

The Role of Common Physical Properties and Augmental Functions in Metaphor Effect

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ABSTRACT

Metaphor is a tool frequently used in psychotherapy such as Acceptance and Commitment Therapy (ACT), a contextual behavioral model of psychological intervention rooted in an approach to human language and cognition known as Relational Frame Theory (RFT). This experimental analogue study aimed to analyze the effect of two variables in the metaphor effect on promoting psychological flexibility according to RFT: (a) the presence of common physical properties between the individual's experience and the metaphor, and (b) the specification of appetitive augmental functions in the metaphor content. A 2x2 factorial design was implemented where the presence/absence of the above-mentioned variables was manipulated. Eighty-three participants first responded to measures of experiential avoidance, cognitive fusion, and generalized pliance. Subsequently, they were exposed to a cold-pressor task at pretest. Afterwards, participants were randomly assigned to four experimental protocols consisting of a metaphor that included: (a) common physical properties and augmental functions, (b) only common physical properties, (c) only augmental functions, and (d) none of these variables. Then, participants were re-exposed to the cold-pressor task (posttest). The results showed that both variables had a statistically significant effect on the pain tolerance induced by the cold-pressor task.

Key words: metaphor; ACT, Relational Frame Theory, physical properties, augmenting, personal values.

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Novelty and Significance

What is already known about the topic?

- There is no empirical RFT research on the metaphor components that maximize the promotion of psychological flexibility.
- Previous RFT research has shown that analogies with common physical properties are judged as more apt than purely verbal ones.

What this paper adds?

- First empirical analysis of the metaphor components that promote psychological flexibility.
- Provides data supporting the inclusion of common physical properties and augmental functions in the metaphor content.

Analogy is broadly described as relating two situations that share a common pattern of relations among their constituent elements (e.g., Holyoak, 2005), whereas most theorists consider the metaphor as a special type of analogy in which one of the situations is more representative than the other (e.g., Gentner, Bowdle, Wolff, & Boronat, 2011). Both analogy and metaphor facilitate the rapid understanding of one situation by reference to another. This generative ability has turned them into very frequently used

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tools in diverse applied settings (Bassok & Holyoak, 1989; Blanchette & Dunbar, 2001; Capelli & Jolibert, 2009; Hesse, 1966). For instance, multiple forms of psychotherapy have emphasized the use of metaphor as a way to facilitate the clients' understanding of their problems and experiences by reference to another situation that is clearer and more representative (e.g., Kopp, 1995; Stoddard & Afari, 2014; Tay, 2013; Törneke, 2016). This emphasis of psychotherapy on metaphor is not surprising because it usually addresses abstract topics (e.g., emotions, feelings, expectations) that have their own origin in metaphor (e.g., Lakoff & Johnson, 1981; Skinner, 1945). Furthermore, psychotherapy usually addresses counterintuitive facts that are more difficult to understand when referring to them directly (e.g., Törneke, 2016; Villatte, Villatte, & Hayes, 2016).

In spite of its recognized relevance for psychotherapy, relatively little research has been conducted to isolate the specific components that make metaphors more useful in this setting. McCurry and Hayes (1992) conducted a review of the field, finding that three components seem to be associated with the successful use of metaphors: memorability, comprehensibility, and aptness. However, the specific factors that promote these components are not very well known. Subsequent research has found that the number of metaphors used in therapy is not an important factor but instead the cooperation between the therapist and the client in the generation of metaphors (Angus, 1996; Angus & Rennie, 1988; Törneke, 2016). Additional research has found that the use of metaphor by the therapist increases the chances that the client will remember the session (Martin, Cummings, & Hallberg, 1992).

Two main problems have been detected in metaphor research in psychotherapy (e.g., McMullen, 2008; Tay, 2013; Törneke, 2016). On the one hand, studies on the topic often use different definitions of metaphor, which hinders the communication and replication of results. On the other hand, the research conducted has analyzed metaphor independently of the context in which it is used. Therefore, a more functional approach to metaphor use in psychotherapy is needed in which the research question would be what features of metaphor facilitate the accomplishment of specific therapeutic goals (McMullen, 2008; Törneke, 2016). This research rationale would lead to the analysis of metaphor as used in different forms of psychotherapy to obtain specific objectives.

Acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999) is usually recognized for the wide use of metaphors (e.g., Stoddard & Afari, 2014). ACT is a contextual-behavioral model of psychological intervention that pursues the promotion of psychological flexibility. As it is rooted in an approach of human language and cognition known as relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001), ACT is in a privileged position to develop a research program of metaphor that could potentially increase its efficacy. Precisely, one of the topics with more fruitful research within RFT is analogical reasoning (e.g., Ruiz & Luciano, 2012).

RFT defines analogy as the establishment of a relation of coordination (i.e., sameness or equivalence) among common types of relations (Lipkens, 1992; Stewart, Barnes-Holmes, Hayes, & Lipkens, 2001). For instance, if we establish relations of coordination between the Spanish words "silla" and "estrella" and the English words "chair" and "star," then we could establish a simple analogy by deriving a frame of coordination between the two trained relations (i.e., silla is to chair as estrella is to

star). Metaphors are relationally more complex than analogies because they involve the presence of additional forms of relational control based on physical or functional properties. Additionally, these physical or functional properties are more representative (i.e., a hierarchical relation) in one of the relational networks, which causes the transformation of functions in metaphor to be unidirectional (Foody, Barnes-Holmes, Barnes-Holmes, *et al.*, 2014; Ruiz & Luciano, 2011, 2012; Törneke, 2010, 2016). Specifically, according to Stewart and Barnes-Holmes (2001), metaphor involves the following elements: (a) deriving a frame of coordination between two separate relational networks, (b) discriminating a formal relation via the previous derivation, (c) modifying the relational network of the target, and (d) transforming functions of the target based on the formal relation discriminated.

Research of the use of metaphors in ACT should be mainly directed to finding which components facilitate the promotion of psychological flexibility. From an RFT perspective, psychological flexibility is conceptualized as the generalized repertoire of framing ongoing behavior in hierarchy with the deictic I (i.e., observing and taking distance from the ongoing behavior), which typically reduces the discriminative functions of ongoing behavior and allows the derivation of rules that specify appetitive augmental functions (i.e., valued directions) and behavior that is in accordance with them (Luciano, Ruiz, Vizcaíno Torres, *et al.*, 2011; Luciano, Valdivia Salas, & Ruiz, 2012; Luciano, Valdivia Salas, Cabello, & Hernández, 2009; Ruiz & Perete, 2015; Törneke *et al.*, 2016). Some predictions can be made following the previous definition. For instance, metaphors that would lead clients to derive appetitive augmentals (i.e., rules that specify a conditional or causal relation between behaving in a particular way and obtaining abstract positive reinforcers) would be more efficacious than others that do not specify these augmental functions.

To date, although some suggestions have been made to improve the efficacy of metaphors (e.g., Foody *et al.*, 2014; Törneke, 2016; Villatte *et al.*, 2016), RFT research has not devoted much effort to analyze what components of metaphors promote psychological flexibility. The more related studies are the ones conducted by Ruiz and Luciano (2015, 2016). In Ruiz and Luciano (2015), participants judged experimental analogies as more apt when the relational networks contained common physical properties (color spots) than when they did not share these properties. In a subsequent study, Ruiz and Luciano (2016) demonstrated that the inclusion of common physical properties among relational networks also facilitates a faster derivation of the analogy.

Although previous studies are relevant, they are difficult to extrapolate to ACT practice because their dependent variables were not indicators of psychological flexibility. The current study aimed to advance in the RFT analysis of the components of metaphors in their effect on promoting psychological flexibility. Specifically, the effect of two components of metaphors in pain tolerance in a cold-pressor task is tested. On the one hand, following the studies by Ruiz and Luciano (2015, 2016), we tested whether the presence of common physical properties between the relational networks involved in the metaphor improved its effect on increasing pain tolerance (i.e., more psychologically flexible reaction to pain). Common physical properties among relational networks are additional relational cues to analogy derivation so that participants might identify their

experiences better with the metaphor content. On the other hand, following analogue studies that have shown the effect of including personal values (e.g., Branstetter-Rost, Cushing, & Douleh, 2009; Gutiérrez, Luciano, Rodríguez, & Fink, 2004; Luciano *et al.*, 2010, 2014; Páez Blarrina *et al.*, 2008), we tested whether the inclusion of experiencing pain as a condition to act according to appetitive augmentals would increase the metaphor effect in pain tolerance (in line with Luciano *et al.*, 2010).

This study could be considered an analogue of a situation in which an individual needs to tolerate intense pain in order to follow a valued direction; for example, when the individual is in a painful rehabilitation process after being exposed to surgery (Fernández, Luciano, & Valdivia Salas, 2012). In this situation, the ACT therapist would need to know if it is better to include physical properties similar to the individual's pain in the metaphor content and to specify appetitive augmental functions.

METHOD

Participants

Eighty-three undergraduates (42 women; age range= 18 to 34; $M= 19.47$, $SD= 1.46$) attending different courses participated in the experiment. None of them had previous experience with the procedures or the theory (i.e., RFT and ACT) involved in this study. Exclusion criteria were suffering from cardiac and circulatory affections, hypertension, diabetes, epilepsy, chronic pain conditions, or recent wounds (only one participant was excluded because of suffering from arrhythmia) because the experimental task (i.e., cold-pressor) might have adverse effects on them.

Design and variables

This study follows a 2x2 factorial design. Independent variables were: (a) the presence or absence of common physical properties with the discomfort experienced in the cold-pressor task, and (b) the presence or absence of explicit augmental functions in the metaphor content (i.e., a personal value context). The combination of these two independent variables led to the four experimental conditions. The protocol of Condition A involved a metaphor that included common physical properties with the discomfort and specified augmental functions to tolerate the pain. The metaphor of Condition B only included common physical properties. The metaphor of Condition C only included the specification of augmental functions to tolerate pain, whereas the metaphor in Condition D did not include any of these components.

The main dependent variable was pain tolerance as measured by the percentage of time tolerating the pain at posttest in relation to pretest, where spending the same amount of time at posttest as at pretest would correspond to 100%, spending twice the time would be 200%, and so on. We computed these scores because the cold-pressor task is known for the variability in participants' response, so this way of scoring somehow controls for the time tolerated in the task at pretest. Differential scores can be tricky in this case because a difference of 10 s is not the same for a participant who

tolerated the task for 100 s or only for 10 s (i.e., in the first case, the improvement is very small, whereas in the second case, it is double). A secondary dependent variable was pain perception as measured by the differential score between pretest and posttest (differential score = posttest score – pretest score).

Participants were randomly allocated to the experimental conditions with the sole restriction of maintaining the same proportion of men and women because previous research has shown some gender differences in performance of the cold-pressor task (e.g., Keogh *et al.*, 2005; Pokhrel *et al.*, 2013).

Setting and Apparatus

All sessions were conducted individually in an experimental room equipped with a table, two chairs, an armchair, a tablet, headphones, a 30x20x20 cm glass container with two interconnected compartments: one for the ice and the other for the water. In the latter compartment, participants introduced their hands. A digital thermometer was adhered to the container to control the water temperature. Two water pumps (300 litres per hour) were also adhered to the glass container to maintain the water circulating. An ice maker machine was used to keep the temperature of the glass container constant.

Experimental Task

The cold-pressor task was used as the experimental task. It has been broadly used in medical and psychological studies because the sensation that it produces on participants is analog to particular conditions such as chronic pain and persistent psychological distress. Participants were invited to introduce their right hand up to their wrist in a glass container with circulating ice water at 4.5 to 5.5 Celsius degrees. This temperature is higher than the usual (1 to 3 Celsius degrees) but, according to Mitchell, MacDonald, and Brodie (2004), this higher temperature facilitates the use of the strategies trained by the experimenter. Participants were requested to leave their hand in the water for as long as possible, but they were also reminded that they were free to stop and remove their hands from the water at any time. Pain tolerance was measured by the total amount of time participants kept their hand in the water. Participants who kept the hand in the water for 300 seconds at pretest were excluded from further participation in the study because they reached the maximum admissible pain tolerance for ethical reasons.

Instruments

Acceptance and Action Questionnaire-II (AAQ-II; Bond *et al.*, 2011; Spanish version by Ruiz, Langer, Luciano, Cangas, & Beltrán, 2013; Ruiz *et al.*, 2016). The AAQ-II is a general measure of psychological inflexibility. It consists of 7 items that are rated on a 7-point Likert-type scale (7 = always true; 1 = never true). Cronbach's alpha for this study was .87.

Cognitive Fusion Questionnaire (CFQ; Gillanders *et al.*, 2014; Spanish version by Ruiz, Suárez Falcón, Riaño Hernández, & Gillanders, 2016). The CFQ is a general measure of cognitive fusion. It consists of 7 items that are rated on a 7-point Likert-type scale (7 = always true; 1 = never true). Cronbach's alpha for this study was .90.

Generalized Pliance Questionnaire (GPQ; Ruiz et al., 2016). The GPQ is a measure of generalized pliance (i.e., a behavioral repertoire characterized by having social approval as the main source of reinforcement; Luciano, Valdivia Salas, & Ruiz, 2012; Törneke, Luciano, & Valdivia Salas, 2008). It consists of 18 items that are rated on a 7-point Likert-type scale (7= always true; 1= never true). Cronbach's alpha for this study was .92.

Self-reports of pain during the cold-pressor task. After each exposure to the cold-pressor task, participants were asked how intense was the induced pain on a 10 cm, visual analogue scale (VAS).

Assessment of the protocol comprehension. To ensure the understanding of the protocol, participants were asked the following four questions on a piece of paper: (a) Where does the story happen?, (b) How was the water in the story?, (c) What would you feel if you swam to the other side?, and (d) What would you obtain if you swam to the other side?

Protocols

The protocols were presented in audios of approximately 4 minutes through headphones connected to a tablet. They had common components at the beginning and the end of the recording. In the beginning, all participants listened to the following instructions: "You come from the cold-water task. Now, remember the sensation you felt in your hand while you were doing the task (pause of 15 s). As you know, the aim of this experiment is to analyze which strategies people with chronic pain could use to obtain the things that are important for them even though they are experiencing pain. Your participation in this experiment is important because it could contribute to the quality of life of individuals living with chronic pain. We are not expecting any results in particular, anything you do is OK for us. We only ask you to do the task honestly and to try to follow the next exercise. Now I'd like you to imagine this."

Participants then received the randomly assigned protocol. Afterwards, the recording ended by saying: "Now, you are going to do the task again. We suggest you to try to put into practice what the story told you and see if it could help you to bear the discomfort of the task better. Remember that anything you do is OK for us, and that we are not expecting anything special in any direction. We have finished, please call the experimenter."

All protocols consisted of adapted versions of the swamp metaphor (Hayes *et al.*, 1999; Gutiérrez *et al.*, 2004), where the independent variables were manipulated by stating that the water of the swamp is cold or dirty (presence or absence of common physical properties with the cold-pressor task) and that, on the other side of the swamp, there is the most important thing for the participant or the same landscape (i.e., presence and absence of augmental functions to tolerate pain). The differential sentences of the protocols are italicized.

Protocol A. This protocol presented a metaphor involving common physical properties with the discomfort experienced during the cold-pressor task and the specification of augmental functions to tolerate it. After the introduction (see above), the recording followed by saying: "Imagine you are at the edge of a big swamp. The other side of the swamp is very far away and it would take you several minutes to get there. On

the other side of the swamp, *try to imagine that there is the most important thing for you, this thing you dream about, the one that excites you the most and makes you vibrate*. Please, let yourself think for a few seconds what would be on the other side of the swamp and the emotion that would drive you to get there (pause of 30 s). The water of the swamp is *very cold* and when you look at the other side, you realize that the only way to get there is to cross the swamp by swimming. It would take you five minutes to get to the other side. The farther you swim in the swamp, the more *cold* you would feel, but you would know that you would be much closer *to this thing that is so important for you*. You would also know that *cold* is something you would feel momentarily, something uncomfortable that it makes sense to feel for a few minutes because on the other side is *the most important thing for you*. Please, let yourself imagine the feeling that you would have swimming in the swamp while going to the other side and the feeling that you would have seeing the other side closer (pause of 15 s). What would you choose to do? Would you stand at the edge of the swamp watching *how the most important thing for you fades away on the other side* or would you jump into the water and swim despite the discomfort of the *cold?* (pause of 10 s)."

Protocol B. This protocol presented a metaphor involving common physical properties without specifying augmental functions. The recording proceeded: "Imagine you are at the edge of a big swamp. The other side of the swamp is very far away and it would take you several minutes to get there. On the other side of the swamp, *there is a landscape that is exactly the same as the one you are seeing from your side*. Please, think for a few seconds what would be on the other side of the swamp and the emotion that would drive you to get there (pause of 30 s). The water of the swamp is *very cold* and when you look at the other side, you realize that the only way to get there is to cross the swamp by swimming. It would take you five minutes to get to the other side. The farther you swim in the swamp, the more *cold* you would feel, but you would know that you would be much closer *to the other side*. You would also know that *cold* is something you would feel momentarily, something uncomfortable that it makes sense to feel for a few minutes *to reach the other side*. Please, let yourself imagine the feeling that you would have swimming in the swamp while going to the other side and the feeling that you would have seeing the other side closer (pause of 15 s). What would you choose to do? Would you stand at the edge of the swamp looking *at the landscape from the other side* or would you jump into the water and swim despite the discomfort of the *cold?* (pause of 10 s)."

Protocol C. This protocol presented a metaphor that specified augmental functions to tolerate pain without common physical properties with the discomfort experienced during the cold-pressor task. The recording followed: "Imagine you are at the edge of a big swamp. The other side of the swamp is very far away and it would take you several minutes to get there. On the other side of the swamp, *there is the most important thing for you, this thing you dream about, the one that excites you the most and makes you vibrate*. Please, let yourself think for a few seconds what would be on the other side of the swamp and the emotion that would drive you to get there (pause of 30 s). The water of the swamp is *thick, filthy, and smells like a sewer*, and when you look at the other side, you realize that the only way to get there is to cross the swamp by swimming. It would take you five minutes to get to the other side. The farther you swim in the swamp, the more *smell and disgust* you would feel, but you would know that you would be much closer *to this thing that is so important for you*. You would also know that *disgust* is something you would feel momentarily, something uncomfortable that it makes sense to feel for a few minutes because on the other side is the *most important thing for you*. Please, let yourself imagine the feeling that you would have swimming in the swamp while going to the other side and the feeling that you would have seeing the other side closer (pause of 15 s). What would you choose to do? Would you stand at the edge of the swamp watching how the *most important thing for you*

fades away on the other side or would you jump into the water and swim despite the discomfort of the *disgust?* (pause of 10 s).”

Protocol D. This protocol presents a metaphor without common physical properties and without specifying augmental functions to tolerate pain. The recording proceeded as follows: “Imagine you are at the edge of a big swamp. The other side of the swamp is very far away and it would take you several minutes to get there. On the other side of the swamp, *there is a landscape that is exactly the same as the one you are seeing from your side.* Please, let yourself think for a few seconds what would be at the other side of the swamp and the emotion that would drive you to get there (pause of 30 s). The water of the swamp is *thick, filthy and smells like a sewer* and when you look at the other side, you realize that the only way to get there is to cross the swamp by swimming. It would take you five minutes to get to the other side. The farther you swim in the swamp, the more *smell and disgust* you would feel, but you would know that you would be much closer *to the other side.* You would also know that *disgust* is something you would feel momentarily, something uncomfortable that it makes sense to feel for a few minutes *to reach the other side.* Please, let yourself imagine the feeling that you would have swimming in the swamp while going to the other side and the feeling that you would have seeing the other side closer (pause of 15 s). What would you choose to do? Would you stand at the edge of the swamp watching *the landscape from the other side* or would you jump into the water and swim despite the discomfort of the *disgust?* (pause of 10 s).”

Procedure

The procedure of the study was approved by the Center for Psychological Research of the institution. All participants signed an informed consent that made explicit the procedures and participation conditions. The experimental sessions were conducted individually and lasted approximately 30-40 minutes distributed in four phases (see Figure 1):

Phase 1. Pre-experimental measures. The first 15 minutes were used to obtain the pretest measures, which were preceded by an informed consent to exclude participants who reported some medical history incompatible with the cold-pressor task. In order to make the experimental task valuable to them, participants were told that the aim of the study was to analyze what kind of coping strategies might be helpful to people suffering from constant pain and/or who have to deal with situations that are accompanied by much discomfort. Then, participants responded to the AAQ-II, CFQ, and GPQ.

Phase 2. Pretest cold-pressor task. Participants were first exposed to the cold-pressor task in company of the experimenter. Participants received the following instruction: “Insert your right hand up to the wrist and keep it in as long as possible. Remember that you can take it out at anytime.” The experimenter measured with a chronometer the time since the participant inserted the hand until he removed it. At the end of the exposure, participants were asked to respond to the VAS of the perceived pain during the task.

Phase 3. Protocols. Participants were then randomly assigned to one of the four experimental conditions. Participants were asked to sit and listen to the protocols through headphones. To avoid the potential influence of the experimenter’s expectations, he did not know which protocol the participant was hearing. After listening to the protocol, participants were given a sheet with the four brief questions about the story they had just heard.

Phase 4. Posttest cold-pressor task. Participants were invited to perform the cold-pressor task again. Afterwards, they were completely debriefed about the aims of the experiment.

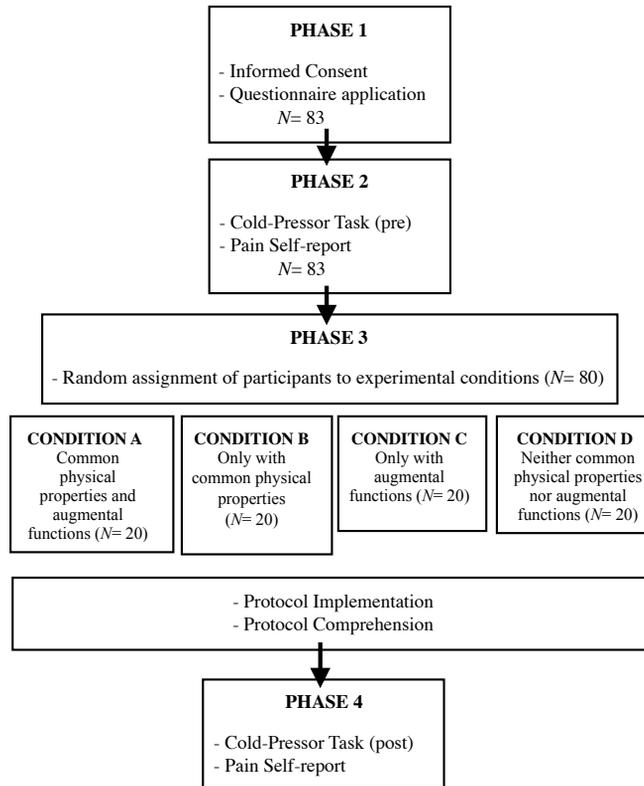


Figure 1. Overview of the experimental procedure.

Data analysis

The total number of participants was a priori determined with G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Fuchner, 2007) by specifying a medium to large effect size ($\eta^2 = .10$), power of .80, and alpha error probability of .05 in the option “ANOVA: fixed effects, special, main effect and interactions.” The power analysis indicated that a total of 75 participants was necessary to detect a medium to large effect size through a two-way ANOVA.

Statistical analyses were performed on SPSS 19[®]. One-way analyses of variance (ANOVAs) were first conducted to explore the equivalence of the experimental conditions on experiential avoidance (i.e., AAQ-II scores), cognitive fusion (i.e., CFQ), generalized pliance (i.e., GPQ), and pretest tolerance and intensity of pain in the cold-pressor task (Phase 2).

Given the presence of outliers in the percentage of time tolerating the pain at posttest in relation to pretest that violated the assumptions of normality and homoscedasticity to conduct ANOVAs, 10% of the data in each experimental condition were trimmed

(2 participants in the upper and lower limit per condition, respectively). Subsequently, two-way ANOVAs were computed to analyze differential effect of the protocols. The proportions of the total variance that is attributed to an effect (i.e., eta squared or η^2) are reported as effect sizes typical of ANOVA. Eta squared values of .01, .06, and .14 were interpreted as small, medium, and large effects, respectively. Lastly, between-condition effect sizes in Phase 4 were calculated with Cohen's d (Cohen, 1988), which can be interpreted as small ($d = .20$ to $.49$), medium ($d = .50$ to $.79$), and large (above $d = .80$).

RESULTS

The one-way ANOVA revealed that there were no differences between the experimental conditions in the AAQ-II, CFQ, GPQ, pretest tolerance, and pain intensity (see Table 1). Accordingly, the experimental conditions seem to be equivalent at pretest in these variables.

Participants' performance for each experimental condition can be observed in Figure 2. Only three participants in Condition D (no common physical properties and no augmental functions) showed a decrease in pain tolerance from preintervention to postintervention. Eight out of 16 participants in Condition A showed improvements higher than 200%, whereas only 4, 4, and 2 participants in Conditions B, C and D, respectively, showed this improvement level.

Figure 3 and Table 2 show the descriptive data in the percentage of time tolerating the pain at posttest in relation to pretest for each experimental condition. Participants in Condition A showed the highest score ($M = 202.63$, $SD = 62.27$), followed by Conditions B and C ($M = 172.19$, $SD = 41.54$; $M = 171.19$, $SD = 53.09$, respectively), and Condition D ($M = 139.21$, $SD = 46.52$), which showed the lowest score. According to the two-way ANOVA, both independent variables had a statistically significant effect on pain tolerance (common physical properties with the discomfort, $F_{(1)} = 6.135$, $p = .016$, $\eta^2 = .093$; specification of augmental functions, $F_{(1)} = 6.024$, $p = .017$, $\eta^2 = .091$). The effect

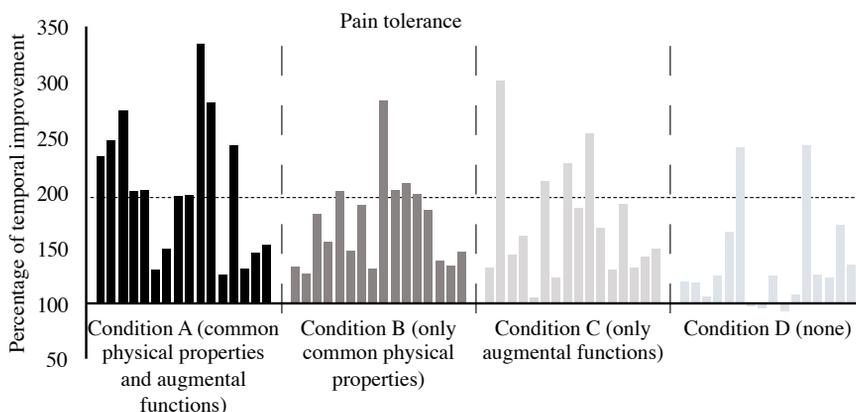


Figure 2. Percentage of temporal improvement in pain tolerance in posttest in relation to pretest for participants of each experimental condition. The horizontal, dashed line highlights improvements above 200% of temporal improvement.

sizes of both independent variables were medium. There was no interaction between the two independent variables, $F_{(1)} = .008, p = .93, \eta^2 = .000$.

Between-condition Cohen's d are also presented in Table 2. Effect sizes between Condition A (which included both independent variables) and Conditions B and C (which included only one independent variable) were medium, whereas the effect size with relation to Condition D (which did not include any independent variable) was large.

Table 3 shows the descriptive data with regard to differential pain perception for each condition. The two-way ANOVA showed that the independent variables did not show a statistically significant effect (common physical properties with the discomfort, $F_{(1)} = .876, p = .846, \eta^2 = .000$; specification of augmental functions, $F_{(1)} = 1.861, p = .178, \eta^2 = .03$. There was no interaction between the two independent variables, $F_{(1)} = .038, p = .846, \eta^2 = .001$.

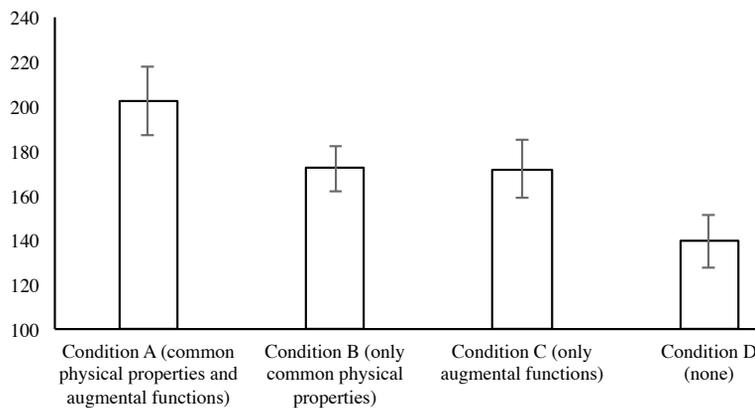


Figure 3. Mean percentage of temporal improvement in posttest in relation to pretest for each experimental condition and error bars.

Table 2. Descriptive data for each condition regarding the Percentage Time Tolerating Pain at Posttest in relation to Pretest

Conditions	A	B	C	D
Between-Condition Cohen's d				
A		.59	.53	1.17
B			.01	.75
C				.66
<i>M</i>	202.63	172.19	171.91	139.21
<i>(SD)</i>	(62.27)	(41.54)	(53.09)	(46.52)

Notes: Condition A= common physical properties and augmental functions; Condition B= only common physical properties; Condition C= only augmental functions; Condition D= none.

Table 3. Descriptive data (mean and standard deviation) for Pre-Post Change in Pain Intensity in each condition.

	Condition A (values and common physical properties)	Condition B (only common physical properties)	Condition C (only values)	Condition D (none)
<i>M</i>	-.94	-.27	-.92	-.34
<i>(SD)</i>	(2.41)	(1.85)	(1.89)	(1.87)

DISCUSSION

The current study aimed to analyze the effect of two components of metaphors as conceptualized by RFT in an analogue study in which participants were exposed twice (i.e., pretest and posttest) to a cold-pressor task. Specifically, the two components manipulated in this study were: (a) the presence of common physical properties between the metaphor content and the individual's painful experience, and (b) the specification of augmental functions to tolerate pain. The combination of the two levels (i.e., presence or absence) led to a 2x2 factorial design. After pretest exposure to the cold-pressor task, participants were randomly allocated to one of the experimental conditions and listened to a 4-min protocol through headphones. The experimenter was blinded to the experimental condition to which participants were assigned.

The results of the experiment showed a significant effect of both independent variables on pain tolerance. In other words, the inclusion of common physical properties with the pain experienced by participants and the specification of augmental functions to tolerate pain increased the effect of the metaphor. These variables did not show interaction, and their effects were summative. No significant change took place in pain intensity across conditions. This suggests that the process of change of the protocols was not necessarily the decrease of pain perception but the alteration of the discriminative functions for avoiding pain by incorporating appetitive augmental functions to tolerate pain (i.e., psychological flexibility). These results are consistent with other studies (e.g., Gil Luciano, Ruiz, Valdivia-Salas, & Suárez Falcón, in press; Gutiérrez, Luciano, Rodríguez, & Fink, 2004) where it was found that ACT-based protocols did not reduce pain, but increased pain tolerance.

One interesting finding of this study is that common physical properties had an effect on increasing pain tolerance even when the metaphor did not specify appetitive augmental functions (i.e., valued directions). It seems that common physical properties could have caused better identification with the metaphor and this might lead participants to provide value to the task, as the experimental context posited some general meaning that might be working as positive abstract reinforcers such as helping people suffering from chronic pain or surpassing oneself.

Some limitations of the study are worth mentioning. Firstly, the effect of the protocols was tested only in an experimental task. Further research could incorporate additional experimental tasks of different types to allow better generalization of the results. Secondly, only undergraduate students participated in this study, which reduces the generalization of the results. Thirdly, the sample size was small to conduct moderation analyses. Future research could explore whether metaphors that specify augmental functions work better for participants showing high levels of psychological flexibility, as they would show higher values clarity and distancing skills than participants with high psychological inflexibility. Additionally, the inclusion of common physical properties might show a higher effect in participants with low and medium levels of analogical reasoning abilities because they facilitate the comparison of the two parts of the metaphor (i.e., relational networks). However, participants with a high level of analogical reasoning

might not benefit from the inclusion of common physical properties because they derive metaphors very fluently so that they do not need aids to compare the two parts of the metaphor (e.g., Ruiz & Luciano, 2011, 2015).

In conclusion, according to the results of this study, the ACT therapist from the example of the person in a painful rehabilitation process after surgery should design a metaphor that includes common physical properties with the experienced pain and specify appetitive augmentals to tolerate it.

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