Future research should therefore examine pliance and tracking by employing a wider range of procedures (e.g., reaction time tasks, intermittent reinforcement schedules, consequences such as painful stimuli, self-generated rules as well as rules delivered by significant others) to draw conclusions concerning the generalizability of the current and future findings.

In recommending that researchers consider a wider range of procedures, the role of other potential moderators of pliance and tracking (and augmenting) may be brought into sharper focus. For instance, the impact of the following variables could be explored in future research: the characteristics of the rule-giver (e.g., gender, age, authority), the presence or absence of psychological symptoms, properties of the context (e.g., experimental context vs. naturalistic environment), the nature of the consequences that were delivered

(e.g., monetary reward vs. social approval), and the physical presence or absence of the experimenter.

Although our primary purpose was not to assess the methodological quality of the studies included in this review, we did examine potential risks of bias. This examination revealed that, in general, the reports of the studies included in this review did not provide sufficient information to assess all risks of bias. We therefore recommend that researchers pay attention to how they report their studies, particularly in the context of the current guidelines for reporting scientific studies. These guidelines suggest then when reporting studies, researchers should provide information that allows readers to infer conclusions regarding the internal and external validity of a study. Such information typically includes, for example, the way in which the sample size was determined, the precise method of randomization, appropriate details pertaining to the inferential and descriptive statistics, and any criteria used to assess eligibility for the study (see Schulz, Altman, & Moher, 2010, for more guidelines). In addition, if single-case designs are employed, it is recommended that researchers also report the precise target behaviors, the raw data points, and whether there is evidence for the generalization of the findings (see Smith, 2012, or Tate et al., 2008, for additional guidelines). In making this point, we recognize that meta-analyses and systematic reviews are increasingly valued by the scientific community because they enable us to draw general conclusions about a research topic. Yet, such research syntheses can only be made if all or most key elements of studies are adequately reported. We do, however, acknowledge that the Cochrane Collaboration tool for assessing risks of bias was specifically developed for Randomized Control Trials (RCTs). As a consequence, some of the risks of bias included in this tool may not be as relevant for experimental behavioral research. It is therefore necessary to take this into account when considering our conclusions regarding potential risks of bias.

In closing, we acknowledge that our exclusion criteria may have limited the number of eligible studies. First, our decision to only include peer-reviewed journal articles led us to discard dissertations and book chapters. Second, as earlier mentioned, we only included experimental studies that set out to investigate one or more of the above concepts (i.e., it was explicitly stated in the abstract or introduction that the research investigated pliance, tracking, and/or augmenting). As such, we did not include experimental work that was interpreted in terms of these concepts. Third, by focusing on experimental work that sought to examine the functional properties, and distinctions between pliance, tracking, and augmenting, we excluded other potentially relevant experimental work that did not use these concepts. In fact, it is likely that work in other areas of psychology (e.g., experiments on obedience to authority; see Blass, 1999, and Milgram, 1963) exists that may be of relevance to our understanding of the behaviors associated with pliance, tracking, and augmenting.

Appendix A

Experimental Work on Pliance.

	Baruch, Kanter, Busch, Richardson, and Barnes-Holmes (2007)	Berry et al. (1992)	Donadeli and Strapasson (2015), Experiment 1	Donadeli and Strapasson (2015), Experiment 2	Donadeli and Strapasson (2015), Experiment 3	McAuliffe, Hughes, and Barnes-Holmes (2014)
Specific characteristics of the plys						
Did the rules specify/imply contingencies between a behavior and speaker-mediated consequences for compliance with the rules?	The rules *implied* a contingency between a behavior and speaker-mediated consequences for two reasons: (a) Participants were informed that their performances would be checked at the end of each session and (b) the experimenter told participants that he wanted them to select the comparison stimulus most/least like the sample stimulus.	The rule *implied* a contingency between a behavior and speaker-mediated consequences as participants were told that the experimenter was concerned about the extent to which they buckled up or not.	The rules *implied* a contingency between a behavior and speaker-mediated consequences because the experimenter told participants that she wanted them to select the comparison stimulus that belonged to the same category as the sample stimulus.	The rules *implied* a contingency between a behavior and speaker-mediated consequences because the experimenter told participants that she wanted them to select the comparison stimulus that belonged to the same category as the sample stimulus.	The rules *implied* a contingency between a behavior and speaker-mediated consequences because the experimenter told participants that she wanted them to select the comparison stimulus that belonged to the same category as the sample stimulus.	The rules *implied* a contingency between a behavior and speaker-mediated consequences for two reasons: (a) Participants were informed that their performances would be checked at the end of each session and (b) the experimenter told participants that he wanted them to select the comparison stimulus most like the sample stimulus.
Who delivered the consequences for rule-appropriate behavior?	Points were delivered via the computer program. The monetary rewards were delivered by the experimenter.	Female undergraduate students.	Points were delivered via the computer program. The Brazilian reais were delivered via the experimenter, i.e., a 22-year-old female.	Points were delivered via the computer program. The Brazilian reais were delivered via the experimenter, i.e., a 22-year-old female.	Points were delivered via the computer program. The Brazilian reais as well as the verbal rebukes were delivered via the experimenter, i.e., a 22-year-old female.	Points were delivered via the computer program.
Was a functional analysis conducted?	No	No	No	No	No	No

Appendix B

Experimental Work on Tracking.

	Baruch, Kanter, Busch, Richardson, and Barnes-Holmes (2007)	McAuliffe, Hughes, and Barnes-Holmes (2014)	Zettle and Young (1987)
Specific characteristics of the tracks			
Did the rules specify/ imply a contingency between behavior and natural consequences?	Yes, the rules *implied* a contingency between behavior and natural consequences, because participants were also informed that correct stimulus selections would lead to an increase in points and that each point earned, improved their chances of receiving a monetary reward.	Yes, the rules *implied* a contingency between behavior and natural consequences, because participants were also told that they would be awarded a point (and thus could earn more money) if they selected the correct comparison stimulus, while a point would be taken away if they made an incorrect selection.	Yes, the rules *implied* a contingency between behavior and natural consequences, because participants were also told that each time they moved the marker correctly, they would receive one point and that each point earned, entitled them to one ticket in a drawing for a $20 prize.
Did a correspondence exist between the consequences specified in the rules and the actual consequences presented in the task?	Yes, before the change in contingency occurred.	Yes, before the change in contingency occurred.	Yes, before the extinction phase.
Was a functional analysis conducted?	No	No	No

Appendix C

Experimental Work on Formative Augmenting.

	Whelan and Barnes-Holmes (2004), Experiment 1	Whelan and Barnes-Holmes (2004), Experiment 2
Specific characteristics of the formative augmentals		
Did the rules refer to initially neutral stimuli?	Yes (an initially neutral shape).	Yes (an initially neutral stimulus and a three-letter nonsense word).
Did the rules establish initially neutral stimuli as reinforcers or punishers?	Yes	Yes
Was a functional analysis conducted?	Yes, the procedure used in this study made it possible to identify the behavioral history that gave rise to the behavior in the experiment.	Yes, the procedure used in this study made it possible to identify the behavioral history that gave rise to the behavior in the experiment.

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Notes

1. Note that terms such as *rules, verbal rules*, and *instructions* are often used interchangeably in this literature. It is also important to realize that they are not technical terms that have emerged from an inductive, bottom-up functional analysis (although see O'Hora, Barnes-Holmes, & Stewart, 2014, for recent work in this vein). As such, we will use these terms interchangeably as a means to simply orientate the reader toward a particular class of behavior.
2. Note that this example could be interpreted as being relevant to the Premack principle, given that eating dessert could function as an activity that reinforces the child's vegetable consumption (Premack, 1959). Critically, however, the current example is an instance of rule-governed behavior and thus if the child eats more vegetables, this occurs because of the rule, rather than direct contact with the contingencies as required by the Premack principle.

References

Barnes-Holmes, D., Barnes-Holmes, Y., Hussey, I., & Luciano, C. (2016). Relational frame theory: Finding its historical and intellectual roots and reflecting upon its future development. In R. D. Zettle, S. C. Hayes, D. Barnes-Holmes, & A. Biglan (Eds.), *Handbook of contextual behavioral science* (pp.117-128). New York, NY: Wiley-Blackwell.

Barnes-Holmes, Y., Hussey, I., McEnteggart, C., Barnes-Holmes, D., & Foody, M. (2016). Scientific ambition: The relationship between relational frame theory and middle-level terms in acceptance and commitment therapy. In R. D. Zettle, S. C. Hayes, D. Barnes-Holmes, & A. Biglan (Eds.), *Handbook of contextual behavioral science* (pp.365-382). New York, NY: Wiley-Blackwell.

Baruch, D. E., Kanter, J. W., Busch, A. M., Richardson, J. V., & Barnes-Holmes, D. (2007). The differential effect of instructions on dysphoric and nondysphoric persons. *The Psychological Record*, *57*, 543-554.

Berry, T. D., Geller, S. E., Calef, R. S., & Calef, R. A. (1992). Moderating effects of social assistance on verbal interventions to promote safety belt use: An analysis of weak plys. *Environment and Behavior*, *24*, 653-669.

Blass, T. (1999). The Milgram paradigm after 35 years: Some things we now know about obedience to authority. *Journal of Applied Social Psychology*, *29*, 955-978.

Buskist, W. F., & Miller, H. L. (1986). Interaction between rule and contingencies in the control of human fixed-interval performance. *The Psychological Record*, *36*, 109-116.

Catania, A. C., Matthews, B. A., & Shimoff, E. (1982). Instructed versus shaped human verbal behavior: Interactions with nonverbal responding. *Journal of the Experimental Analysis of Behavior*, *38*, 233-248. doi:10.1901/jeab.1982.38-233

Cerutti, D. T. (1989). Discrimination theory of rule-governed behavior. *Journal of the Experimental Analysis of Behavior*, *51*, 259-276. doi:10.1901/jeab.1989.51-259

Donadeli, J. M., & Strapasson, B. A. (2015). Effects of monitoring and social reprimands on instruction-following in undergraduate students. *The Psychological Record*, *65*, 177-188.

Galizio, M. (1979). Contingency-shaped and rule-governed behavior: Instructional control of human loss avoidance. *Journal of the Experimental Analysis of Behavior*, *31*, 53-70. doi:10.1901/jeab.1979.31-53

Gaschler, R., Marewski, J. N., Wenke, D., & Frensch, P. A. (2014). Transferring control demands across incidental learning tasks—Stronger sequence usage in serial reaction task after shortcut option in letter string checking. *Frontiers in Psychology*, *5*, Article 1388. doi:10.3389/fpsyg.2014.01388

Hayes, S. C. (1993). Rule governance: Basic behavioral research and applied implications. *Current Directions in Psychological Science*, *2*, 193-197.

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition*. New York, NY: Kluwer Academic.

Hayes, S. C., Brownstein, A., Haas, J. R. J., & Greenway, D. E. (1986). Instructions, multiple schedules, and extinction: Distinguishing rule-governed from schedule-controlled behavior. *Journal of the Experimental Analysis of Behavior*, *46*, 137-147. doi:10.1901/jeab.1986.46-137

Hayes, S. C., Brownstein, A. J., Zettle, R. D., Rosenfarb, I., & Korn, Z. (1986). Rule-governed behavior and sensitivity to changing consequences of responding. *Journal of the Experimental Analysis of Behavior*, *45*, 237-256. doi:10.1901/jeab.1986.45-237

Hayes, S. C., & Wilson, K. G. (1993). Some applied implications of a contemporary behavior-analytic account of verbal events. *The Behavior Analyst*, *16*, 283-301.

Hayes, S. C., Zettle, R. D., & Rosenfarb, I. (2004). Rule-following. In S. C. Hayes (Ed.), *Rule-governed behavior: Cognition, contingencies, and instructional control* (pp. 191-218). Oakland, CA: Context Press.

Higgins, J. P. T., Altman, D. G., & Sterne, J. A. C. (2011). Chapter 8: Assessing risk of bias in included studies. In J. P. T. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions version 5.1.0*. The Cochrane Collaboration. West Sussex, England:John Wiley & Sons Ltd. Available from http://handbook.cochrane.org/chapter_8/8_16_chapter_information.htm)

Hojo, R. (2002). Effects of instructional accuracy on a conditional discrimination task. *The Psychological Record*, *52*, 493-506.

Hughes, S., & Barnes-Holmes, D. (2016). Relational frame theory: Implications for the study of human language and cognition. In S. Hayes, D. Barnes-Holmes, R. Zettle, & T. Biglan (Eds.), *Handbook of contextual behavioral science* (pp. 1-79). New York, NY: Wiley-Blackwell.

Kroger-Costa, A., & Abreu-Rodrigues, J. (2012). Effects of historical and social variables on instruction following. *The Psychological Record*, *62*, 691-706. doi:10.1016/S0005-7894(70)80039-9

Matthews, B. A., Shimoff, E., Catania, C., & Sagvolden, T. (1977). Uninstructed human responding: Sensitivity to ratio and interval contingencies. *Journal of the Experimental Analysis of Behavior*, *27*, 453-467. doi:10.1901/jeab.1977.27-453

McAuliffe, D., Hughes, S., & Barnes-Holmes, D. (2014). The dark-side of rule governed behavior: An experimental analysis of problematic rule-following in an adolescent population with depressive symptomatology. *Behavior Modification*, *38*, 587-613. doi:10.1177/0145445514521630

Milgram, S. (1963). Behavioral study of obedience. *Journal of Abnormal and Social Psychology*, *67*, 371-378.

Ninness, H. A. C., Ninness, S. K., Sherman, S., & Schotta, C. (1998). Augmenting computer-interactive self-assessment with and without feedback. *The Psychological Record*, *48*, 601-616.

O'Hora, D., & Barnes-Holmes, D. (2004). Instructional control: Developing a relational frame analysis. *International Journal of Psychology and Psychological Therapy*, *4*, 263-284.

O'Hora, D., Barnes-Holmes, D., & Stewart, I. (2014). Antecedent and consequential control of derived instruction-following. *Journal of the Experimental Analysis of Behavior*, *102*, 66-85. doi:10.1002/jeab.95

Otto, T. L., Torgrud, L. J., & Holborn, S. W. (1999). An operant blocking interpretation of instructed insensitivity to schedule contingencies. *The Psychological Record*, *49*, 663-684.

Podlesnik, C. A., & Chase, P. N. (2006). Sensitivity and strength: Effects of instructions on resistance to change. *The Psychological Record*, *56*, 303-320.

Premack, D. (1959). Toward empirical behavior laws: I. Positive reinforcement. *Psychological Review*, *66*, 219-233.

Ribes, E., & Rodriguez, M. E. (2001). Correspondence between instructions, performance, and self-descriptions in a conditional discrimination task: The effects of feedback and type of matching response. *The Psychological Record*, *51*, 309-333.

Schlinger, H. D. (1993). Separating discriminative and function-altering effects of verbal stimuli. *The Behavior Analyst*, *16*, 9-23.

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomized trials. *British Medical Journal*, *340*, 698-702.

Shimoff, E., Catania, A. C., & Matthews, B. A. (1981). Uninstructed human responding: Sensitivity of low-rate performance to schedule contingencies. *Journal of the Experimental Analysis of Behavior*, *36*, 207-220. doi:10.1901/jeab.1981.36-207

Skinner, B. F. (1969). *Contingencies of reinforcement: A theoretical analysis*. New York, NY: Appleton-Century-Crofts.

Smith, J. D. (2012). Single-case experimental designs: A systematic review of published research and current standards. *Psychological Methods*, *17*, 510-550. doi:10.1037/a0029312

Tate, R. L., McDonald, S., Perdices, M., Togher, L., Schultz, R., & Savage, S. (2008). Rating the methodological quality of single-subject designs and n-of-1 trials: Introducing the Single-Case Experimental Design (SCED) Scale. *Neuropsychological Rehabilitation*, *18*, 385-401. doi:10.1080/09602010802009201

Törneke, N. (2010). Learning RFT: An introduction to relational frame theory and its clinical applications. Oakland, CA: New Harbinger.

Törneke, N., Luciano, C., & Valdivia-Salas, S. (2008). Rule-governed behavior and psychological problems. *International Journal of Psychology and Psychological Therapy*, *8*, 141-156.

Villas-Bôas, A., Meyer, S. B., Kanter, J. W., & Callaghan, G. M. (2015). The use of analytic interventions in functional analytic psychotherapy. *Behavior Analysis: Research and Practice*, *15*, 1-19.

Weiner, H. (1970). Instructional control of human operant responding during extinction following fixed-ratio conditioning. *Journal of the Experimental Analysis of Behavior*, *13*, 391-394. doi:10.1901/jeab.1970.13-391

Whelan, R., & Barnes-Holmes, D. (2004). Empirical models of formative augmenting in accordance with the relations of same, opposite, more-than, and less-than. *International Journal of Psychology and Psychological Therapy*, *4*, 285-302.

Zettle, R. D., & Hayes, S. C. (1982). Rule-governed behavior: A potential theoretical framework for cognitive-therapy. In P. C. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy* (pp. 73-118). New York, NY: Academic Press.

Zettle, R. D., & Young, M. J. (1987). Rule-following and human operant responding: Conceptual and methodological considerations. *The Analysis of Verbal Behavior*, *5*, 33-39.

Zimmerman, E. H., Zimmerman, J., & Russell, C. D. (1969). Differential effects of token reinforcement on instruction-following behavior in retarded students instructed as a group. *Journal of Applied Behavior Analysis*, *2*, 101-112. doi:10.1901/jaba.1969.2-101

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