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Expectancies Flexibility and Relational Responding: The Role of the Training History and Functional Coherence

J Carmelo Visdómine Lozano

Instituciones Penitenciarias, Ministerio del Interior, España

Abstract

This paper aims to complete the research on the way in which the transfer and reversal of both internal and external control expectancies is prompted in problem-solving tasks. In Experiment 1, ten adult participants were presented 24 cards to test for two pre-existing arbitrary classes through a stimuli-sorting task. Subsequently, three stimuli per class were employed to train respectively either internal or external attributions. Problem-solving included differential cueing and verbal feedback as interventions. A test for the transfer of expectancies was arranged on two novel stimuli per class, and the problems corresponding to these stimuli were also trained. Finally, an analogy or illustrated instruction centered on the ability of the participants was presented to reverse the attributions on novel stimuli of both classes. Results showed that almost all participants reached the transfer of internal and external expectancies, but only one participant reversed his expectancies. Experiment 2 (ten participants) followed the same procedure, but did not include the training of the problems corresponding to the transfer stimuli. The same illustrated instruction was presented, and, this time, 6 out of the 8 participants who passed the training criteria showed a differential reversal, presenting a more flexible pattern due to a training of fewer exemplars. Finally, in Experiment 3, five adult participants followed the same experimental training procedure, but a different analogy centered on the means required to solve the problems, and referred only to the external attributions class, was presented. All participants showed the transfer of expectancies; one participant reversed his expectancies for class 2, and the remaining four showed an undefined pattern of responding, presenting a flexible and open responding. Results are discussed in terms of the variables that prompt competitive functions and incoherence in a relational network, and those that promote flexibility.
Key words: arbitrarily applicable relational responding, attributions, expectancies, flexibility.

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Novelty and Significance

What is already known about the topic?

- Control expectancies and attributions can be prompted both in children and adults through the arrangement of differential contingencies consisting of cueing and responsibility feedback.
- Control expectancies and responsibility attributions in problem-solving can transfer through arbitrary relations, along with parallel difficulty estimations.
- Generalized internal and external control expectancies can be reversed in a derived way through illustrated instructions focused on the difficulty of the problems.

What this paper adds?

- Flexibility of generalized expectancies (i.e. a derived reversal) can be reached in those cases in which the training history is limited and leaves open the confirmation of the expectancies transferred.
- An approach to an emerging flexibility of expectancies firmly established can be attained through instructions focused on relations that are not functionally incompatible to those trained.
- Functional (in)coherence between the functional contexts (Cfuncs) of relational networks is basic to understanding flexibility and sensitivity to others' instructions.

The role of attributions and expectancies in behavioral regulation has been the concern of several theoretical approaches of Psychology (Furnham, 2009). Visdómine and Luciano (2006) highlighted Rotter's theory on "locus of control" as one of the most

* Correspondence: Secretaría General de Instituciones Penitenciarias, Alcalá St., 38-40, Madrid, España. Email: JCarmelo.Visdomine@dgip.mir.es. *Acknowledgment*: This study contains part of the research carried out by the author under the supervision of Professor Carmen Luciano in fulfillment of the requirements of his PhD in Clinical and Health Psychology developed during 2003 and 2004 at Universidad de Almería. The author would like to thank Dr. Luciano for her wise guidance. The author thanks his doctorate fellows for their help and assistance.

comprehensive accounts developed from Clinical Psychology. According to the "locus of control" theory, there are two basic expectancies that human beings may present about the control of reinforcement in their lives: internal and external. Moreover, Rotter (1966) proposed that such expectancies worked as a unity or generalized expectancy in every individual (i.e., as a locus of control), and he elaborated a 30-items scale to measure each person's locus. Since then, locus has been proposed to be a key personality dimension in several areas, behavioral disorders included (e.g., Kesavayuth, Poyago-Theotoky, Tran, & Zikos, 2020; Zawawi & Hamaideh, 2009).

However, despite the relevance that responsibility attributions and control expectancies could have in the regulation of behavior, Rotter's conceptualization configures "locus of control" as a hypothetical construct. Therefore, the traditional socio-cognitive construct of "locus" obscures instead of clarifies the research on the behavioral and contextual nature of attributions and expectancies. Both attributions and expectancies are the two sides of the same coin, since the former describe factors responsible for events and outcomes already happened (even own behavior), while the latter describe events or outcomes that will occur in the future after some speaker's behavior (Forsyth, Chase, & Hackbert, 1997; Guerin, 1994). In addition, as Visdómine and Luciano (2006) reviewed, the traditional studies that have focused on the conditions that prompt a generalization or change of expectancies are very limited, and are restricted to stimuli generalization, as well as to the use of psychometric scales and complex psychotherapeutic programs.

A different approach to locus of control and generalized expectancies and attributions has been recently proposed from a contextualistic perspective (Visdómine Lozano, 2015). A way to clarify the role of both attributions and expectancies could be to conceive them as behavior-behavior relations, rather than as cognitive processes that unfailingly determine behavior (Hayes & Brownstein, 1986; Wilson, 2001). According to this approach, several relational frames get involved in generalized internal and external control expectancies. A relational frame can be defined as a set of stimuli arbitrarily related which is subject to mutual entailment (if A is related to B, then B is related to A), combinatorial mutual entailment (if A is related to B, and B is related to C, then C is related to A), and transformation of stimulus functions across those relations, according to the context or type of relation involved (Hayes & Hayes, 1992). Some of such fundamental frames are the formed by I-OTHERS and CAUSAL complex discriminations, which are progressively acquired throughout developmental interactions. Particularly, the CAUSAL relational frame involved in control expectancies seems to be an incomplete unidirectional conditional frame in which the "I" plays the role of "causal agency". This happens because we do not only learn to describe the contingencies that shape our behavior. Our verbal community also teach us to respond under the control of rules in which the verbal abstraction we call "I" serves to generalize goal-directed actions through specific rules when the contingencies that initially shaped our behavior tend (or need) to be increasingly intermittent or distant in time (Barnes-Holmes, Hayes, & Dymond, 2001; Luciano, Valdivia, Cabello, & Hernández, 2009). The combination of both the DEICTIC I-Others and the CAUSAL relational frames ("I [as DEICTIC cue] am [as COOR cue] able/cause [as CAUSAL cue] of X [as behavioral content]"; or "X [as behavioral content]-depends on [as CAUSAL cue]-me/others [as DEICTIC cue]") could work as rules for the control of other behaviors. This rule-governed behavior would derive from the arrangement of both additional differential contingencies of social reinforcement and IF-THEN conditional frames. These two interventions would establish the subsequent coherent say-do relations that we call "rule-governed behavior" and that involve the "I" (Luciano, 1992; 2017). As a consequence, "I" or "Self" would become the verbal context in which the different types of rule-following behavior would work, regardless such types of rule-following behavior were appetitive-oriented or avoidance-oriented, and whether they were governed by others' contingencies (pliance), by environmental contingencies as specified by the rule (tracking), or by function-altering stimuli (augmenting) (Luciano, Valdivia, & Ruiz, 2012). Thus, "I" and "Self" could play the role at the same time of abstracted relational cues of both a HIERARCHICAL frame and of a DEICTIC frame, hence the psychological and even philosophical relevance of such relational cues (Hayes, 1984; Luciano, 2017; Visdómine Lozano, 2012). In addition, the generalization degree of expectancies on every person would depend not only on processes of generalization of stimuli, but also on the transfer and transformation of functions produced via different types of coherent relational networks. In turn, such networks would include several stimuli, situations, other persons, etc., present on everyone's life (Visdómine Lozano, 2015). Thus, I may feel responsible for and able to obtain some results in the condition X by its relation to other conditions or stimuli I have experimented formerly elsewhere, and not exclusively by my direct experience in such condition X.

This is the form in which the relevance of the self-rules that we call "expectancies" should be analyzed in relation to different applied areas. For example, a functional-contextualist account of different and varied behavioral disorders has found that some individuals present a pervasive kind of self-rules that are similar to control expectancies, but particularly focused on the control of the negative reinforcement derived from the avoidance of own uncomfortable emotions, thoughts, memories, etc. In parallel, such functional analysis has found that these individuals neglect valued areas of their lives, presenting at the same time rules of external control for the achievement of the reinforcement related to such valued areas. This pervasive pattern has been called "experiential avoidance" and "psychological inflexibility" (see Gil Luciano, Ruiz, Valdivia Salas, & Suárez, 2017; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996; Luciano & Hayes, 2001). And such sorts of rules have been defined as a "context of reason-giving" that finally promotes a "context of control" (Zettle & Hayes, 1986). These verbal contexts, in turn, leads to psychological suffering. This demonstrates the importance of the rules centered on the control of different types of events in regard with human wellbeing. The key issue would be to understand properly the contextual nature and features of such rules.

This contextualistic account of locus of control is supported by some previous experimental studies. Specifically, Luciano, Gómez, Molina, and Zaldívar (1998), and Visdómine and Luciano (2002) analyzed the formation and transfer of both internal and external attributions in children through problem-solving tasks. The former trained two five-member equivalence classes in three 10 to 11 years-old children, while the latter tested for two pre-experimentally established five-member arbitrary classes (vowels and numbers 1 to 5) in five 6 to 7 years-old children. Both studies prompted internal and external attributions in problem-solving through the training of three tasks per class (the tasks were labeled with three stimuli of each class: A1, B1, C1, A2, B2, C2). The procedure to solve the tasks included the arrangement of differential cueing, and (internal vs. external) responsibility feedbacks. A test for the transfer of expectancies on two non-trained stimuli of each class was performed (D1, E1, D2, E2), and all participants in both studies achieved a differential transfer. Likewise, Visdómine and Luciano (2002) established a further experimental control to test for the conditional effects of the audience on the prompting of internal and external expectancies upon novel and non-related stimuli, showing the possibility that others could contribute as conditional stimuli to the extension of functional classes and derived responding.

Finally, in Visdómine, Luciano, Valdivia, Gutiérrez, and Ortega (2010), fifteen 18 to 25 years-old adults participated. Two 12-member pre-existing arbitrary classes (Spanish woman names, and African countries names) were tested through a stimuli-sorting task, and, as in the previous studies, three stimuli per class were employed to label three problems that were trained to prompt both internal and external responsibility attributions. After such training, the participants were tested for the differential transfer of both internal and external control expectancies upon two novel stimuli of each class (D1, E1, D2, E2). This time, difficulty estimations were also tested for. In the next phase, all participants were trained to solve the tasks of D1, E1, D2, and E2. Lastly, both a direct and literal instruction (10 participants) and an analogy or illustrated instruction (5 participants) were introduced in regard with three stimuli per class (H1, I1, J1, H2, I2, J2) to reverse the control expectancies and difficulty estimations on novel stimuli (K1, L1, K2, L2). Eight participants reversed their expectancies and difficulty estimations in the general instruction condition, and four participants did it in the illustrated instruction condition, demonstrating that attributions and expectancies behave as complex relational responses.

Complex forms of verbal responding (or self-rules) like these ones have been recently analyzed from a new descriptive frame called Hyper-Dimensional and Multi-Level framework (HDML) (Barnes-Holmes, Barnes-Holmes, Hussey, & Luciano, 2016). This new descriptive tool has labeled such complex forms of verbal behavior as “elaborated and extended relational responses” (EERRs) –by opposition to “brief and immediate relational responses” (BIRRs)– which would be complex instances of arbitrarily applicable relational responding (AARRing) appearing in natural settings (see Barnes-Holmes, Finn, McEnteggart, & Barnes-Holmes, 2017). Note, however, that AARRing is a prior contextualist concept referred to derived relational responses just like they are produced in experimental preparations concerned on the training of equivalence and non-equivalence (e.g., difference, opposition, comparison, etc.) relations (Steele & Hayes, 1991). The authors that propose “EERRs” as a new concept for such large samples of verbal behavior apply this concept to clients’ narratives observed in clinical interactions (Barnes-Holmes, Barnes-Holmes, & McEnteggart, 2018). Some examples they stand out are particular depression-diagnosed clients’ sayings like: “I am a terrible person” or alike. Other examples could be sayings like “When I feel depressed I am neither able to stay with others nor to go to my workplace”. Consequently, expectancies and attributional self-rules as those with which the experiments mentioned earlier worked could also be understood as EERRs, and so, they could be analyzed in the same terms. HDML decomposes both brief and elaborated relational responding into five levels (mutual entailment, combinatorial entailment, relational networks, relating relations, and relating relational networks) and four dimensions (coherence, derivation level, complexity, and flexibility). As regards the dimensions, a particular AARRing will be coherent whether its relational pattern is composed of compatible relations; it will have a given derivation level depending on if it is the first time it is performed or not; it will be more or less complex depending on the number and type of relations it consists of; and it will be flexible depending on the extent of change when some contextual variable is arranged to influence to such AARRing.

From this standpoint, the current experimental series, which were carried out during the years 2003-2004, could be understood in the same terms. That is, they could be viewed as an analysis of some variables related to some particular dimensions of concrete types of EERRs as are attributions and expectancies. The development of HDML has provided of a special relevance to the data obtained in such experimental series. Even, we think that the experiments mentioned earlier (Luciano *et alia*, 1998; Visdómine & Luciano, 2001; Visdómine *et alia*, 2010) can shed some light on the processes of transformation of functions that occur when complex AARRings are involved and interact between them, as HDML seeks to analyze, albeit such experiments were done some time earlier to the development of HDML. Specifically, the current study aims to complete the knowledge about the variables that strengthen and transfer attributions, expectancies, and difficulty estimations, as well as about some variables that facilitate their flexibility.

The experimental procedure followed to prompt and transfer differential expectancies was similar to the followed by Visdómine Lozano *et alia* (2010). The main differences with the study described in such article lie on the conditions arranged to promote flexibility. Such conditions consist of: a) the element of the problem-solving process in which the specific illustrated instruction of the reversion phase was centered on to make attributions flexible upon new stimuli, inasmuch as Visdómine Lozano *et alia* (2010) was directly centered on task difficulty and now, Experiments 1 and 2, was centered on the participants' ability in the subsequent problems, and Experiment 3, on the means provided to solve such problems; and b) the manipulation of the number of exemplars (i.e. problems) trained before a reversal intervention is implemented when such intervention does not produce any kind of flexibility, such that Experiments 1 and 2 applied the same reversal intervention, and differentiated only on the number of problems trained after the transfer of expectancies.

Experiment 1
Method

Participants

Ten volunteer participants, aged between 19 and 25 years (*M*= 22.3; *S*D= 2.26), 4 females and 6 males, were recruited at Universidad de Almería through class announcement. Two of the participants were graduated on Medicine, two were graduated on Psychology, three studied Economics, one studied Psychology, another one studied Chemistry, and a final one studied Law. They were selected on the basis of not having participated in prior researches on transfer of functions.

Experimental Setting, Stimuli, and Materials

The apparatus and materials employed in this experiment were described in Visdómine Lozano *et alia* (2010). Experimental sessions were conducted in a Psychology Lab at *Universidad de Almería*. The lab was composed of two rooms equipped with a table and two chairs each room. A tape-recorder (Sony TCM-S68V) was used to register all interactions.

Twelve Spanish female first names (María, Silvia, Cristina, Rosa, Inés, Verónica, Pilar, Lola, Susana, Natalia, Carmen, Luisa) and twelve Spanish names of African countries (Sudán, Níger, Zaire, Kenia, Camerún, Etiopía, Senegal, Burundi, Zimbaue, Guinea, Uganda, Congo) served as stimuli of categories 1 (A1 to L1) and 2 (A2 to L2) respectively. These pre-existing classes were used due to the large number of stimuli needed to accomplish the experimental target of the study. These stimuli were presented as printed paper cards (297x210 mm). Problem-solving tasks corresponding to some stimuli of each class (A1 to E1) required the use of additional cards (same size as stimuli cards) with their respective label and each problem description printed on their surface. All problems employed paper and pencil to be solved, and problems B1 and C1, besides, required eight 2-eurocent coins the former, and six glasses and a bottle of water the latter.

Two evaluation scales were designed ad hoc for different phases of the present study: an attribution scale, and a difficulty scale. The attribution scale contained the question "What do you attribute having solved this problem to?" with three horizontal scales ranging each from 1 to 10 that were labeled "own ability", "others' intervention", and "chance", respectively. A second scale, i.e. the difficulty scale, also consisted of a horizontal scale ranging from 1 to 10, with the sentence: "Mark off how difficult this problem looks to you".

Experimental Sequence and Problems

The procedure consisted of five phases that participants run individually during a single session. Phase 1 served to evaluate the two pre-existing arbitrary classes in the repertoire of the participants; Phase 2 corresponded to the training of internal and external attributions through problem-solving tasks labeled with three stimuli of each class (A1, B1, C1, A2, B2, C2); Phase 3 served both to test for a differential transfer of internal and external expectancies (and the respective difficulty estimations) on two novel stimuli per class (D1, E1, D2, E2), and to solve the problems corresponding to such stimuli; Phase 4 was arranged to introduce the reversal illustrated instruction in regard with three stimuli per class (H1, I1, J1, H2, I2, and J2); and, finally, Phase 5 served to test for a derived and differential reversal of expectancies (internal and external) and difficulty estimations on two novel stimuli per class (K1, L1, K2, and L2).

In particular, the problems used in Phases 2 and 3 were mind games that involved complex verbal relations, and that were selected and adapted from specific books concerned on the matter (see Cossu, 1990; Mayer, 1992; Summers, 1998). Some other problems were taken from Visdómine Lozano and Luciano (2002). A complete description of all problems can be obtained upon request from the first author. Only a brief summary of the problems will be provided herein (see Table 1). Problem A1 was an adaptation of the Dunker's radiation task, in which a physician had to apply a laser to destroy a tumor without damaging other surrounding tissues; problem B1 consisted

Table 1. Description of the experimental tasks employed in the problem-solving phases arranged to train both internal and external responsibility attributions.

Class 1 stimuli	Problems labels	Tasks	Class 2 stimuli	Problems labels	Tasks
A1	María	Dunker's radiation task	A2	Sudán	Fields of cereals
B1	Silvia	Triangle of coins	B2	Níger	Crime suspects
C1	Cristina	Glasses of water	C2	Zaire	Matrix of squares
D1	Rosa	Package of keys	D2	Kenia	Relatives
E1	Inés	Arithmethic series	E2	Camerún	Colored rooms

of reversing a triangle of eight coins sketched on a sheet of paper by moving only two coins; problem C1 asked for the participants to put three glasses full of water together if they had a series of three empty glasses and three full glasses in an alternate order (i.e., empty, full, empty, full, empty, full), and they could only move one of the glasses; problem A2 described some contiguous fields of three different types of cereals, and the participants had to go from one of such fields to another one in accordance with some restrictive rules; problem B2 described a murder and six suspects of whom some characteristics were known (profession, sex, height, weight, age, and type of smoking habit), and participants had to find out the profession of the murderer, having in mind two restrictive but complementary rules; and problem C2 was composed of a matrix of nine alternated white and grey squares, which were divided into four triangles each one, and each triangle had a letter inside it, and the participants had to choose a similar square among six additional squares that completed the series of letters.

Such problems were selected by their high difficulty in order to gain feedback believability during training, as proved in a pilot trial; the three most difficult problems were employed to establish external attributions in three stimuli of class 2, and the other three problems were employed to establish internal attributions in three stimuli of class 1. Class 1 problems would require minimum cueing to find the solution by the own participants, while class 2 problems would always require help from others to find the solution.

Further, four additional problems were presented in Phase 3 to confirm and strengthen the expectancies just transferred on stimuli D1, E1, D2, and E2. Thus, problem D1 asked for the weight of seven keys if someone had a package containing twelve of such keys, and each key weighted 1 Kg. Problem E1 proposed a series of fractions, and the participants had to complete the series. In problem D2 three heirs were relatives among them, and the participants had to find out the married man taking into account some conditional complementary rules. Finally, E2 described a house composed of five rooms painted on different colors, and participants had to discover which room was painted on "V" taking into account four complementary rules about the size and position of each room.

Procedure

The general procedure was equivalent to the followed by Visdómine Lozano *et alia* (2010). Three experimenters were involved in the development of the experiment. The participants were conducted to the experimental setting, and once in the lab they were informed by Experimenter 1 that the session would last about 2 hours during which they should accomplish some paper and pencil tasks, although, before, they should sign an informed consent agreeing to do it and to be recorded. After this, Experimenter 1 began with Phase 1.

Phase 1. Assessment of pre-experimental classes. Experimenter 1 put the 24 stimuli cards mixed and face down the table, and said: "These are the names of some problems we will work on in a while. Please put them face-up and create two piles of cards based on those that you think go together". After the participants sorted the stimuli correctly and named the two resulting categories (i.e., "female first names" and "names of African countries"), they proceeded to the next phase without receiving any praise or corrective feedback. Otherwise, the experiment finished and the participant was removed from the study.

Phase 2. Training of attributions (locus). Internal attributions were trained in relation to problems A1, B1, and C1, and external attributions were trained in relation to problems

A2, B2, and C2, but all these problems were disposed in a semi-random order to prevent order effects. Thus, the training order for all participants was A1, A2, B1, C1, B2, and C2. Experimenter 1 began this phase placing the card corresponding to problem A1 on the table, and saying: "This is problem María, please read, and pay attention". After the participant read the problem, Experimenter 1 asked the participant to fill out a difficulty scale (PRE scale), and subsequently, to solve the problem, although after 30 second approximately without a correct answer, the experimenter provided the first clue of a total of four. The clues could be repeated up to four times each (see Table 2). The repetition of the clues was programmed to provide time to the participants to establish the relations between the clues and the problems statements necessary for problem-solving. The experimenter changed of clue when the participants gave some approaching response, or when the clue was repeated four times. If the participant did not give the solution after the presentation of the four clues four times each, she or he was dropped from the study. As soon as participants described verbally the correct solution of problem A1, Experimenter 1 provided feedback about their internal responsibility (e.g., "Good for you, you found the solution by yourself"), and then, participants went to room 2, in which Experimenter 2 asked them to solve the problem in a sheet of paper. After this, participants went back with Experimenter 1, and filled out both the attribution and difficulty scales (POST scales) corresponding to problem A1. Subsequently, Experimenter 1 placed the training card of problem A2 on the table, and said: "This is problem Sudán, please, read, and pay attention". As with problem A1, Experimenter 1 asked participants to fill out a new difficulty scale regarded with problem A2, and to solve the problem. Again, after 30 seconds, approximately, without any correct response, Experimenter 1 encouraged participants to solve the problem while repeating parts of the heading of the problem (up to four times), though, contrary to the intervention on problem A1, neither clues nor any other relevant additional information was provided. Once participants answered "I do not know the solution" or similar when Experimenter 1 asked them whether they knew how to solve the problem, the experimenter showed the solution and provided feedback of external responsibility like "So, it has been me who finally told you the solution of this problem". Then, participants went to room 2 with Experimenter 2, who asked them if they could show the solution of the problem or not, in which case, he (Experimenter 2) would show how to solve the problem. As participants did not found the solution by themselves, they finally asked Experimenter 2 to teach them the solution of the problem step by step. After Experimenter 2 tough the solution, participants return with Experimenter 1, and filled out both the attribution and difficulty scales corresponding to problem A2. Subsequently, problems B1, C1, B2, and C2 were trained in a similar fashion. When the training sequence finished, Experimenter 1 showed the participants all cards employed to train the problems, one at a time, and, in a random sequence different for every participant, asked: "Please recall, for this problem were you able to find out the solution, or was it me who had to tell you the solution?" The mastery criterion that participants must achieve to continue on to Phase 3 was to answer to this question with internal and external attributions in two out of the three problems per category, and to obtain in class 1 problems a higher means on "Ability" than on "Others" and "Chance."

Phase 3. Transfer test and re-training. Once Phase 2 finished, Experimenter 1 went outside room 1, and Experimenter 3 entered, presented the stimuli cards of D1, E1, D2, and E2, and asked: "I will show you the name of some problems you will be working on in a while and will ask you a couple of questions". The experimenter placed the D1 stimulus card on the table, and then asked: "Do you think you will be able to find out the solution to this problem or will somebody else have to tell you the solution?" Next, Experimenter 3 asked participants to rate the difficulty on a difficulty scale. E1, D2, and E2 followed the same procedure, after which Experimenter 3 left room 1, and Experimenter 1 entered again to re-train problems D1, E1, D2, and E2 regardless the result on the transfer test, in order to strengthen attributions in the participants who showed a differential transfer, as well as to improve the discrimination between both classes on those participants who did not achieve a differential transfer on these stimuli. The participants that did not achieve a differential transfer proceeded to be

Table 2. Clues programmed to train the problems of class 1.

Problems	Clues
A1	1. To draw an imaginary silhouette of the tissue, the tumor, and the laser, and say: "with one 6-ampere laser you couldn't do it, so, how could you do it?" 2. Again, upon the imaginary drawing, to say: to not destroy the tissue through this point, what do you think you would have to do when you apply the laser? 3. To say "If you are going to send it "x" amperes through this point to not destroy the tissue, what should you do to send the tumor the remaining amperes that you need to destroy it?" 4. To say: "Ok, through this point you don't damage the tissue, and you get that "x" amperes are applied to the tumor; what would you do to send the tumor the remaining amperes without damaging the tissue through any other point."
B1	1. Upon the figure of coins depicted on a sheet of paper, to say: "The target is to put the vertex down oriented (pointing to the right position). 2. To say: "Thus, according to the problem description, the triangle must have a basis of 4 coins, an intermediate row of 3 coins, and a vertex of 1 coin" (pointing to the rows of coins, but without signaling any movement). 3. Pointing only to the intermediate row of 3 coins, to ask: "Which coin would you move to leave a 4-coins row upward?" 4. Pointing to the sheet of paper and to the coin moved after clue 3, as well as to the position that the new vertex should occupy, to ask: "and to make the vertex?"
C1	1. To point toward two empty glasses, and to say: "remember, moving only one full glass you must put three full glasses together." 2. To say: "please, imagine the glasses," and to extend the hand on the air as if handling a glass, but without doing any movement. 3. To point upon the paper the targeted group of three glasses (two full glasses and one empty between them), and ask: "what would you do?" 4. To ask: "Which glass would you take?... imagine that you take the glass… OK, and that you already have it in the hand… What could you do with it to put three full glasses together?"
D1	1. To say: "Look, the problem reports the weight of 12 keys that are equal, which is not the same as if they were different." 2. To say: "Thus, we know the weight of 12 keys, but the problem asks for the weight of 7 keys." 3. To say: "Considering that 12 keys weight one kilogram, that is, 1000 grams, how much would each key weight?" 4. To say: "How would you calculate the weight of 7 keys knowing the weight of one key?"
E1	1. To say: "This is a succession, the relevant issue is the change from one member to the following." 2. To say: "It is important to see if each member is a single number, or if it is composed of more than one." 3. To say: "Look, both numbers of the member do not necessarily change in the same manner." 4. To say: "The number that completes the series has to form part of the same relation that links every member with the others."

tested again for a transfer of expectancies on two novel stimuli per class (F1, G1, F2, and G2) in the same way as with D1, E1, D2, and E2.

Phase 4. Reversal intervention. Contrary to the illustrated instruction employed by Visdómine Lozano *et alia* (2010), which was centered on the difficulty of the problems of each class, the illustrated instruction of the present experiment was centered on the ability of the participants to solve subsequent problems of each class. Experimenter 1 said the following:

"Well, pay attention, please. I am going to explain you with an example the relationship that this problem (H1) has now with the rest of the problems of its class. It is like if these problems (showing A1, B1, and C1) were household appliances of a trademark A. Until now, you have known how to make them work. Conversely, from this moment on, this problem (showing H1), you won't be able to make it work; this problem (showing I1) you neither will be able to make it work; and this problem (showing J1) you neither will be able to make it work. Likewise, this problem (showing H2) is like if it were another household appliance of a trademark B. Until now, you have not been able to make the household appliances of this trademark (showing A2, B2, and C2) work, but regarding this problem (showing H2), you will be able to make it work; regarding this problem (showing I2) you will also be able to make it work; and regarding this problem (showing J2) you will also be able to make it work."

Phase 5. Reversal test. Experimenter 1 left room 1, and Experimenter 3 entered to test for the reversal of expectancies and difficulty estimations on K1, L1, K2, and L2, following the same protocol as indicated in Phase 3. After participants' responses, Experimenter 3 left room 1, and Experimenter 1 entered, who thanked participants for their cooperation, and the experiment finished.

Results

Inter-observer agreement was calculated for problem-solving training, as indicated in Visdómine Lozano *et alia* (2010). Besides tape-recording, experimenters registered on printed records their interventions when implementing the experimental treatments, mainly in relation to class 1 problems (i.e., the number of clues and repetitions needed to facilitate that participants find out the solution). This measure was calculated by dividing the smaller number of clues and repetitions by the larger number of each problem, and multiplying by 100%, so that the average inter-observer agreement for all problems was 85%.

Data concerning the training will be exposed in first place, in second place data related to the transfer, and finally the data of the reversal. The number of clues and the times that each clue was repeated are represented on Figure 1. As regards the attributions prompted during training, all participants but participant 2 achieved the mastery criterion. The means of the attribution scores were clearly differentiated between the two classes of problems for all participants, except for participant 2, such between "ability" (internal attributions) and "others" (external attributions oriented to others' intervention), as between "others" and "chance". This is important because high scores on "chance" could have involved the intervention of a non-controlled variable (see Figure 2). A visual examination of the correlation between the number/repetition of the clues provided, and the prompting of differential attributions and expectancies does not allow concluding a firm entailment between them. Both the verbal relations involved in the training feedbacks, and the contrast with class 2 problems, could explain this issue.

Furthermore, several two-tailed *t*-tests confirmed these data. Mainly, we can highlight the following results. "Ability" (internal) scores were significantly higher than "others" (external) scores for problems of class 1, $t(8)= 6.281$, $p <.000$; "ability" scores were also significantly higher than "chance" for class 1 problems, $t(8)= 7.222$, $p <.000$. As expected, "ability" scores were significantly lower than "others" scores for problems of class 2, $t(8)= -7.060$, $p <.000$; and, in addition, "ability" scores for class 1 problems were significantly higher than "ability" scores for class 2 problems, $t(8)= 20.541$, $p <.000$. Regarding difficulty scores, although class 1 problems were rated as significantly easier than class 2 problems after a first sight (PRE ABC), $t(8)= -4.131$, $p= .003$, the difference between the difficulty scores rated for both classes increased after training (POST ABC), as Figure 3 shows, $t(8)= -5.238$, $p= .001$.

With regard to the transfer of expectancies (Phase 3), all participants who reached the training criterion (all but participant 2), achieved a differential transfer of internal (class 1) and external (class 2) expectancies (Figure 2). Likewise, difficulty estimations prior to any contact with the problems contents were equally transferred with a difference between classes statistically significant, $t(8)= -6.391$, $p <.000$. When these problems (D1, E1, D2, and E2) were trained, the attributions generated for both classes were clearly differentiated, keeping the same pattern of responding as in the training of problems A, B, and C (see Figure 2). So, "ability" scores for D1 and E1 were significantly higher than "others' intervention" scores, $t(8)= 7.428$, $p <.000$, as well as "others' intervention" scores were significantly higher that "ability" scores for D2 and E2, $t(8)= 7.333$, $p <.000$. Similarly, difficulty scores were significantly lower

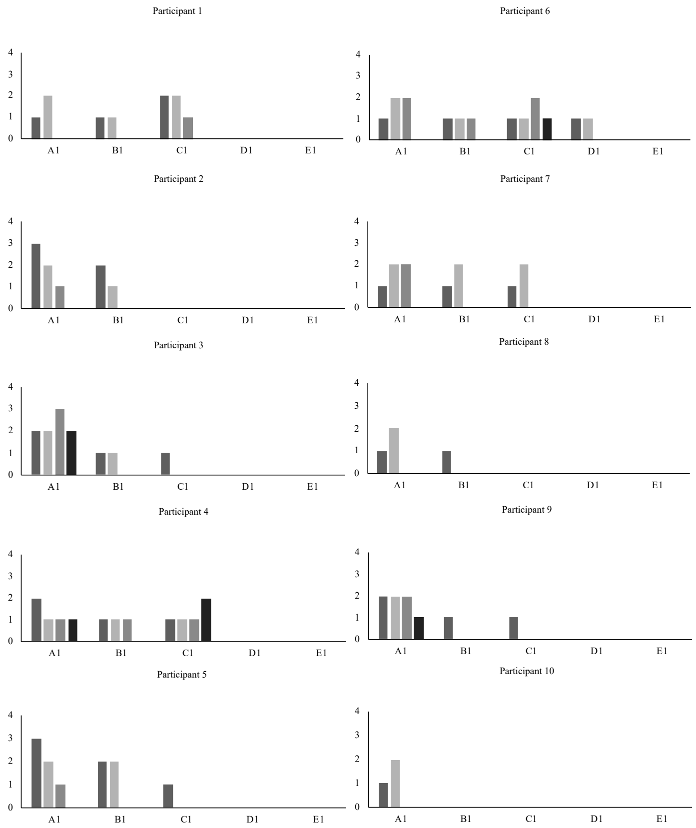

Figure 1. Graphic representation of the clues (columns) and repetitions of each clue (numbers in the Y axis) provided for the training of the problems of class 1 (A1, B1, C1, D1, and E1) in Experiment 1.

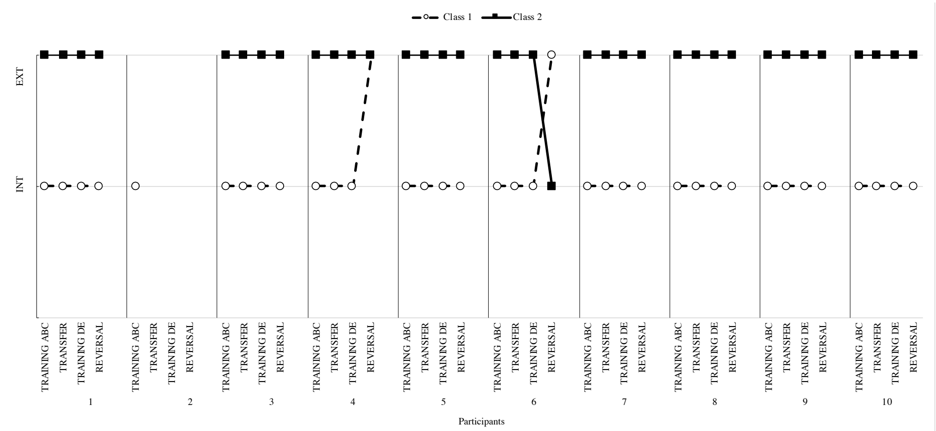

Figure 2. Graphical representation of the differential pattern of attributions and expectancies for each participant across the experimental phases in Experiment 1. Notes: INT= "internal", indicates that the participant scored "own ability" above "others" and "chance"; EXT= "external", indicates that the participant scored either "others" above "own ability" and "chance".

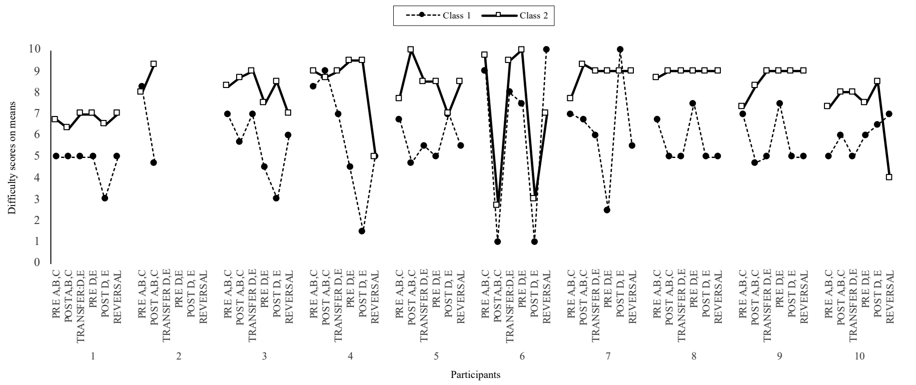

Figure 3. Evolution of difficulty scores (on means) for each participant in experiment 1.

for D1 and E1, than for D2 and E2, $t(8)= 3.195$, $p= .0109$ (see Figure 3). This time we can observe that difficulty scores increased their distance for problems D1 and E1 with regard to D2 and E2 in participants 1, 3, 4, 8, and 9, showing a clear correlation with the absence of clues provided for these problems.

Finally, Figures 2 and 3 also show that reversal on novel exemplars was not achieved but for one participant (participant 6), and perhaps for participant 10, though this participant did not reversed with clarity expectancies for class 1 stimuli, since he manifested persistent doubts about his own control and others' intervention in solving the problems corresponding to such stimuli. He only reversed his expectancies for the stimuli of class 2. However, his estimations of difficulty for both classes reversed according to the procedure. Another particular result was that of the participant 4, who reversed his expectancies for class 2 stimuli, but not for class 1 stimuli. He did neither reverse his difficulty estimations, and rated both classes at the same level (i.e., 5). The remaining six participants who passed the training criteria (participants 1, 3, 5, 7, 8, and 9) maintained the pattern of expectancies and estimations of difficulty derived from the training.

Discussion

The current experiment replicates the data already obtained by Visdómine *et alia* (2010) in relation to the training and transfer of both internal and external control expectancies in problem-solving tasks. In this case, all participants (but participant 2, who did not met the training criterion) achieved a differential transfer of expectancies and difficulty estimations on D1, E1, D2, and E2 stimuli. In Visdómine Lozano *et alia* (2010) three participants achieved the transfer on F1, G1, F2, and G2, after the training of D and E problems, showing the relevance of multiple exemplar training on the strengthening of a complex AARRing. The discrimination of tasks difficulty, that is, of the requirements of the tasks to find out the solution, helped to form a differential pattern of internal and external expectancies. Even more, although the participants rated class 1 problems as easier than class 2 problems since the beginning, this fact did not impede the formation of own-oriented responsibility expectancies.

We would like to draw attention on the complexity of the behaviors performed by the participants in the experimental setting. It is usual to find in transfer of functions studies BIRRs, in terms of Barnes-Holmes *et alia* (2016), Barnes-Holmes *et alia* (2017), and others, like mutual and combinatorial entailments between stimuli. The present study shows, to our view, EERRs or complex levels of AARRing, since control expectancies and difficulty estimations involve themselves different relational frames. Some of such frames are I-Others, Causal, Conditional, More/Less-Than ("easier", "more difficult", etc.), and others. In addition, we show the interaction of complex AARRings like expectancies about the own responsibility in problem-solving tasks and the illustrated instruction presented in Phase 4 as an attempt to prompt a reversal on novel stimuli. Besides, the experimental tasks also involved complex verbal relations.

However, unlike the results presented by Visdómine *et alia* (2010), the results of the current experiment show an absence of generalized reversal. We can explain these data as a product of the competition between the history trained to the participants and the verbal relations involved in the illustrated instruction of the reversal phase. The instruction directly focused on the "ability", which was the element on which the training was explicitly centered from the beginning, and which was confirmed by the training of problems D and E. In this competition of functions, the self-discriminative functions of "ability" trained through problem-solving (i.e., shaped), was more "powerful" than the self-discriminative functions of "ability" contained in the relations of the instruction (i.e., instructed). Another form of analyzing the absence of reversal is saying that the relations contained in the instruction were incoherent with the relations strengthened between I-Others, own ability/others' intervention, the problems, the stimuli classes, and difficulty. Though, "difficulty", and "own/others' intervention" are not at the same level as the stimuli (and problems) of both classes, and neither at the level of the "I/Others" discrimination. It could be said metaphorically that such elements ("difficulty" and "own/others' intervention") are the "content" of the classes, but not the classes themselves. Likewise, "I/Others", as it was analyzed in the introduction, are cues of the HIERARCHICAL/PERSONAL frame that serve as context (i.e., self-as-context) for the remaining behavioral contents (i.e., self-as-content) (Luciano *et alia*, 2012). Thus, the incoherence would not be produced between the relations of the networks (i.e., in the Crel), but between the "contents" of such networks (i.e., in the Cfunc).

At any rate, the persistence of the pattern trained could be called "rigidity" or "inflexibility". Rotter defined this rigidity as "an absence of learning" due to the expectancy of a single correct solution which remains the same, and manipulated four contingencies to test for expectancy change in a task (Schroeder & Rotter, 1952). Visdómine Lozano *et alia* (2010) also found an appropriate change of control expectancies on arbitrary related stimuli. In this case, the change was produced when the target of the verbal rules introduced to prompt such change or flexibility focused on task difficulty.

Thus, there seems to be two basic sources to promote flexibility on an AARRing once such AARRing is established: a) direct contingencies reversing the contingencies that support the AARRing; and b) the type of arbitrary relations involved in the verbal interventions employed to change the AARRing. Nevertheless, the next experiment did not centered on any of these variables, but on the training history itself that gave rise to expectancies. As claimed by St Peter Pipkin and Vollmer (2009), further research on history effects is needed in Behavior Analysis. These authors concluded that history effects on later conditioning or contingency reversal was widely studied inside the lab in non-human subjects, but human research required more investigation.

In the field of relational responding, several studies have focused on the history effects of competitive functions. For example, Barnes, Lawlor, Smeets, and Roche (1996) found that the self-discriminative functions of words like “slow” and “able” competed in the establishment of equivalence classes in developmentally retarded children. Other studies like Gutiérrez, Luciano, and Valdivia (2001), Moxon, Keenan, and Hine (1993), and Watt, Keenan, Barnes, and Cairns (1991) have also worked on this subject. But these studies show competitive effects of the pre-experimental history of the participants. There are also studies concerned on history effects analyzed in the lab, albeit they are the fewer. In turn, some of these studies focus on competitive arbitrary relations, that is, in the Crel (e.g., Pilgrim, Chambers, & Galizio, 1995; Roche, Barnes-Holmes, & Smeets, 1997). However, this neither was our specific interest. Our study follows specifically the same line as other studies that began to study in the lab history effects regarding the Cfunc, or “competitive functions” experimentally acquired by a diversity of relational networks. For example, Rodríguez, Luciano, Gutiérrez, and Hernández (2004) studied history effects in equivalence classes through the latent-inhibition functions of stimuli pre-exposed in the lab; Luciano *et alia* (2013) analyzed the persistence of avoidance responding after the extinction of experimentally induced aversive classical conditioning, depending on both different contextual cues and instructions of similarity between the contexts of conditioning/extinction and of avoidance; and Montoya and Molina (2017) did it through function-altering rules in relation to experimentally established reinforcing-approach and aversive-avoidance functions.

Similarly, the following experiment will study in the lab the history effects as regards the more or less flexibility of expectancies, through manipulating the amount of contingencies (i.e., number of trained problems) arranged to prompt a differential transfer of expectancies. Consequently, the experiment will employ the same unfruitful illustrated instruction of Experiment 1 to attempt the reversal of expectancies. If such a history of training of fewer exemplars could facilitate the transfer of expectancies, it would demonstrate that, perhaps, there exists something like a “threshold” that allows the prompting of a complex AARRing. Likewise, it would also demonstrate that beyond such threshold, a given AARRing acquires a progressive and growing inflexibility.

Experiment 2
Method

Participants, Materials, and Experimental Sequence

Ten participants were included in this experiment following the same criteria as in Experiment 1. They were aged between 18 and 22 years old (*M*= 19.7; *SD*= 1.25), and seven of them were females, and three were males. Three participants studied Chemistry, one studied Sport Sciences, two studied Law, and four studied Psychology. The material, experimental sequence, and problems were the same as the programmed for Experiment 1.

Procedure

The only difference with Experiment 1 was that the training of problems D1, E1, D2, and E2, was not carried out after the transfer test performed on Phase 3. So, participants passed directly from the transfer test to Phase 4 (reversal intervention), in which the same illustrated instruction of Experiment 1 centered on the participants’ ability or control on problem-solving was introduced in the same manner as in Experiment 1.

Results

As in Experiment 1, data concerning the clues provided for the training are represented on Figure 4. These figure shows that, in general, problem A1 required more clues than problems B1 and C1. But, as in the previous experiment, a firm conclusion about the relation between the number and repetitions of the clues, and the pattern of attributions generated, cannot be excerpted. Attributions training was clearly differentiated for problems A1, B1, C1, A2, B2, and C2 (see Figure 5). All but participant 18 reached the training criterion. In fact, "ability" scores were significantly higher than "others' intervention" scores for the problems of class 1, $t(8)= 5.287$, $p= .0007$, and conversely, "others' intervention" scores were significantly higher than "ability" scores for the problems of class 2, $t(8)= -7.8652$, $p <.000$. Statistical differences were not calculated for "chance" scores, since they always remained exceptionally low in comparison to "ability" and "others' intervention" scores, and, therefore, showed clearly irrelevant in the process of making attributions.

Regarding difficulty estimations, this time there were not differences statistically significant at the beginning between the two classes, $t(9)= -1.923$, $p= .087$, but there

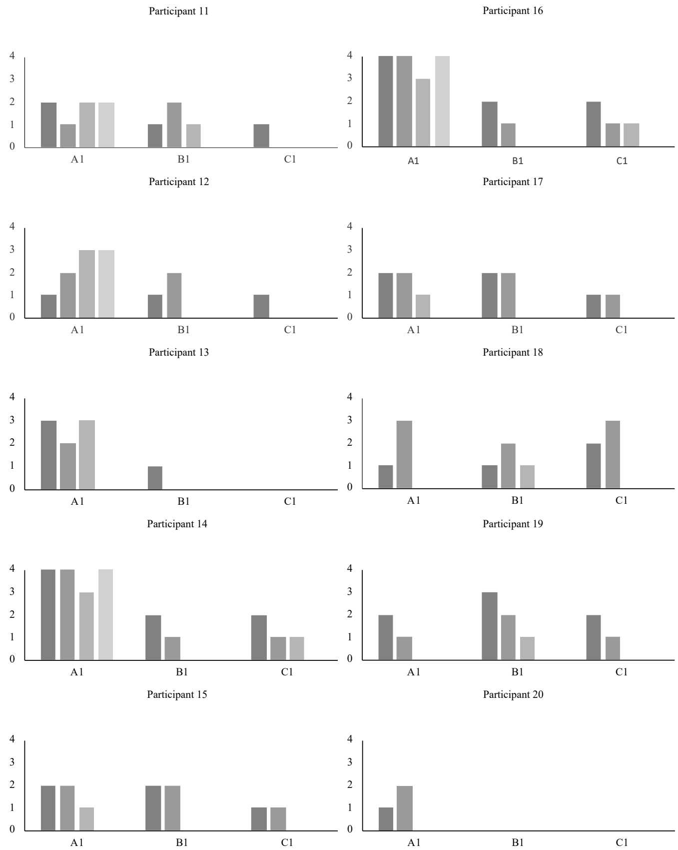

Figure 4. Graphic representation of the clues (columns) and repetitions of each clue (numbers in the Y axis) provided for the training of the problems of class 1 (A1, B1, and C1) in Experiment 2.

were significant differences after the training of the problems, $t(9)= -2.619$, $p= .028$. As Figure 6 shows, the difference between the means of difficulty scores grew from PRE to POST training (specifically in participants 14 to 20).

The transfer of internal and external expectancies was clearly produced for 8 out of 9 participants (see Figure 5), and difficulty estimations (Figure 6) were also transferred with a difference statistically significant, $t(8)= 2.306$, $p= .0025$. And finally, the differential reversion of both internal and external expectancies, as well as of difficulty estimations, was attained by 6 of the 8 participants who showed a differential transfer (see Figures 5 and 6), with differences statistically significant for difficulty, $t(5)= 2.5706$, $p= .0117$.

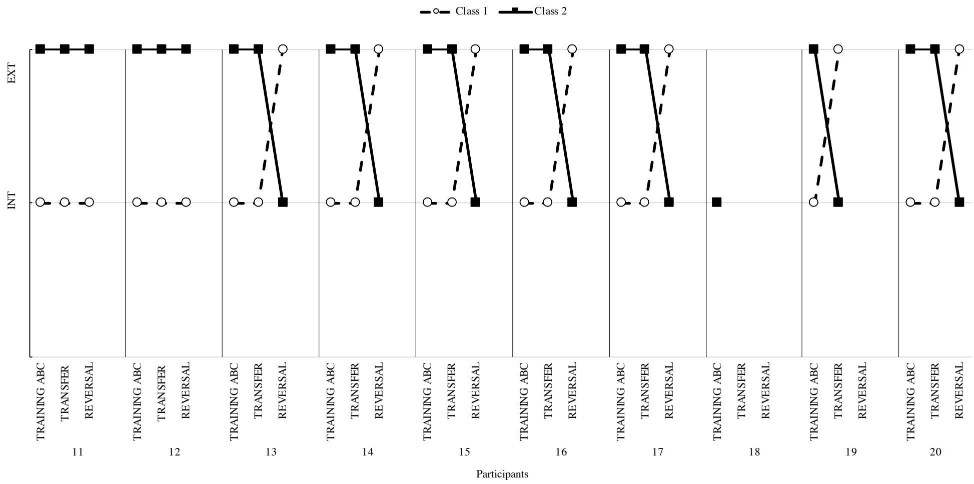

Figure 5. Graphic representation of the differential pattern of attributions and expectancies for each participant across the experimental phases in Experiment 2. *Notes*: INT= internal, indicates that the participant has scored "own ability" above "others" and "chance"; EXT= external, indicates that the participant has scored either "others" above "own ability" and "chance".

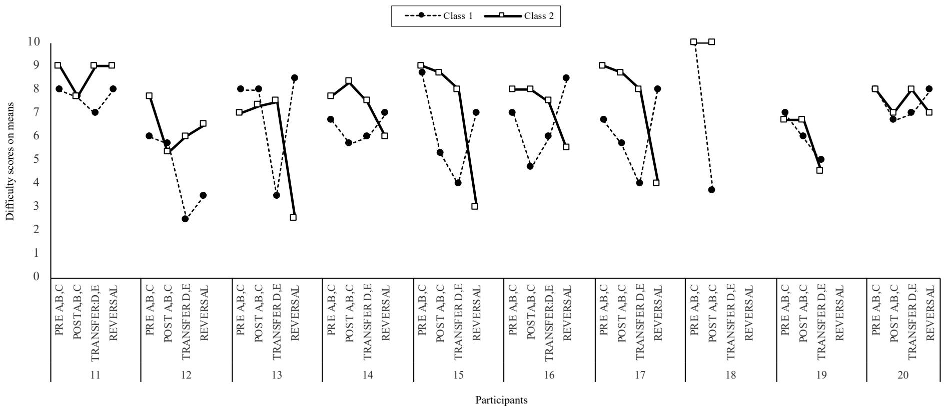

Figure 6. Evolution of difficulty scores (on means) for each participant in Experiment 2. It can be observed that participants 13, 14, 15, 16, 17, and 20 crossed their difficulty scores on the reversal phase, as expected, and according to the expectancies reversal.

Discussion

Thus, a training consisting of fewer exemplars facilitated the reversal of expectancies and difficulty estimations with an illustrated instruction that did not serve to produce such reversal in Experiment 1. Notwithstanding, the training of problems A, B, and C was enough to prompt a differential transfer of expectancies and difficulty estimations but for one participant (participant 18). We can conclude that the number of training trials (number of problems trained, in our case), is relevant to prompt a particular relational responding, as Visdómine *et alia* (2010) confirmed in relation to expectancies in three participants who did not achieve the transfer in a first test. And, additionally, the number of training exemplars is relevant as well to install a more or less flexible relational responding once such responding is minimally strengthened. As we discussed in Experiment 1, the illustrated instruction employed, which was centered on the ability of the participants, could not promote a reversal of expectancies and difficulty estimations. The main explicative variable was that the instruction competed directly with the self-discriminative functions shaped during problem-solving. However, the lack of confirmation and strengthening of expectancies on problems D1, E1, D2, and E2, left the participants "open" to a feasible change in the contingencies. This occurred even in those contingencies of subsequent problems when such problems entailed (as specified by the reversal instruction) a radical modification of the implication of participants and the respective self-discriminative functions involved (those of own/others' ability and intervention). Even more, we could say that in these conditions, participants were "sensitive" to Experimenter 1's instructions, regardless the training contingencies experimented by the participants.

Albeit the field of "sensitivity to contingencies" is a very vast area of research that cannot be explored in these lines, we think that our finding deserves a brief commentary to this regard. After an extensive review, Madden, Chase, and Joyce (1998) concluded that the form in which verbal and non-verbal contingencies interacted and controlled human behavior was far from being well established. Recently, Harte, Barnes-Holmes, Barnes-Holmes, and Kiss (2020) have reviewed the same field, and have added the research on the types of instructional control (pliance, tracking, and augmenting). These authors have concluded that depending on the source of a particular relational network (i.e., if it is fully or partially instructed, or shaped by the interaction with the scheduled contingencies), such network will have different levels of coherence, derivation, and flexibility. Thus, we could say that the participants of Experiment 2 were more sensitive to the instruction of the experimenter, than Experiment 1 participants were, in relation to the shaped rule-following behavior prompted in all participants through problem-solving. In other words, depending on the history of training, a particular AARRing will be more or less flexible to subsequent contextual events that go against the functional coherence provided to the network of such AARRing (in our case, Experimenter 1's instruction of reversal). The type of instructional control involved is something about which we cannot say anything, because a different arrangement of contingencies would have been needed, and it was not a matter of concern of the current experimental series.

In the next and last experiment, our target will be to attempt to obtain some degree of flexibility through centering the illustrated instruction of reversal on the remaining element of problem-solving: the means required to find out the solution of the problems of class 2.

Experiment 3
Method

Participants, Materials, and Experimental Sequence

According to Sidman (1960), there is not a minimum number of replications between subjects that could be understood as necessary to demonstrate the influence or effect of independent variables in behavioral research, when a within subject design of multiple reversion (e.g. ABAB) could not be implemented. The level of replication will depend on the degree of control exerted over the variables manipulated. Such was our case, since a new phase A (internal expectancies for class 1 and external expectancies for class 2) after our phase B (our reversal intervention, or Phase 4), would weakened seriously the believability of the context generated in our experiment. As we have observed in Experiments 1 and 2, the inclusion of 10 participants was sufficient, and even exceeded the minimum level of replication. So, like Visdómine et alia, (2010) did in one of their experimental conditions, the number of participants was reduced up to 5 in this experiment. As compensation, more complete tests for the participants' attributions and expectancies were implemented on Phases 3 (transfer and training of problems D and E) and 5 (reversal test) to asses with further accuracy the effect of the experimental treatments.

The five participants of this experiment were included following the same criteria as in the previous experiments. They were aged between 21 and 28 years old (M= 24.6; SD= 2.96), and three of them were females, and two males. One participant studied Architecture, another one studied Psychology, a third one studied Environmental Sciences, other studied Professional Training, and a fifth one studied Psychopedagogy. The material, experimental sequence, and problems were the same as the programmed for Experiments 1 and 2.

Procedure

The procedure was the same as in the earlier experiments. Only some minor corrections were implemented on the problems of class 1 to clarify their style. The main difference with the other experiments was the illustrated instruction presented to prompt a reversal of expectancies on Phase 4. In particular, the instruction was directed to reverse expectancies on class 2, leaving class 1 "locus" untouched. The instruction was centered on the means required to solve the problems of class 2, and said:

> "To this moment we have seen two types of problems; please, let me know if I am wrong. In some problems you have found out the solution by yourself, and you have resolved them; and in other problems we have had to tell you the solution and how they should be resolved, given their difficulty and the time we had. In the new phase, it is about you come to solve all the problems, both the easy ones as those you consider more difficult, since there will be of both types. So, what would you need, and what would you ask for us to be you who comes to solve the new problems, taking into account that all the things that you consider appropriate to ask for us will be steps that only you will give, and, therefore, will be part of the way to find out the solution… For instance, more time, perhaps? Paper and pencil? I do not know… To clarify some confuse issue about one of the problems? Whatever you think necessary to be yourself who find out the solution. We are convinced that you are able to do it in the right conditions, but we need to know what conditions are those. We will spend all the time you need to think about all the questions that let you solve the problems. Because we consider, tell me if I am wrong, that to solve a problem is not only to say the solution, but to take the necessary steps to do it, that is, it is the process itself, and sometimes

such process involves to ask others some questions or to make use of some tools. This is like a mathematician who faces a problem that requires of complex operations, and makes use of a calculator, or asks some concrete doubt to a colleague; in such a case we do not say that the mathematician has not resolved the problem; he only employs instruments to solve it. Well, from now on, this will be the situation, regardless what has happened up to now."

Finally, on Phase 5, after the test for the reversal, Experimenter 1 asked the participants two open questions to know their verbalizations about some general aspects of the experiment. So, the first question was: "Why have you answered as you have done when Experimenter 3 has made you some questions just a while ago (i.e., on the test of reversal)?" And the second question was: "Usually, in your daily life, in which conditions have you considered that you were the responsible for solving some problem by yourself?"

RESULTS

Data concerning the clues provided for training are represented on Figure 7. It can be seen that the modification made in the problems descriptions turn unnecessary the clues provided to the participants in the earlier experiments. In addition, the attributions training was clearly differentiated for problems A1, B1, C1, A2, B2, and C2 (see Figure 8). All participants reached the training criterion, and "ability" scores were significantly higher than "others' intervention" scores for the problems of class 1, $t(4)= 5.333$, $p= .006$, while "others' intervention" was significantly higher than "ability" for the problems of class 2, $t(4)= -9.036$, $p= .001$.

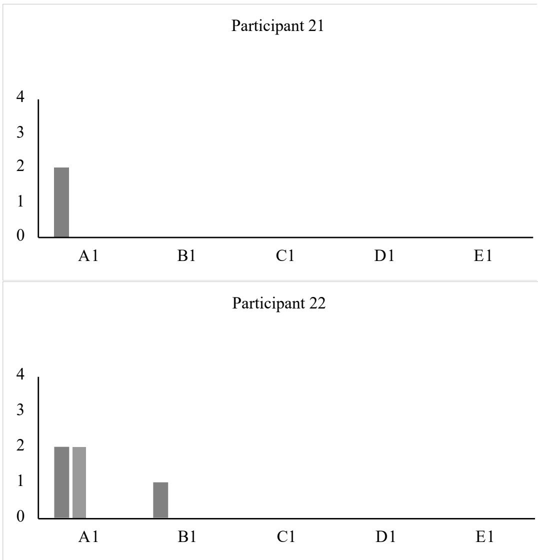

Figure 7. Graphic representation of the clues (columns) and repetitions of each clue (numbers in the Y axis) provided for the training of the problems of class 1 (A1, B1, C1, D1, and E1) in Experiment 3 (Participants 23, 24, and 25 did not require clues and therephore their graphic representations have not been included.

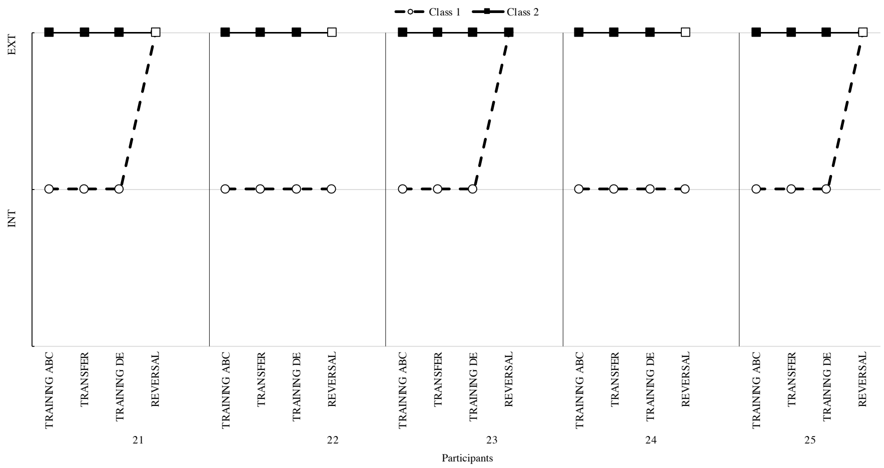

Figure 8. Graphic representation of the differential pattern of attributions and expectancies for each participant across the experimental phases in Experiment 3. *Notes*: INT= internal, indicates that the participant has scored "own ability" above "others" and "chance"; EXT= external, indicates that the participant has scored either "others" above "own ability" and "chance". White squares on the Class 2 line represent persistent doubts of the participants 21, 22, 24, 25 in the oral test of the reversal phase.

Regarding difficulty estimations, problems of both classes were rated with differences statistically significant at the beginning (PRE A, B, C), t(4)= -4.003, *p*= .027, though after the training of such problems (POST A, B, C), there were not differences statistically significant, *t*(4)= -2.025, *p*= .113. Even so, a visual analysis of the data (see Figure 9) reveals that the participants differentiated at a within-subject level both classes of problems, all but participant 25, who crossed her ratings between the classes.

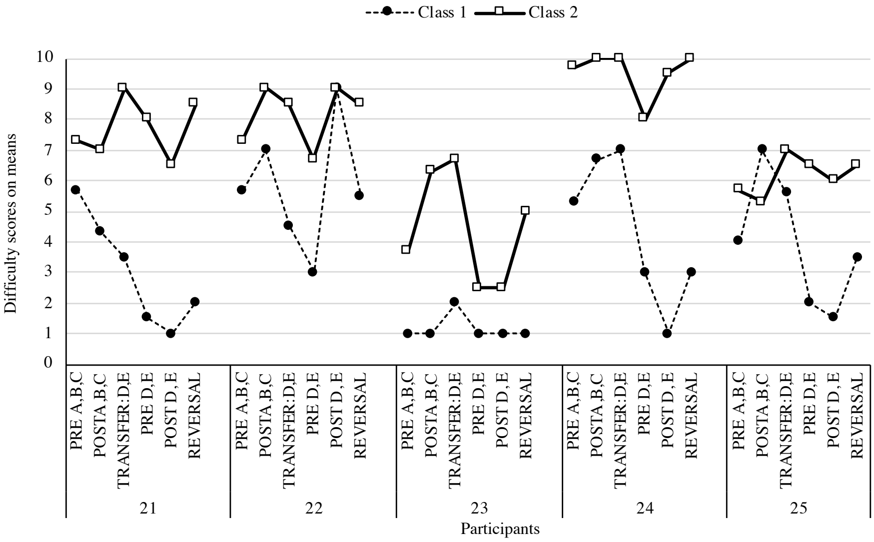

Figure 9. Evolution of difficulty scores (on means) for each participant in Experiment 3. According to the reversal intervention, difficulty scores did not reversed in the reversal phase.

The transfer of both internal and external control expectancies was clearly attained both asking aloud to the participants, and on the printed records. In the first test (i.e., aloud question), all participants manifested differentiated expectancies (see Figure 8), and in the second test (i.e., printed records), “ability” scores were significantly higher than “others’ intervention” scores for class 1 stimuli (D1, E1), $t(4)= 4.447$, $p= .011$; and “others’ intervention” scores were significantly higher than “ability” scores for class 2 stimuli (D2, E2), $t(4)= 4.353$, $p= .012$. Difficulty scores tested on the transfer also shed differences statistically significant according to the training procedure, $t(4)= -5.233$, $p= .046$.

When problems D and E were trained, attribution scores were clearly differentiated for both classes, and thus “ability” scores were significantly higher than “others’ intervention” scores for class 1, $t(4)= 6.139$, $p= .004$; and “others’ intervention” scores were higher than “ability” scores for class 2, $t(4)= -4.650$, $p= .016$. As happened with the training of the problems A, B, and C, the difference between the difficulty scores was statistically significant at the beginning, $t(4)= -5.151$, $p= .011$, but not after resolving the problems, $t(4)= -2.667$, $p= .053$. However, we find again that a visual exam of the data (see Figure 9) shows that all participants but one (participant 2) rated in a differential fashion both classes.

Finally, as regards reversal data, we find that, as expected, participants maintained their internal expectancies for class 1 stimuli (see Figure 8) both before the aloud question, and on the printed record, in which they showed differences statistically significant between “ability” scores and “others’ intervention” scores for class 1 stimuli, $t(4)= 3.992$, $p= .016$. However, in the oral test participants showed doubtful about their subsequent responsibility on the subsequent problems of class 2, and, indeed, their written scores in this class did not obtain differences statistically significant, $t(4)= .225$, $p= .833$, which would be in accordance with the experimental target, since the aim was to undermine the role of others in the solution of class 2 problems. Visually, we realize that participants 21 and 25 scored “ability” higher than “others’ intervention”, and participant 23 did not differentiate excessively the scores between “ability” and “others’ intervention”. Moreover, difficulty scores still maintained statistically significant differences between class 1 and class 2 stimuli, $t(4)= -5.462$, $p= .005$.

Consequently, we cannot say that the reversal instruction achieved the full reversion of control expectancies on class 2 (except for participants 21 and 25, as we have just said), but did “break” the transfer of expectancies, and put the participants in a really “expectant” state. In fact, when the participants were asked why they answered in the form they did it to Experimenter 3 (reversal test), all said that they did not know if answering according to what Experimenter 1 told them, or according to what they have experimented with the problems, to the extent that class 2 problems were excessively difficult. To the question of in which conditions throughout their life they had believed to have resolved by themselves any problem, the shared answer was that when they did not need anybody to do it, regardless the time and mistakes.

Discussion

In this experiment we find that a complete reversal of class 2 expectancies was not achieved through an instruction focused on the means needed to solve the problems. However, the responding of the participants changed from a defined pattern, as the produced in the lack of reversal in Experiment 1, to an undefined pattern in which most of the participants showed persistent doubts about their responsibility on the subsequent problems of class 2. This result was observed, at least, on the oral test of reversal. Even, there was some degree of incoherence between the oral and printed tests in some participants. Thus, participants 21 and 25 did not reverse their expectancies on the oral test, but they did it on the printed register, while participant 23 did reverse her expectancies on the oral test, but not on the printed register. Participants 22 and 24 showed doubtful on the oral test but their scores on the printed record were clearly differentiated, and maintained the same pattern as in the training and transfer. These results could be attributed to a lack of understanding of the reversal instruction, and it would be advisable in future research to test for the comprehension of such an intervention. However, this possibility is not feasible to have happened, since the incoherence is observed just in those elements that the instruction aimed to change (i.e., responsibility on class 2 problems), meanwhile the rest of the elements (responsibility on class 1 problems and difficulty estimations of both classes) maintained as the reversal instruction specified. One issue that varied across experiments is that the instruction in Experiment 3 did not include the presentation of individual stimuli (H, I, J). So, it is not clear if this fact could have influenced in some way on the results. In addition, the extent of the "illustrated" content of the reversal instruction was lower than that of Experiments 1 and 2, and this should be better controlled in future research.

In any case, such a discrepancy between both oral and printed tests can reflect a usual situation when people must respond to psychometric scales, which would be equivalent to our printed record. Even when people have doubts about some item of a scale, they are compelled to answer in some way defined by the person who made the scale, distorting their authentic response. Formal psychological evaluations are prone to reject undefined or open ("expectant") responses, and this supposes a lack of consideration of an essentially flexible response.

Likewise, the two open questions made to the participants at the end of the experiment did not lead to consider a lack of understanding. Conversely, participants' answers to such questions point out to the competitive effect between the experimenter's rule (the reversal instruction), and the participants' experience with the problems, as discussed in Experiment 2. Continuing the discussion about the "sensitivity to the contingencies" that we began in the previous experiment, we could add some reflections. In Experiment 1 such "sensitivity" (and its respective flexibility) was not produced due to an extensive and consolidated training history that, besides, were functionally incompatible with the discriminative functions included in the reversal instruction. But in Experiment 2 such flexibility could be attained due to a lesser consolidation of such history (thanks to a training of fewer exemplars), despite the same incompatible instruction as in Experiment 1 was employed. And in Experiment 3 a "halfway" sensitivity was reached. This "halfway" or emerging sensitivity involved to install some variability in the participants' responses. Some of such responses now presented with the form of doubts, which in terms of Barnes-Holmes *et alia* (2017) involve a higher flexibility. The shared responding was to provide one response to the experimenter and a different one on the printed record. Further, the participants did not accept automatically the experimenter's instruction (which, in addition, discarded the Pygmalion effect, i.e., to respond in accordance with experimenters' expectancies). And this is a result different to those of Experiments 1 and 2.

Accordingly, we must attribute to the component of problem-solving on which the reversal instruction was focused the origin of such sensitivity. This time the functions contained on the relations of the instruction “opened” the possibility of being the own participants the responsible for problem-solving without modifying the difficulty of the problems. But as the control expectancies of the participants were shaped through successive problems, the functions instructed did not reverse in a complete fashion such expectancies. This seems to be in the same line as Harte *et alia*’s (2020) conclusions. That is, depending on the source of the relational network, and the source of the contextual variable that aims to produce flexibility on such network, we will observe different levels of such flexibility. Thus, since the reversal instruction of this experiment did not contained a function directly incompatible with the self-discriminative function shaped, some degree of flexibility was observed. The level of task difficulty discriminated by the participants seems to be the other incompatible discriminative function that hindered the reversal of class 2 expectancies, since task features and own/others’ behavior were inextricably linked by the training procedure.

General Discussion

The experimental series presented in this article shows some of the relevant conditions that promote flexibility in a complex AARRing (i.e., EERR) established in the experimental setting (control expectancies). Two arbitrary classes were employed to train such AARRing, and as a consequence of such training, a parallel AARRing also arose after problem-solving (differential difficulty estimations); their transfer and reversal was equally tested for. Therefore, the current research is an example of how an elaborated and extended relational response can be investigated from a contextualist viewpoint.

One critical issue of the current experimental preparation was the employment of arbitrary classes present in the repertoire of the participants. Such classes could have entailed that all stimuli were directly related between them, but, as it was argued by Visdómine *et alia* (2010), it is not feasible that all stimuli appearing in the experiment were directly related in such a way due to the extension of the classes used. This extension was in fact the main reason to choose this type of classes. Otherwise, participants could have suffered experimental fatigue, and, it could have undermined their attention and implication in generating the complex AARRing of control expectancies, which were the very target of the experiment.

Other critical issue of the present study is the involvement of different experimenters “in the flesh”, and not through messages of computer programs. This kind of intervention is subjected to multiple inconveniences. Perhaps, the main of such troubles probably is the lack of complete control over the interactions that composed the experimental treatments. However, the use of multiple registers and the design of multiple replications between subjects allowed better observing and controlling the effects of the intervention. Furthermore, the direct involvement of experimenters should be perhaps considered an essential element of behavioral research that aims to investigate issues like “sensitivity to contingencies” or the difference between shaped and instructed human behavior. The major reason is that the interaction with others is the very source of the functions implicated in such kind of behavior. The mere presentation of an instruction on a PC screen should not be interpreted automatically as a “ply” or rule supported by others’ social contingencies. The experimental subject could also respond to such instruction as if it were a “track” or rule supported by the specification of subsequent contingencies. The substitution of other persons for computer messages, which is the prevalent methodology in behavioral research nowadays, can denaturalize excessively the experimental analogue intended to reproduce natural interactions, and this could be one of the variables distorting the data obtained in fields like the mentioned above. In these fields the presence of others as “contingency deliverers” is fundamental. Even, the physical presence of experimenters does not guarantee this functional distinction, but it is a closer step. A further manipulation of consequences would be necessary to asses if instructions as the used here work as a ply or as a track. In our case, we can only talk about the “functional coherence” between the relations prompted by the training contingencies and the relations specified by the instructions.

As regards the effect of the conditions arranged to facilitate flexibility on control expectancies, we can conclude that the extent of strengthening is basic, even when the verbal intervention that was aimed to achieve such flexibility dealt with self-discriminative functions incompatible with the core self-discriminative functions potentiated through the training (i.e., own vs. others’ ability in problem-solving). Moreover, only in the case of a history that served to produce a transfer of expectancies, but that left open the confirmation of such expectancies, flexibility could be produced. Other conditions able to produce such flexibility occurred when the verbal interventions were focused on difficulty (see Visdómine *et alia*, 2010), or on the means needed (see Experiment 3).

These results are alike to some experiences observed in the clinic, as when therapists find strong resistances in changing the attributions and control expectancies of their clients about coping with situations and interactions that the clients do not believe to be able to take over. Clients, for example, often say that they cannot face situations linked to uncomfortable thoughts and feelings, mainly when the intensity of such feelings is quite high. Usually, this high level of uncomfortable feelings appears when the history behind such private events has been excessively potentiated. This is a phenomenon often found when traditional cognitive strategies like “thought suppression” (Wenzlaf & Wegner, 2000), or attribution restructuring (Jacobson *et alia*, 1996; Longmore & Worrell, 2007) are employed. The direction toward which our results seem to point out is that these strategies do not work because they try to instruct arbitrary relations with functions that are directly incompatible to the functions emerged from the history of the clients. This possibility seems only feasible when the history of such clients has not been excessively strengthened (as our Experiment 2 demonstrates in relation to control expectancies). Therefore, traditional cognitive therapy could work when clients’ attributions and expectancies have not been largely reinforced. A direct change of cognitions (elaborated and extended relational networks in contextualistic terms) are not easily attainable when such cognitions are firmly established. This phenomenon has been labeled “cognitive rigidity” (Cohen, 2017), and an alternative procedure to promote such psychological flexibility would be needed. Such procedure could consists of introducing verbal or relational interventions that could alter the motivational function involved in behaving in accordance with one relational network or another, regardless the topography and content of such networks. In this way, the involvement of aversive private events like feelings of sadness, inferiority, dependence, incapability, etc. in those networks would be “irrelevant”. A form could be to help to discriminate the hierarchical relations of the I-Others relational frame, and to link this hierarchical frame to regulatory functions toward personal values (i.e., long-lasting and hierarchically superior reinforcement contingencies), such that other self-discriminations or psychological contents like own ability attributions, thoughts of incompetence, dependence on others’ intervention in solving the own problems, etc., would be placed in a level hierarchically inferior to that of personal values, as recent studies have done with clear and promising results from an ACT-based clinical intervention (Gil Luciano *et alia*, 2017; Luciano *et alia*, 2011).

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