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Attending to individual recipients' knowledge when generating persuasive analogies

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ABSTRACT

When addressing the general population, experts and novices ground analogical arguments on culturally shared situations. No studies, however, have assessed the extent to which the analogies used in person-to-person exchanges relate to the background knowledge of their intended recipient. In Experiment 1, two groups of psychology students received a description of a patient seeking psychological assistance. They were tasked with generating analogies to dissuade her from embarking on a short therapy, on the grounds that such therapies leave the underlying causes unchanged. While one of the groups was asked to analogise to the knowledge background of the patient, the other group was not given such indication. Results showed that even though participants can adjust their analogies to their addressees upon explicit request, they rarely do it spontaneously. Experiment 2 yielded similar results despite a more vivid presentation of the critical information about the recipient. A final study showed that a sample of the same population regards tailored analogies as being more persuasive than non-tailored analogies, thus confirming that participants of the first two experiments selected analogies that were less appropriate than other types of analogies that they are capable of generating.

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Drawing an analogy involves acknowledging that two situations, whose objects maintain superficial differences, are organised by similar systems of relations. Based on a mapping between elements playing parallel roles, knowledge about the more familiar situation (the *base analogue*) can be projected onto the other situation (the *target analogue*) (Gentner, 1983; Holyoak, 1984).

Analogical reasoning plays a central role in activities as important as problem-solving (Loewenstein, 2010), instruction (Richland, Zur, & Holyoak, 2007), scientific discovery (Hallyn, 2000), creative design (Christensen & Schunn, 2007), and advertising (Page Moreau, Markman, & Lehman, 2001). As in the abovementioned activities, the usefulness of analogies for argumentation rests in part in its potential for inducing a representational change about a target situation (Blanchette & Dunbar, 2002). One of the mechanisms through which analogy can induce a conceptual change consists in *highlighting* information in the target that is more salient in the base analogue (Gentner & Wolff, 2000). For example, in thinking about owning a car, the ideas of mobility and independence easily come to mind. However, given an analogy between running over a person with a car and injuring a person with a gun, the shared idea of legal responsibility comes to the fore. In this way, a person can be persuaded, for example, about his or her blame on a casual accident that took place with his or her car (Minervino & Oberholzer, 2007).

In contrast with highlighting—which is limited to emphasising target information that is already known to the analogiser—the projection of analogical inferences represents a mechanism capable of generating new knowledge about the target (Blanchette & Dunbar, 2002; Day & Gentner, 2007; Perrott, Gentner, & Bodenhausen, 2005). Given that the knowledge about the base domain is normally richer than that of the target, unmapped base ideas tend to be projected onto the target. As an example, George H. W. Bush gathered support for a military intervention in Iraq by comparing the

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expansionist ambitions of Saddam Hussein to those of Adolf Hitler: Just as Hitler was not satisfied with having conquered a small country like Poland and soon proceeded to invade other nations, so would Saddam Hussein invade other countries after Kuwait, possibly leading to a conflict of unpredictable dimensions.

Analogies to be used in persuasive arguments should satisfy several constraints. One prerequisite is that the mapping between base and target elements should be relatively easy to compute; otherwise the analogy will be not comprehended. Several studies have demonstrated the importance of superficial similarity in finding the right set of correspondences between base and target elements (Day & Goldstone, 2012; Kotovsky & Gentner, 1996; Ross, 1987). A second precondition refers to the familiarity with the base domain. The key contribution of an analogy to the comprehension of new ideas consists in providing a familiar framework in terms of which the new ideas can be assimilated (Gentner, 1983, 1989; Holyoak & Thagard, 1989, 1995). The concept of familiarity refers to many aspects, two of which have received special attention. The first one refers to the idea that the base analogue should pertain to a domain of knowledge that is well known by the recipient (Harrison & Treagust, 1993; Jee et al., 2010; Roehm & Sternthal, 2001; Taber, 2001; Thagard, 1992). The second aspect refers to the fact that base concepts should be relatively concrete. The perceptual character of base concepts allows interpreting abstract ideas in more imageable ways (Day & Goldstone, 2012; Lakoff & Johnson, 1980).

When the analogiser estimates that the recipient of the analogy is knowledgeable about the thematic domain to which the target analogue belongs, the constraint of familiarity can be satisfied by means of selecting base analogues that pertain to the same domain as the target analogue, as exemplified by Bush's analogy. However, in those situations where the analogiser presumes that the recipient of the analogical argument is not familiar with the domain of the target situation (e.g. the new ideas are somewhat technical and abstract), base analogues should be chosen from domains different from that of the target, and analogisers should estimate the extent to which recipients are familiar with the base domains to be employed. If superficial similarity can be sometimes sacrificed when constructing an analogy (superficial differences rarely constitute a great impediment for mapping; see Holyoak, Novick, & Melz, 1994, for a review), familiarity cannot, since including unfamiliar base analogues would result in unintelligible analogies.

According to the audience design hypothesis, communicators design messages to be appropriate to what they assume to be the knowledge of the recipients (Clark, 1992). Fussell and Krauss (1989) provided evidence that people attempt to adapt messages to the knowledge of the intended recipients, and that these efforts affect the intelligibility of the messages. As posited by several models (e.g. Nickerson, 1999), one estimates what other persons know on the basis of what one knows, adjusted to take account of ways in which one considers one's own knowledge to be unusual (but see Bezuidenhout, 2013, for a counterpoint). Despite these adjustments, however, evidence exists that people tend to overestimate the probability that another person knows something one knows oneself (e.g. Keysar, Ginzel, & Bazerman, 1995). In the particular case of analogical argumentation, this bias could result in imputing one's own familiarity with the base domain to the addressee of the argument, leading to inappropriate analogies whose base domains are not sufficiently familiar to the recipients. The present study was interested in assessing the extent to which communicators take advantage of available clues to what others know when constructing analogies for argumentation.

Recipients of analogical arguments can range from large heterogeneous groups (e.g. an audience in a stand up presentation) to a single individual (e.g. a friend whose job and favourite activities are known by the argumentator). These cases represent different sorts of challenges vis-à-vis the problem of calibrating one's message to what one believes its recipient knows (Nickerson, 1999). When conveying a somewhat technical and abstract concept to a heterogeneous group, the most that the analogisers can do is selecting base analogues believed to be, on average, reasonably well known and concrete to the population at large, based on shared knowledge and experiences common to a society or culture. As an example, most of the analogies that appeared in the press prior to the 1996 referendum on the independence of Quebec were drawn to widely understandable situations such as "abandoning an ocean liner to board on a lifeboat in the middle of a storm" (an anti-emancipation analogy) or "having your own house" (a pro-emancipation analogy; Blanchette & Dunbar, 2001). In a follow up study, Blanchette and Dunbar (2000) obtained

similar results with non-expert participants trying to convince the general population of supporting the zero-deficit strategy for controlling public expenses. More recently, Trench, Oberholzer, Adrover, and Minervino (2009) generalised these results to several other argumentation topics that transcend the economic and political domains. Thus, there is growing evidence that when generating analogies for the general population, analogy makers appeal to distant base situations which seem to be relatively familiar to the population at large.

In person-to-person exchanges, the analogisers often have clues about the idiosyncratic background knowledge and experiences of their interlocutor. For example, we can estimate what a given individual knows on the basis of her profession, interests, etc. The more specific the information one has about an individual, the better the job one should be able to do to fine-tune analogies for that person. Linking target topics with base analogues for which the recipient has a great deal of knowledge and first-hand experience would increment familiarity to a greater extent than linking them to public knowledge and experiences of others that people may know in a more superficial way. Going back to a previous example from Blanchette and Dunbar (2001), comparing the independence of Quebec to a situation of abandoning an ocean liner to board on a lifeboat in the middle of a storm could result in a comprehensible analogy to almost all the audience, but might result in a deeper and more vivid understanding for a person that has suffered such situation during a shipwreck. As shown by Goode, Dahl, and Page Moreau (2010), first-hand experiences facilitate not only the transfer of factual knowledge about base situations but also the emotional knowledge associated with them. To the extent that people infer that these emotions (e.g. the negative emotions associated with a shipwreck) are likely to occur during the target experience (e.g. the independence of Quebec), the analogy will win in persuasive power.

The main objective of Experiment 1 was to assess the extent to which people involved in analogical argumentation spontaneously tend to exploit the available information about their interlocutor when constructing analogical arguments. To this end, two groups of psychology students were asked to pretend they were the mental-health consultant of an adult woman who became anxious in social situations, and who wanted to initiate a short psychotherapy. After receiving information about the patient's job and leisure activities, participants were asked to generate analogies that could be used to persuade the patient of undertaking a longer psychotherapy, so as to identify the deep causes of the problem and not merely to eliminate its surface effects. Given that the topic could be considered to be rather technical and abstract to the recipient (mental processes and causality are extremely abstract; Draaisma 2001; Gentner & Grudin 1985; Lakoff & Johnson, 1980, 1999), a sensible strategy to follow could consist in drawing analogies whose base analogues referred to the knowledge and activities of the patient. While the idea of "eliminating the ultimate causes so as to prevent the problem from reappearing" seems far from obvious for laypeople when applied to psychological phenomena, it is relatively straightforward when applied to more concrete situations (e.g. if there's a damp spot in the wall, one must locate the leak and not merely repaint the patch).

With the aim of assessing the extent to which people naturally exploit recipient-specific information when generating persuasive analogies, one of our groups did not receive any indication about the convenience of tailoring their analogies to the knowledge and activities of their intended recipient. In order to determine whether participants were in principle capable of identifying structurally equivalent situations within the knowledge and activities of the recipient, a second group of participants received explicit indication to relate their analogies to the job and activities of the patient. If participants of this second group prove capable of producing recipient-related analogies under explicit indication, this could serve to discard that insufficient tailoring in the non-hinted group originates in an intrinsic difficulty to identify structurally equivalent situations within the knowledge and activities of the recipient.

Experiment 1

Method

Participants and design

Eighty students of psychology at University of Comahue (mean age = 21.01 years, *SD* = 2.20) volunteered to take part in the experiment. All participants signed an informed consent for participation in a study on argumentation, and were evenly distributed across the two conditions of the experiment. While one of the groups received an indication to consider the knowledge and activities

of the interlocutor when generating analogies (the *hinted group*), another group did not receive such indication (the *non-hinted group*). The dependent variable was whether the base analogues of the generated analogies pertained to any of the domains of knowledge of the recipient.

Procedure

Participants of both groups received a written explanation on the use of analogies for argumentation, illustrated with an intradomain and an interdomain example. After that, participants of both groups received a hypothetical situation in which the protagonist proposed one possible way of solving a problem, accompanied by information about knowledge and activities with which the protagonist was familiarised. Participants were tasked with writing down analogies that could be used to persuade the protagonist of following an alternative way to solve her problem. While participants in the hinted group were further required to base their analogies on situations that were related to the knowledge and activities of the protagonist, participants of the non-hinted condition were not given this indication. Both groups were allotted a total of 20 min to read the instructional materials and write persuasive analogies for the target situation. The procedure was administered in groups of four, with each participant working individually.

Materials

The target situation asked participants to pretend they were the mental-health consultant of an adult woman who had become increasingly anxious when interacting with other people, and who was willing to embark on a brief psychotherapy. Participants' task consisted in trying to persuade her to undergo a prolonged psychotherapy aimed at unveiling the ultimate causes of the problem. With the aid of analogies, participants had to convey the idea that brief treatments attack the current symptoms but leave the underlying causes unchanged, soon leading to the reappearance of the problem (see Supplemental Materials). Four versions of this story were generated varying the job and the two leisure activities in which the recipient of the analogies was said to participate: (1) teacher + cycling and gardening: (2) painter + skiing and cooking, (3) transit policeman + tennis and decoration, and (4) civil engineer + swimming and camping. In each of the two groups of the experiment an equal number of participants (10) were randomly assigned to each of the different versions.

Data analysis

Two independent judges were asked to sort participants' proposals into three categories. They were asked to regard as "complete analogies" all those proposals where the base analogue explicitly mentioned all five of the following features: (1) an initial problem, (2) an attempt to attack the problem, (3) a reappearance of the problem, (4) a more laborious attack on the causes of the problem and (5) the definitive disappearance of the problem. They were asked to classify as "incomplete analogies" all those cases where one or two of these elements were missing, and as "non-analogies" all the cases in which three or more features were lacking. Once this first analysis was complete, two further judges (two psychologists) were handed all analogical proposals (i.e. complete and incomplete analogies) matched with the description of the job and the leisure activities that corresponded to the protagonist of the target analogue upon which such analogy was inspired. For each of the proposals, judges were asked to decide whether the base situation pertained either to the job or to any of the two leisurely activities of the protagonist. Judges agreed in 84.15% of the cases regarding the analogical quality of the proposals, and in 91.05% of the cases regarding their relation to the knowledge background of the intended recipient. Cases of disagreement were solved by discussion.

Results and discussion

Collapsing across groups, participants reported a mean of 2.65 proposals ($SD = 1.02$), out of which 32.56% were classified as complete analogies, 57.07% as incomplete analogies, and 10.37% as non-analogies. Non-analogies were excluded from further analyses. The main objective of Experiment 1 consisted in assessing the extent to which analogisers are sensitive to the knowledge and activities of their interlocutor when embarking in analogical argumentation. Taking together complete and incomplete analogical proposals, whereas only 7.77% of the analogies proposed in the non-hinted group were drawn to situations that were connected to the knowledge of their intended recipients, 70.11% of the analogies in the hinted group were recipient-tailored. Data were analysed in SPSS 20.0 using generalised linear mixed modelling. We

applied a logistic mixed model with binomial distribution and logit link function. Group (hinted, non-hinted) was entered as the fixed factor, and Use (use vs. no use) as the binomial dependent variable. The random effects structure included three intercepts to account for intercept variability across participants, number and completeness of the analogies (the Satterthwaite correction was applied to estimate the degrees of freedom due to unequal number of observations per participant).

This analysis revealed that Group significantly predicted analogy tailoring, $F(1, 119) = 36.1$, $p < .001$, with recipient-tailored analogies being noticeably more likely to occur in the hinted, as compared to the non-hinted group, $B = 4.14$, $SE = .69$, $t = 6.008$, $p < .001$. As becomes apparent by inspecting Figure 1, this dramatic advantage of the hinted condition in terms of the proportion of recipient-tailored analogies was neither associated to a decrease in the total number of proposals per participant, not to their completeness.

The success of the hinted group in analogising to situations pertaining to the knowledge and activities of their interlocutors reveals that non-hinted participants' failure to make their analogies familiar to their audience was not originated in an inability to draw suitable analogies to the knowledge domains of the recipients.

Regarding the observed tendency not to exploit recipient-specific information during analogical argumentation, a possible limitation of the materials used in Experiment 1 might have resided in the lack of vividness with which recipients' information was presented. In order to make this information more salient, in Experiment 2, the target situations were presented to participants through realistic videos in which the protagonists of the situations were represented by an actor that, after exposing her problem, refers emphatically to her profession and leisure activities.

Experiment 2

Method

Participants and design

Eighty students of psychology at the University of Comahue (mean age = 23.2 years, $SD = 3.94$) volunteered to take part in the experiment. Participants signed an informed consent for participation in a study on argumentation, and were evenly distributed across the two conditions of the experiment. As in Experiment 1, while participants of one of the groups were explicitly required to take into account the knowledge and activities of the interlocutor when generating analogies, participants of a second group did not receive such indication. The dependent variable was whether the base analogues of the generated analogies were related to the knowledge and experiences of the recipient.

Procedure and materials

The procedure followed with the hinted and the non-hinted groups was identical to that of Experiment 1, except for the fact that the written descriptions of the target situation of Experiment 1 were replaced by 3 min videos in which the patient seeking psychological assistance was characterised by an adult woman. After explaining the reasons for seeking psychological assistance and expressing her willingness to embark on a brief therapy, the simulated patient referred very emphatically to her job and to two of her favourite leisure activities. Within each of the conditions of the experiment, an equal number of participants randomly received either one of four versions of the target situation, which differed from each other in terms of the work and leisure activities of the protagonist. The jobs and leisure activities of each version were identical to those of Experiment 1.

Data analysis was identical to that of Experiment 1, with judges agreeing in 86.97% of the cases regarding the analogical quality of the proposals, and in 93.53% of the cases concerning their relation to the knowledge and activities of the intended recipient of the analogies.

Results and discussion

Collapsing across groups, participants reported a mean of 2.81 proposals ($SD = 1.11$), out of which 25.33% were scored as complete analogies, 64% as incomplete analogies, and 10.67% as non-analogies. As in Experiment 1, the main research question concerned the extent to which analogisers naturally tend to consider the knowledge and activities of their interlocutor when embarking in analogical argumentation. Taking together complete and incomplete analogical proposals, whereas only 10% of the analogies proposed in the non-hinted group were drawn to situations that were thematically connected to the knowledge of their intended recipients, 63.36% of the analogies in the hinted group were recipient-tailored. A generalised linear

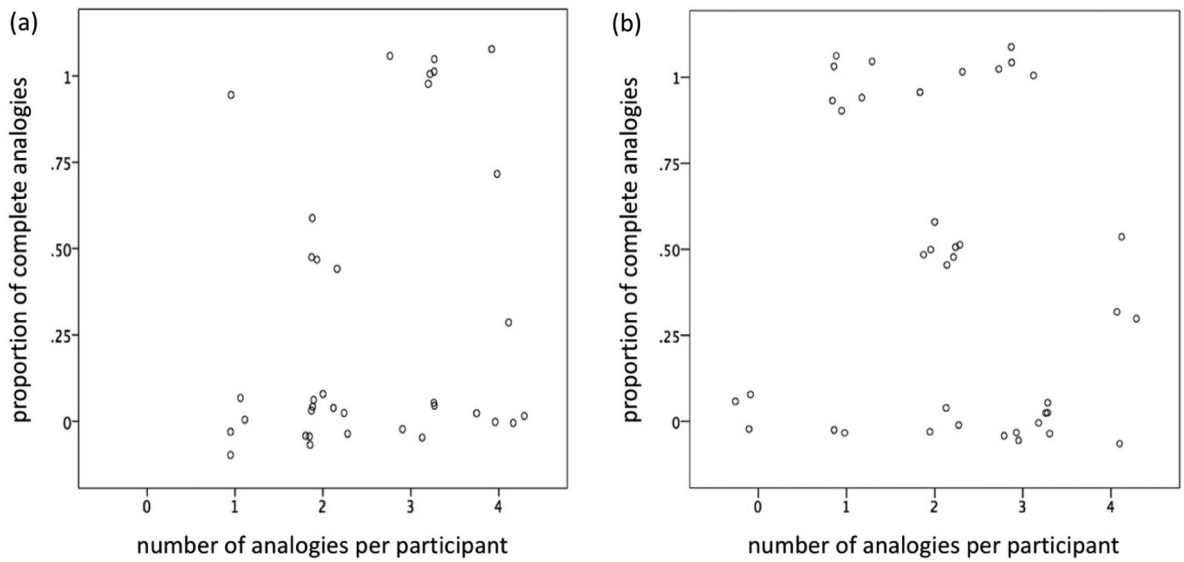

Figure 1. Scatterplots revealing a lack of association between the number of analogies proposed by a particular participant and the proportion of complete analogies within such participant's production. Panels (a) and (b) correspond to the non-hinted and the hinted conditions of experiment 1, respectively.

mixed model with identical distribution, link function, and random structure as in Experiment 1 revealed that group once again significantly predicted analogy tailoring, $F(1, 81) = 38.1$, $p < .001$, with recipient-tailored analogies being more likely to occur in the hinted, as compared to the non-hinted group, $B = 2.74$, $SE = .44$, $t = 6.17$, $p < .001$. As in Experiment 1, this dramatic increase in the proportion of analogies that were sensitive to the knowledge and activities of the recipient was not explainable by means of decreasing the number of analogical proposals or of relaxing the completeness of the analogies (see Figure 2). These results replicate those of Experiment 1, thus confirming that the observed tendency to pass over recipient-specific information is rather robust, and does not stem from an inability to employ the domains of the recipients as base domains in the analogies they generate. Most importantly, results from Experiment 2 indicate that the observed lack of recipient-

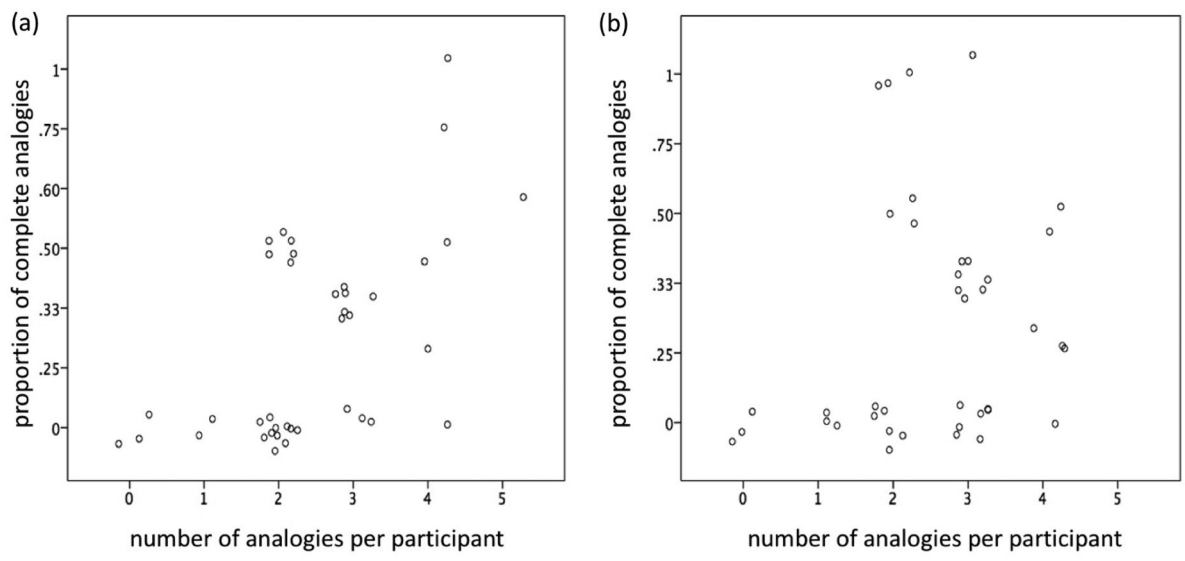

Figure 2. Scatterplots revealing a lack of association between the number of analogies proposed by a particular participant and the proportion of complete analogies within such participant's production. Panels (a) and (b) correspond to the non-hinted and the hinted conditions of experiment 2, respectively.

tailored analogies observed in Experiment 1 was not due to the fact that the critical information about the knowledge of the recipient had been presented to participants in a non-vivid fashion.

Taken collectively, these results suggest that participants select analogies that are less appropriate than other types of analogies that they are capable of generating, something that would represent a clearly suboptimal deployment of cognitive resources. However, a sensible question concerns whether our population indeed regards tailored analogies as being more persuasive than the different types of non-tailored analogies that participants tend to generate. In preparing the ground for a third experiment aimed at comparing the persuasiveness of tailored analogies against the different types of non-tailored analogies produced by participants, we sorted the non-tailored analogies generated by the non-hinted group of this second experiment into a small set of mutually exclusive categories that would exhaustively cover the observed range of non-tailored analogies. Besides paving the way to Experiment 3, the relative frequencies of these types of non-tailored analogies will serve as a basis for speculating about the mechanisms underlying the observed proportion and distribution of non-tailored analogies, an analysis to be fleshed out in the General Discussion.

After an iterative analysis of participants' responses, we settled on a classification scheme comprising two types of intradomain analogies, and two types of interdomain analogies. In the case of intradomain analogies, base analogues ranged from instances of very technical psychological concepts to situations that were generally available to the population at large. With regards to interdomain analogies, our informal inspection of non-tailored proposals revealed that participants' comparisons were sometimes associated to *conceptual metaphors*, that is, to culturally shared analogies between abstract topics and more concrete (usually sensorimotor) experiences having a parallel structure (Lakoff & Johnson, 1980, 1999). In order to assess the relative prevalence of the above types of analogies among participants' responses, all non-tailored analogies produced in the non-hinted condition of this second experiment were handed to two professors of cognitive psychology who were knowledgeable about Lakoff and Johnson's (1980) conceptual metaphor theory, but who were blind to the objectives of the present study. During a first pass through the set, they were asked to classify as *intradomain analogies* all the comparisons whose base situation involved psychotherapeutic interventions of any type by a professional practitioner, and to classify as *interdomain analogies* all comparisons where the base situation did not involve psychotherapeutic interventions. Judges reached an 88% of agreement in their decisions, and resolved cases of disagreement by discussion. Upon resolving all cases of initial disagreement about the intra/interdomain nature of non-tailored proposals, the judges were further required to break down intradomain analogies according to "whether they involved technical psychological principles or concepts that are generally unknown to laypeople, such as cognitive dissonance, modularity or return of the repressed, or whether they did not involve such technical principles or concepts". With regards to interdomain proposals, judges were required to further classify them according to whether or not they were associated to conceptual metaphors. Judges reached an 82% of agreement regarding whether intradomain proposals involved technical concepts, and an 85% of agreement regarding whether interdomain analogies were associated to conceptual metaphors. In both cases, instances of disagreement were solved by discussion. Judges' first classification of non-tailored analogies revealed a prevalence of intradomain analogies (60%) over interdomain analogies (40%). Their subsequent classification of intra and interdomain analogies revealed that non-technical intradomain analogies were by far the most frequent subtype (40%), followed by interdomain analogies not associated with conceptual metaphors (22.22%), technical intradomain analogies (20%), and finally interdomain analogies associated to conceptual metaphors (17.78%). By means of presenting a new sample of participants with representative exemplars of each of these types of non-tailored analogies, Experiment 3 was aimed at assessing which (if any) of these types of analogies represents a serious competitor to tailored analogies in terms of perceived persuasiveness.

Experiment 3

Method

Participants and design

A total of 160 students of psychology at University of Comahue (mean age = 23.07 years, *SD* = 2.92) volunteered to take part in the experiment. All

participants signed an informed consent for participation in a study on the perceived persuasiveness of analogical arguments. Participants were evenly distributed across the four conditions of the experiment, each of them comparing one exemplar of tailored analogies against one exemplar of the different varieties of non-tailored analogies (i.e. tailored vs. technical intradomain; tailored vs. non-technical intradomain, tailored vs. interdomain derived from conceptual metaphor and tailored vs. interdomain not associated to conceptual metaphors).

Procedure

During a brief instructional phase, participants of all groups received a written explanation about the concept of analogy and its usefulness for argumentation, coupled with an intradomain and an interdomain examples. After presenting this information, the written materials stated that: Among theorists of persuasion, there is a debate around the convenience of tailoring analogies to the knowledge of a particular recipient: while some theorists claim that linking analogies to the knowledge of individual interlocutors yields more compelling analogical arguments, other theorists contend that personalizing analogies is inconducive, and may even hinder their persuasive power (this framing was used to make sure that participants pay attention to the fact that the analogies to be rated differed from each other in terms of their use of recipient-specific information, but without biasing them towards either alternative). Once the 10 min allotted for this activity had elapsed, participants received a written description of the target situation used in Experiment 1 (i.e. the story about a patient who was seeking psychological assistance due to social anxiety and who wanted to embark on a brief therapy), which included information about her job and leisurely activities. This hypothetical situation was followed by two analogical arguments allegedly generated by the psychotherapist while arguing for a prolonged therapy aimed at unveiling the ultimate causes of the problem and not merely to eliminate its effects. While one of the analogies was drawn to a situation that pertained to the job of the patient, the other one was not, something that was indicated in the materials as "analogy tailored to the knowledge of the patient" vs. "analogy not tailored to the knowledge of the patient". Using a 7-point Likert scale (1 = not persuasive at all, 7 = very persuasive), participants were asked to rate each of the analogies in terms of how effective they anticipated that it would be for convincing the patient of undertaking the longer therapy.

Table 1. Tailored analogy and four types of non-tailored analogies whose persuasiveness was rated by participants of experiment 3.

TAILORED TO THE RECIPIENT (patient's job: civil engineer)
Undertaking a brief psychotherapy would be like trying to get rid of a damp spot in a wall simply by repainting it, but without having previously fixed the broken pipe where the leaking originates.
INTRADOMAIN TECHNICAL
Undertaking a brief psychotherapy would be like trying to help an autistic child overcome a language disability simply by training, but without dealing with the lack of libidinal cathexis that is at the root of the autistic syndrome
INTRADOMAIN NON-TECHNICAL
Undertaking a brief psychotherapy would be like trying to cure an alcoholic patient simply by asking him to avoid social gatherings where alcohol is available, but without modifying the affective disorders that underlie alcohol abuse.
INTERDOMAIN RELATED TO CONCEPTUAL METAPHORS
Undertaking a brief psychotherapy would be like trying to get rid of an arthritic pain simply by taking pain relievers, but without attacking the degenerative process that is at the root of the inflammation.
INTERDOMAIN UNRELATED TO CONCEPTUAL METAPHORS
Undertaking a brief psychotherapy would be like trying to get rid of a bad smell in a room simply by opening the windows and ventilating, but without removing the element in which the bad smell originates.

Materials

The five analogies used as stimuli were taken from the pool of analogies generated by participants of Experiment 1 who received the version where the patient was a civil engineer who practiced swimming and camping. While one of them was a representative exemplar of the audience-tailored analogies proposed by participants, the other four were representative exemplars of the four types of non-tailored analogies that correspond to the classification scheme used in Experiment 2. The selected analogies were edited to be clearly comprehensible, and to be similar in length (Table 1 displays the materials employed in the experiment).

Results and discussion

In accord with our expectations, results from the first of the experimental conditions showed that the perceived persuasiveness of tailored analogies (M = 5.52, SD = 1.10) was higher than that of intradomain analogies that involved technical concepts (M = 2.02, SD = .89), $t(39) = 15.26$, $p < .01$. Results from the second group revealed that the perceived persuasiveness of tailored analogies (M = 5.12, SD = 1.13) was also higher than that of non-technical intradomain analogies (M = 3.02, SD = 1.09), $t(39) = 8.86$, $p < .01$. Results from the remaining conditions

revealed that while tailored analogies were rated as more persuasive than interdomain analogies unrelated to conceptual metaphors ($M = 5.57$, $SD = .14$ vs. $M = 4.15$, $SD = .18$, $t(39) = 7.04$, $p < .01$) their persuasiveness did not differ from that of interdomain analogies associated to conceptual metaphors ($M = 5.32$, $SD = 1$ vs. $M = 5.42$, $SD = .90$, $t(39) = 0.62$, $p = .534$).

Taken collectively, results from Experiment 3 demonstrate that tailored analogies are regarded as more persuasive than all other types of non-tailored analogies, with the exception of interdomain analogies associated to conceptual metaphors. Given the relative infrequency of this last type of analogies among participant's responses (less than 20%), the massive use of non-tailored analogies in Experiments 1 and 2 is not consistent with the ratings of persuasiveness obtained in Experiment 3, which tend to favour recipient-tailored analogies. Taking into account that in Experiments 1 and 2 participants could easily generate tailored analogies upon explicit request, it can safely be claimed that participant's natural choice of analogical arguments evidences a clearly suboptimal deployment of their cognitive capabilities.

General discussion

Analogy is generally regarded as a powerful heuristic for argumentation (Hofstadter & Sander, 2013; Holyoak & Thagard, 1995). By comparing a target issue against a source situation that is better comprehended, the argumentator can modify her interlocutor's representation of the target situation (Blanchette & Dunbar, 2002). For an analogy to be effective, base analogues should be reasonably familiar to their recipients. In those cases where the target topic is abstract and rather unfamiliar to the potential audience, base analogues should belong to the fields of knowledge and activities of the recipient of the analogy. A handful of studies suggest that both expert and novice communicators are sensitive to this constraint when generating analogical arguments for a general audience (e.g. Blanchette & Dunbar, 2000, 2001; Trench et al., 2009).

As opposed to addressing heterogeneous groups, in person-to-person exchanges the argumentator often has clues about the specific knowledge of her interlocutor, which could be exploited to better adjust analogical arguments to their recipient. The present study was designed to assess the extent to which laypeople spontaneously take advantage of the available information about their individual addressees when constructing analogical arguments.

In Experiments 1 and 2, participants in two experimental conditions were tasked with generating analogies to persuade a person of undergoing a long-term treatment aimed at unveiling the deep causes underlying her problem. Even though the descriptions given to both groups mentioned the job and leisure activities of the patient who was seeking assistance, only one of the groups was explicitly asked to take advantage of the provided information. Results from this last condition revealed that participants were generally able to analogise to the knowledge of their interlocutor. In sharp contrast, results from the non-hinted groups revealed a disappointingly low proportion of analogies employing this information. These results suggest that participants' natural tendency to disregard recipient-specific information is not due to a general inability to identify potential base analogues within the knowledge domains of the recipient. Finally, the results of Experiment 3 allowed us to establish that people tend to judge tailored analogies as being comparatively more persuasive than most non-tailored analogies, thus showing that the widespread use of non-tailored analogies is not based in a preference for these analogies.

In light of these results, a question that arises concerns why people tend to produce non-tailored analogies despite the availability of tailored analogies which they consider as more persuasive. As the classification of non-tailored analogies carried out in Experiment 2 revealed different types of non-tailored analogies, it is not sensitive to expect that a simple explanation will account for how participants cope with the task of generating persuasive analogies.

The fact that more than half of non-tailored analogies were related to the field of psychotherapy might stem in part from the well-documented tendency of the memory system to favour the retrieval of base analogues that maintain superficial similarity with the target (Catrambone, 2002; Gentner, Rattermann, & Forbus, 1993; Keane, 1987; Trench & Minervino, 2015a). This surface bias in analogical retrieval has received several explanations, ranging from the computational to the evolutionary. In terms of computational plausibility, most modellers of analogical retrieval agree that the computational cost implicated in carrying out a structural mapping between the target analogue and every potential

situation stored in long-term memory would be prohibitive (Forbus, Gentner, & Law, 1995; Thagard, Holyoak, Nelson, & Gochfeld, 1990). In terms of adaptation, however, the observed tendency to base retrieval on readily processable surface cues can be thought to represent no big loss, since most things that look alike are alike relationally as well (the "kind world hypothesis", Gentner, 1989; Medin & Ross, 1989). In the words of Dedre Gentner, if something looks and roars like a tiger, it probably is a tiger. More critically, the environment in which our ancestors evolved was so dangerous that the risk of overlooking a real danger outweighed the cost of missing a truly deep analogy. As an example, suppose that after experiencing an almost deadly encounter with a strange animal he had never seen before, a hominid later came across another animal with a similar visual appearance. While falsely assuming identicality with regards to both animals' behaviour would surely incur some cost in terms of time an energy, wrongly denying their identicality could have been lethal.

Even though our current environment is not nearly as dangerous as that of our ancestors, there are many situations where retrieving literally similar sources still represents a better alternative than retrieving superficially dissimilar analogues (Trench & Minervino, 2017). Just like in category-based induction, where similar exemplars represent a more solid basis for inferences than dissimilar ones (Osherson, Smith, Wilkie, López, & Shafir, 1990; Rips, 1975), the fact that two situations maintain a wide array of surface similarities increases the probabilities that other less obvious features will also be shared. Upon these considerations, most computer simulations to date have modelled the initial stage of analogical retrieval as a fast and inexpensive algorithm that automatically extracts readily accessible superficial cues from the target situation in order to rapidly scan long-term memory for literally similar episodes (e.g. ARCS, Thagard et al., 1990; MAC/FAC, Forbus et al., 1995, LISA, Hummel & Holyoak, 1997).

Despite the overall adequacy of similarity-based retrieval during activities as prediction, decision-making or problem-solving, it is advisable to abandon it under particular situations (e.g. when reaching an impasse in problem-solving, Hofstadter & FARG 1996; Weisberg, 2006). In light of its overall adequacy, it is conceivable that the cognitive system might display an inertia to use it even in those situations where it is no longer useful, as was the case with the intradomain analogies proposed by participants of Experiments 1 and 2, whose persuasiveness scores were much lower than those of recipient-tailored analogies.

The difficulties faced by participants in going beyond superficially similar analogies could be conceptualised in terms of the distinction between Type 1 and Type 2 processing (Evans, 2008, 2009; for a review of similar distinctions, see Stanovich, 1999) and, more specifically, in terms Stanovich et al.'s model (see, e.g. Stanovich, West, & Toplak, 2014). According to this account, Type 1 processing comprises autonomous mechanisms that are rapid, parallel, computationally cheap, and not prone to put a heavy load on central processing capacity. While such processing will be adequate for many situations, it is not designed for the type of fine-grained analysis called for in situations posing particular demands, such as the persuasion tasks employed in the present research. In such situations, the "fast and frugal" heuristics of the "cognitive miser" should be overridden by the more appropriate outcomes provided by Type 2 processes, which tend to be slower, computationally expensive, capacity demanding, sequential and controlled. According to Stanovich et al.'s (2014) model, Type 2 processing involves two levels of cognitive control, the algorithmic level and the reflective level. Whereas the autonomous mind can be overridden by algorithmic-level mechanisms, override need to be initiated by higher-level control. Going back to our experiments, the fact that participants were capable of generating tailored analogies upon explicit request suggests that the lack of tailored analogies in the unhinted condition originated in the dispositional, rather than in the algorithmic level.

According to Perkins and Ritchhart's (2004) three-way model, the dispositional level can be further decomposed into two separate dimensions, *sensitivity* and *inclination*. While sensitivity concerns whether a person notices occasions in the ongoing flow of events that might call for thinking, inclination concerns the extent to which a person is willing to invest effort in thinking the matter through. With this distinction in mind, the lack of tailored analogies in the unhinted conditions of Experiments 1 and 2 could have originated either in a lack of sensitivity or in a deficit in inclination. Recent studies (e.g. Trench, Olguín, & Minervino, 2016) show that analogisers can voluntarily orient their search processes away from the target domain and towards specific

thematic domains provided by the experimenters. Their results suggest that the process of consciously resisting the surface bias in the service of a more serial and controlled memory search is rather taxing. In light of such cognitive demands, it is likely that despite having recognised the convenience of analogising to the knowledge and activities of their recipients, some of the participants in the non-hinted conditions of the present study might have refrained from making the effort that is required to search for analogues within such domains.

The fact that a striking one third of intradomain analogies involved technical concepts of psychology is especially surprising, since it reveals a choice of base analogues that recipients have no possible way of comprehending. With respect to theoretical models of the mechanisms underlying people's estimations of the knowledge of their interlocutors (e.g. Nickerson, 1999), the present results can be taken to support prior evidence showing that people tend to overestimate the probability that another person knows something one knows oneself (e.g. Keysar et al., 1995).

With regards to the interdomain analogies that were not tailored to their recipients, the fact that conceptual metaphors abound for abstract psychological topics (Draaisma, 2001; Gentner & Grudin, 1985; Lakoff & Johnson, 1980, 1999) made it possible for participants to generate analogies that were derived from conceptual metaphors. The fact that non-tailored analogies derived from conceptual metaphors are relatively easier to understand than novel interdomain analogies (Trench & Minervino, 2015b) might explain why participants of Experiment 3 regarded analogies derived from conceptual metaphors as being as persuasive as tailored analogies. Despite their effectiveness, however, these analogies proved less frequent than interdomain analogies unrelated to conceptual metaphors, accounting for only 17.78% of non-tailored analogies.

A possible limitation of our study concerns whether the chosen target topic was sufficiently interesting to engage participants in the task at hand. Given that our population of participants (psychology students with a strong psychoanalytical background) is naturally receptive to the idea of attacking the ultimate causes instead of dealing with the symptoms, we expected participants to be reasonably motivated and comfortable both with the task itself and with the particular stance they were asked to adopt. However, the results obtained should be replicated with other target materials—perhaps more technical than the ones employed in the present study—for which non-tailored analogies would be more clearly inappropriate, and for which conceptual metaphors are inexistent or very difficult to find. Future studies using this kind of materials would allow better assessing the extent to which participants are aware of the convenience of connecting their analogies to the knowledge of their recipient, as well as their willingness to invest the cognitive effort that is normally required to produce this type of analogical arguments.

Regarding our independent assessment of whether tailored analogies are perceived as more persuasive than each of different types of non-tailored analogies (Experiment 3), a limitation resides in having assessed participants' indirect intuitions about the extent to which different types of analogies would succeed in persuading a hypothetical recipient of the analogy. While these data can certainly be considered a reasonable proxy for the differential effectiveness of these kinds of analogies, future studies should assess the superiority of tailored analogies for convincing actual recipients who have real first-person experiences about certain activities and knowledge domains.

The present study has focused on the use of analogies for argumentation. However, the advantage of attending to recipients' knowledge seems to transcend this particular activity. For example, the proper use of analogies during science instruction also presupposes the selection of base analogues that are reasonably familiar to students (Jee et al., 2010). In those cases where the target concepts are rather technical, it is likely that instructional analogies will be drawn to contents from the same field. The overestimation bias that might apply to these situations will refer not that much to whether learners had in fact been exposed to the base concepts, but rather to factors such as the extent to which this knowledge has been consolidated or the ease with which the appropriate base-target mapping can be computed. In learning situations, recipient-tailoring will need to be complemented with an adequate verification of students' knowledge of the base domain, assistance in establishing the appropriate set of analogical correspondences, and a deactivation of inadequate analogical inferences (Glynn, 2008). Despite this complexity, the instructional use of analogies seems to be an important

candidate for assessing how far analogisers tend to go in trying to adjust their analogies to the knowledge of their recipients, and how successful they are. As former students of psychology, we still remember the case of a professor who attempted to illustrate certain intricate psychoanalytical concepts from Jacques Lacan by analogy to very complex topological concepts (e.g. the moebius strip), which were hardly familiar to psychology students.

Another important question concerns the extent to which argumentators can be trained to tailor their analogies to their recipient. Recent studies on text writing (see, e.g. Kakh & Wan Mansor, 2014) suggest that participants can be trained to develop a sense of audience over time. The results of these studies are encouraging for the enhancement of audience awareness during analogical argumentation, as well as during a host of activities for which analogical reasoning represents a useful heuristic. However, such training should not be limited to promoting an estimation of the recipients' declarative knowledge, since other features of base analogues might play an important role as well. As suggested by Blanchette and Dunbar (2001), modelled by Thagard (2000), and demonstrated by Goode et al. (2010), analogies can transfer emotional information from the base to the target. When the politicians observed by Blanchette and Dunbar stated that the independence of Quebec would be "like parents getting a divorce, and may be the parent you don't like getting custody", they had probably estimated that such comparison would result in the transfer of a negative emotional valence from the audience's representation of divorces to that of Quebec's eventual separation from Canada. This analogy could only have been effective in those cases where the recipients had previously assigned a negative emotional valence to divorces, something that the authors of the analogy must have estimated. As a general rule, the training of persuasive analogising should aim at helping people resist their tendency to project their own knowledge, viewpoints and feelings to others—a defining feature of cognitive egocentrism, as Piaget conceived it (Shantz, 1983). Training in argumentation skills has become a central target of formal education at all educational levels (see, e.g. Kuhn & Udell, 2003; Sanders, Wiseman, & Gass, 1994). The specific implications of training analogical argumentation may become more apparent when taking into account the centrality of analogical argumentation in domains such as clinical psychology (Blenkiron, 2005; McMullen, 2008; Tay, 2013) and the law (Sunstein, 1993).

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