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Prompted Generalizations Increase Cross-Domain Analogical Retrieval

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Abstract

Using a cued-recall paradigm, Experiment 1 had two conditions retrieve base situations in response to surface-dissimilar analogs: one in which participants were prompted to re-represent the base situations in general terms, and one in which they reproduced them verbatim. Although the prompted generalizations tended to be either too tied to the original situation or too broad so as to encompass disanalogous cases, they increased retrieval of the base analogs compared to the unprompted condition. Besides replicating the retrieval advantage of prompting one-shot generalizations, Experiment 2 addressed whether a self-administered training could aid participants in producing very general reformulations of base situations of the kind that, in Experiment 1, were associated with greater retrieval. Even though trained participants produced a greater proportion of highly abstract generalizations, the training yielded no retrieval advantage over and above the prompted abstraction condition. We discuss the implications of the present findings for transfer-oriented instruction.

Keywords: abstraction; generalization; analogy; retrieval

Introduction

The ability to distill generic patterns from concrete-level representations is a hallmark of intelligence (Tenenbaum et al., 2011). One of the most striking advantages of generalization concerns the act of relating a current situation to analogous but semantically-distant situations stored in long-term memory (LTM). Although stored items (base analogs) are seldom retrieved in response to analogous situations (target analogs) whose individual elements do not maintain semantic similarity with those of the stored situations (Gentner et al., 1993; Gick & Holyoak, 1980; Trench & Minervino, 2015), several studies have demonstrated that encoding base situations in more generic terms renders them more retrievable when semantically distant analogs are processed (Bernardo, 2001; Catrambone & Holyoak, 1989; Goldstone & Sakamoto, 2003; Trench & Minervino, 2020 for a review).

Among interventions aimed at promoting a more generic encoding of base situations in LTM, the most successful has been the presentation of two analogous base scenarios accompanied by explicit instructions to compare them (e.g., Catrambone & Holyoak, 1989; Gick & Holyoak, 1983; Goldwater & Gentner, 2015). Despite the effectiveness of comparison for generating the kind of schemas that have proven to increase distant analogical retrieval, this strategy suffers important limitations. On the one hand, its applicability is constrained by the requirement that reasoners be exposed to an additional analogous situation for each base case to be encoded (Loewenstein, 2010). A second limitation is that, even when an analogous base item is available, the resulting schemas may inconveniently retain spurious commonalities between the compared cases (Medin & Ross, 1988), potentially over-specifying the resulting schema in ways that limit the future retrieval of the base situations.

In contrast to the well-established finding that humans do not spontaneously distill the abstract features of the situations they routinely encounter, the question of whether they are capable of generalizing a single exemplar upon explicit request has only minimally been explored. Shortly after the emergence of explanation-based accounts of how abstract representations of natural concepts are acquired (e.g., Murphy & Medin, 1985), attempts have been made to extend this framework to the possibility of achieving "one-shot" abstraction of more complex situations or events. As an alternative to classic theories of induction, which focus on how abstract representations are derived from exposure to multiple exemplars, explanation-based learning (EBL) accounts posit that both humans and machines can exploit prior causal knowledge to acquire a concept (e.g., the dumping marketing strategy) out of a single example. Because such prior knowledge provides the learner with causal relations that account for how the elements of a given situation are organized, it should be possible to acquire a schema from even a single example by generalizing its explanation (Mitchell et al., 1986). In turn, the explanation process can potentially separate relevant from irrelevant features, thus preventing the schemas from including spurious, non-essential features that similarity-based generalizations have no principled means to discard (Medin & Ross, 1988). Keeping with the concept of *dumping*, while similarity-based generalization might lead to infer that dumping companies are typically technology-related simply because the observed cases belong to that sector, an explanation-based generalization would readily dismiss this feature as incidental.

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Several machine-learning approaches to EBL have appeared since the 1980s. In contrast to these developments, very few studies addressed the extent to which learners can generate appropriate schemas out of a single example. Ahn et al. (1992) had participants read concrete-level descriptions of three unfamiliar strategies (e.g., the "phoney bank examiner ploy"). After exposure to a worked-example of how a different strategy could be redescribed in general terms, participants had to generate abstract redescriptions of the three original strategies. The fact that participants´ descriptions included almost three quarters of the structural constraints deemed relevant by the experimenters was interpreted as evidence that participants could abstract the general structure of a particular instance. However, the fact that the generated schemas missed over one quarter of the relevant constraints raises the question of whether participants would inconveniently recall the abstracted situation during the processing of partially-matching situations that maintain some structural resemblances with the target, but which lack some defining features of the concept (Leon et al., 2024; Trench et al., 2025). Even in those cases where the schema has retained all the relevant constraints of the example, while it seems likely that participants will recognize this underlying structure when processing literally-similar situations (e.g., when another individual fraudulently persuades someone to withdraw money from her bank and handle it to him as part of a security procedure), it is unclear whether this underlying principle will be activated when less similar elements are involved (e.g., when someone claiming to be an Apple representative asks you to bring your newly purchased item for replacing a faulty component spotted in your model). Given that the gold standard in promoting distant analogical retrieval requires the provision of a second base analog with which to compare the first, the main objectives of Experiment 1 were therefore to assess whether a prompt to produce a more general reformulations out of single items increases their likelihood of being retrieved during the processing of a superficially-dissimilar analog, as well as to identify which particular type of generalizations better support their retrieval. Beyond replicating the finding that a simple prompt encouraging one-shot generalization enhances cross-domain analogical retrieval, Experiment 2 examined whether brief training in the particular kind of abstract generalization proven to increase distant analogical retrieval yields additional benefits beyond those of a single prompt.

Experiment 1

Method

Participants and Design A total of 130 participants (M_{age} = 30.52, *SD* = 12.57, 59% female) were randomly assigned to the prompted abstraction condition (*N* = 65) and the control condition (*N* = 65). A minimum of 64 participants per condition was established by setting a G*Power Analysis (Faul et al., 2007) to detect a medium sized effect with alpha = .05 and power = .8. The dependent variable was the probability of retrieving the critical base stories during the presentation of superficially-dissimilar analogous cases.

Materials Eight pairs of stories were built, each one comprising a base situation between 20 and 40 words in length, and a target story that instantiated the abstract principle of the base story in a different domain. Table 1 displays a sample of experimental materials.

Table 1: Sample sets of materials, Experiments 1 and 2

Set 3	Base analog: A tennis player used to show off his beautiful girlfriend in front of his friends. Tired of his behavior, one of them invited her to dance at a club, and after a while, he ended up with her.
	Target analog: Certain scientist boasted about his own theory in front of his students. One day, one of his students took the scientist's drafts home and presented the theory as his own.
Set 7	Base analog: An app corrected users' grammar in their texts. Over time, this led users to stop checking their own sentences, and their ability to write independently got worse.
	Target analog: A father started stepping in every time his daughter had a conflict at school. Although she stopped having conflicts, over time she began to feel afraid of facing any uncomfortable situation on her own.
Set 2	Base analog: When a pizza stand set up very close to an existing one, the original pizza maker offered help instead of trying to drive him away. Grateful, the new vendor decided to move elsewhere so as not to harm him.
	Target analog: A young woman was attracted to a classmate but noticed that another girl had started flirting with him. Instead of sabotaging her, she offered advice, which made the new girl feel sorry for competing with her.

Procedure Participants were invited via email to participate in an online study, and those who accepted the invitation were sent a link to complete the experiment. Upon providing informed consent, an introductory text informed participants that the experiment comprised two distinct phases: one requiring abstraction (or reproduction, depending on condition), and one demanding memory recall. For Phase 1, the instructional material received by the abstraction group stated that any given situation should be redescribed at the highest level of generality that still preserved its central features, and provided a concrete example of this criterion. The following screen informed participants that they would receive eight different situations, and that they would have to recast each of them in the most general terms that still preserved its central features. In the control condition, the abstraction task of Phase 2 was replaced by a reproduction task intended to function as a non-abstractive encoding control. Its introductory text informed participants that they would receive eight different situations and that, for each of them, they would have to reproduce it on a subsequent screen without being able to reread it. Participants in both conditions typed their responses to each of the base analogs in a separate text box, without limits on time or response length.

The second phase was identical for both conditions. Participants were informed that they would receive a new set of stories, some of which were analogous to one of the stories from the previous phase. For each of the stories, they had to select on-screen yes/no buttons to indicate whether it was analogous to one of the stories of the previous section. If they responded affirmatively, they were asked to specify to which story it was analogous to by mentioning distinctive elements that would allow the experimenters to identify which of the base stories was recalled. Filler stories appeared on trials 2 and 5, and were intended to prevent participants from assuming that every new case corresponded to a situation from Phase 1.

Coding In those cases where participants recalled more than one item from Phase 1, the critical base analog was considered "retrieved" as long as it was listed among the recalled items. The generalizations produced in the abstraction condition were classified into five categories. Level 0 corresponded to restatements of the base analog or any other responses in which no element of the base analog was replaced by a more abstract term. Level 1 comprised responses in which at least one of the base elements was replaced by a more abstract concept, but none of the elements of the base analog was generalized beyond an immediately more abstract concept (e.g., for a base analog stating that *"A company cut key staff to reduce costs and, although expenses went down, service quality declined and customers left*", a Level 1 reformulation was "An institution laid off part of its staff, reducing costs but also lowering quality and losing customers"). Level 2 was assigned to responses in which at least one of the base concepts was generalized beyond its immediate superordinate concept, but other important base concepts remained undergeneralized (e.g., "A group sacrificed essential resources to cut expenses and ended up losing what they were trying to preserve"). Level 3 corresponded to cases in which either all or most base concepts achieved the highest possible degree of generalization (e.g., "Key elements were removed in the pursuit of efficiency, which created an imbalance in perceived quality, eroding the trust and loyalty of those who depended on it"). Finally, Level 4 corresponded to severely underspecified responses that missed defining features of the base situation (e.g., "a decision intended to earn money ends up provoking significant loss"). Agreement between judges reached 83%, with cases of disagreement being resolved by discussion.

Results and Discussion

An analysis of the responses produced in the abstraction condition revealed that 31.92% of participants' responses lacked any generalization (Level 0), 17.50% consisted of generalizations that were too narrow or tied to the original situation (Level 1), 10.19% corresponded to an intermediate level where at least some of the base concepts were maximally abstracted (Level 2), 18.27% displayed the highest possible generalization of the vast majority of the base concepts (Level 3), and 21.93% corresponded to severely underspecified generalizations that missed essential features of the original case (Level 4).

With regard to retrieval performance, participants in the control condition retrieved the base analogs from Phase 1 in 69% of the trials, thus indicating that distant analogs can be retrieved successfully even when participants were not prompted to generalize them. It should be noted, however, that the cued-recall task employed in this and other studies of analogical retrieval can be considered less challenging than the spontaneous-recall paradigm typically employed in problem-solving, where participants receive no indication of the analogical relation between the base and target situations. Despite the already high rates obtained by the control condition, the prompted abstraction condition retrieved the base analogs from Phase 1 even more frequently than participants in the control condition $M = .79$, $SD = .17$ vs. $M = .69$, $SD = .19$, $t(128) = 3.264$, $p = .001$, cohen´s $d = 0.55$.

Concentrating on participants in the prompted condition, Figure 1 shows the retrieval probabilities of base analogs as a function of the achieved degree of generalization. A generalized linear mixed model (GLMM) with type of generalization as a fixed factor and trial number nested within participants revealed an effect of the type of generalization on the probability of retrieving a base analog, $F(4, 513) = 4.265$, $p = .002$. Pairwise comparisons (Bonferroni) revealed that base analogs receiving sufficiently abstract generalizations (i.e., Level 3) were reliably more retrievable than base analogs not receiving any kind of generalization (Level 0), $t(513) = 3.005$, $p < .05$, cohen´s $d = .39$. Compared with base analogs receiving Level 3 generalizations, shallow (Level 1), moderately abstract (Level 2) and overly vapid (Level 4) generalizations yielded retrieval rates that, while numerically higher than those of Level 0, were not statistically different from them (all $p_s > .05$). The fact that the retrieval rate elicited by Level 2 generalizations was not statistically higher than that of Level 0 generalizations despite being numerically higher than that of Level 3 was likely due to the low number of observations falling within this category.

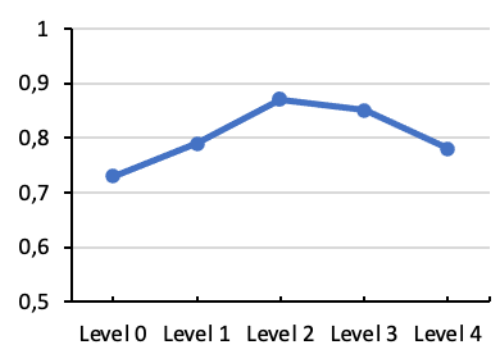

Figure 1: Retrieval probability as a function of type of generalization

Given that Level 3 generalizations increased the probability of retrieving the abstracted situation when processing analogous cases, Experiment 2 assessed whether a training on how to achieve this kind of abstraction yields an advantage over and above the simple prompt to generate them.

Experiment 2

Method

Participants and Design A total of 200 participants (M_{age} = 25.38, *SD* = 9.52 78% female) were randomly assigned to the training condition (*N* = 68), the prompted abstraction condition (*N* = 67) and the control condition (*N* = 65). The dependent variable was the probability of retrieving the critical base stories during the presentation of the target cases.

Materials In all conditions, base and target situations were identical to those used in Experiment 1. The self-administered materials for training participants in how to generate one-shot abstractions at an appropriate level of generality had a faded structure wherein participants transitioned from passively receiving instructional information (Part 1) to actively constructing abstract generalizations (Part 4). Part 1 consisted of a 20 min video employing visual animations of everyday situations to illustrate how recasting a situation in more general terms allows it to be tagged in a way that maximizes its future retrievability in response to subsequent situations eliciting a similar tag. To convey this idea, the video drew on an analogy wherein the process of reformulating a situation in abstract terms was compared to the process of coming up with an appropriate name when saving a new file (the base analog) on a hard drive (LTM). This analogy capitalizes on the fact that, in certain operating systems, the system responds in real time to the title being typed by displaying matching titles of already existing documents. Having labeled an old file with a sufficiently general name thus renders it "discoverable" when attempting to assign the same name to an analogous situation, even when the surface features of the old and the new situations do not match. The second segment of the training presented participants with two hypothetical situations described at a concrete level, along with three reformulations presented in random order: one overly tied to the original situation, one visibly more abstract but that still retained all its structural features, and one that was so vapid and underspecified that it omitted one or more defining features of the base story. After participants assigned each of the presented reformulations to the corresponding level of generality, they received feedback explaining how each reformulation should have been categorized. Part 3 introduced three new situations, each followed by a single reformulation, and participants were asked to indicate whether the reformulation involved a shallow, intermediate, or overly vapid level of generality without having the reformulations of the remaining levels to serve as context. After completing each of these trials, participants received an explanation of how it should have been categorized. Intended as an even less scaffolded stage before participants constructed their own reformulations, Part 4 introduced an additional original situation followed by a reformulation presenting three alternative options for each of the critical objects (varying in degree of generality and presented in random order), and participants were required to select those displaying the appropriate level of generality.

Procedure Participants were invited via email to take part in an online study. In the trained abstraction condition, an introductory text informed participants that the experiment comprised three distinct phases: a brief training on abstraction, an application of the learned strategy to novel cases, and a memory recall activity. After completing the four sections of the training phase at their own pace, participants received the same base situations as in Phase 1 of Experiment 1 and were asked to apply the trained strategy in reformulating each situation at the broadest possible level of generality that still preserved all of its structural aspects. Finally, the introductory text for Phase 2 informed participants that they would receive a final set of stories—some of them analogous to a story of the previous phase and some not—, and that for each of these new stories they would have to indicate whether it was analogous to any of the stories from the preceding phase. The instructions and target situations were identical to those used in Experiment 1.

The procedure followed in the prompted and control conditions was identical to that of Experiment 1, except that in both conditions Phase 1 was preceded by an unrelated study on the evaluation of instructional analogies included to equate conditions in terms of fatigue. Given that analogy evaluation did not induce a relational mindset in previous studies (Du & Son, 2022; Vendetti et al., 2014), we reasoned that it would neither encourage an analogical mindset in the present study.

Results and Discussion

Figure 2 displays the proportions of different kinds of generalizations produced by participants in the trained and prompted conditions. Compared to the prompted condition, trained participants produced lower proportions of Level 0 (no abstraction) responses, $t(133) = 3.06$, $p < .01$, and of Level 1 (insufficiently abstract) generalizations, $t(133) = 2.93$, $p < .01$). As predicted, they also produced higher proportions of Level 2 (intermediate) and Level 3 (highly abstract) generalizations ($t(133) = 2.26$, $p < .05$ and $t(133) = 3.33$, $p < .01$, respectively), with no differences regarding Level 4 (overly abstract) generalizations, $t(133) = 1.28$, $p = .2$.

Figure 2: Proportions of different types of abstraction as a function of condition, Experiment 2

A one-way ANOVA revealed a significant effect of condition on the probability of retrieving the appropriate base analogs, $F(2, 197) = 4.587$, $\eta^2p = 0.045$, $p = .011$. Pairwise comparisons (Bonferroni) showed that participants in the prompted condition retrieved the base analogs from Phase 1 more frequently than participants in the control condition, $M = .715$ $SD = .207$ vs. $M = .619$ $SD = .247$, $p = .033$, cohen´s $d = .045$. This result replicates the finding from Experiment 1 that a simple prompt suffices to elicit generalizations of a base analog that render it comparatively more retrievable during the processing of superficially-dissimilar analogs. Pairwise comparisons further revealed that participants in the trained abstraction condition retrieved the base analogs more frequently than participants in the control condition, $M = .719$ $SD = .181$ vs. $M = .619$ $SD = .247$, $p = .023$, cohen´s $d = .047$. Counter to expectations, however, their retrieval rate did not exceed that of the prompted condition, $M = .719$ $SD = .181$ vs. $M = .715$ $SD = .207$, $p = 1$, cohen´s $d = .02$. Together, these contrasts indicate that although training increased the proportion of Level 2 and Level 3 generalizations, it did not yield a retrieval advantage beyond that produced by a simple prompt to generate sufficiently abstract generalizations.

Figure 3 shows the retrieval rates of base analogs as a function of condition and of the degree of generalization achieved during encoding. To understand the reasons behind the fact that a higher proportion of Level 2 and Level 3 generalizations in the trained group did not yield a retrieval advantage over the prompted condition, we conducted a multilevel logistic regression with trial number nested within-participants and condition (two levels: trained vs prompted) and type of generalization (Level 0 to Level 4) as predictors of analogical retrieval. The generalized linear mixed model (GLMM) revealed main effects of condition, $F(1, 1070) = 5.829$, $p = .015$ and of type of generalization, $F(4, 1070) = 14.151$, $p < .001$, but no significant interaction between both factors $F(4, 1070) = 0.62$, $p = .648$.

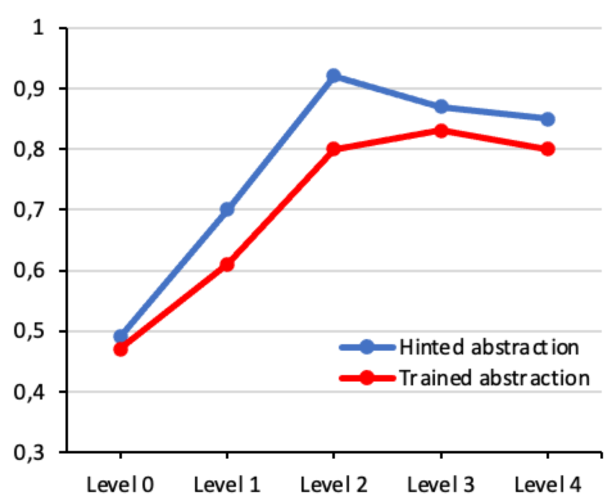

Figure 3: Retrieval as a function of condition and of type of generalization, Experiment 2.

With regard to the effect of type of generalization on the retrieval of base analogs, pairwise comparisons (Bonferroni) revealed that while Level 0 generalizations did not differ from Level 1 (shallow) generalizations in promoting analogical retrieval $t(1070) = 1.482$, $p > .10$, they were outperformed by Level 2 (intermediate) generalizations, $t(1070) = 6.29$, $p < .001$, cohen´s $d = .98$, Level 3 (highly abstract) generalizations $t(1070) = 5.93$, $p < .001$, cohen´s $d = .79$ and Level 4 (overly abstract) generalizations, $t(1070) = 4.259$, $p < .001$, cohen´s $d = .63$. In turn, Level 1 generalizations were outperformed by Level 2 generalizations $t(1070) = 5.618$, $p < .001$, cohen´s $d = .86$, Level 3 generalizations $t(1070) = 5.204$, $p < .001$, cohen´s $d = .67$, and even Level 4 generalizations, $t(1070) = 3.215$, $p < .01$, cohen´s $d = .46$ (all other $p_s > .10$).

The outcome of the GLMM clarifies why no group differences emerged in the ANOVA despite the increased proportion of Level 2 and Level 3 generalizations in the trained group. On the one hand, although Level 2 and Level 3 generalizations were more effective than Level 0 and Level 1 generalizations in promoting retrieval, their advantage was modest in absolute terms. More importantly, the non-interactive negative effect of training in the GLMM suggests that the net effectiveness of these generalizations was higher in the prompted than in the trained condition (see Figure 3). This means that, even though trained participants produced a greater proportion of Level 2 and Level 3 generalizations than participants in the prompted condition, these generalizations were somewhat less effective after training than when they were produced spontaneously in response to a simple prompt.

General Discussion

Results showed that prompting participants to reformulate base analogs at an appropriate level of generality increased their likelihood of retrieving those analogs during the subsequent processing of thematically distant cases. While these results cannot be taken to disconfirm the possibility that the lack of spontaneous generalization observed in previous studies reflects limitations in cognitive competence and/or relational knowledge, they nevertheless suggest the presence of a dispositional component as well.

Among the generalizations produced by participants in the prompted condition of Experiment 1, only those that achieved the highest degree of generality without sacrificing defining features reliably elicited higher rates of analogical retrieval. However, because only a minority (18.27%) of participants' reformulations achieved this level of generality, Experiment 2 aimed to assess whether participants could benefit from a self-administered training in generating the kind of generalizations that have proven more advantageous for subsequent analogical retrieval. Although the trained group produced a higher proportion of Level 2 and Level 3 generalizations than the prompted group, their retrieval of the base analogs—while higher than that of the control group—did not exceed that of the prompted condition.

In contrast to the GLMM analysis of Experiment 1, which revealed a retrieval advantage only for Level 3 (i.e., highly abstract) generalizations, the inclusion of the trained condition in the GLMM analysis of Experiment 2 also revealed a retrieval advantage for Level 2 (i.e., moderately abstract) and Level 4 (overly abstract) reformulations. This pattern suggests that these suboptimal generalizations may have contributed to the increased retrieval rates observed in the prompted condition across both experiments. The retrieval advantage of Level 2 (moderately abstract) generalizations of base situations can be explained in different ways. On the one hand, because these generalizations extend beyond the immediate level of superordination for at least one central concept, participants may extract a similar schema from moderately distant target analogs, allowing these abstract representations to function as a bridge between targets and their corresponding bases. However, standard computational models of analogical retrieval do not require target abstraction as a prerequisite for retrieval. In the MAC/FAC model (Forbus et al, 1995), base and target situations are assumed to be represented as content vectors containing a slot for every known concept, with the fillers of those slots corresponding to the number of times that the represented concept appears in the complete propositional representation of the situation. While the second stage (FAC) computes complex structural mappings between the propositional representation of the target and a narrow set of "finalists," these finalists are selected by calculating dot products between the target and all base situations stored in LTM. As the fillers of the content vectors are assumed to be normalized by way of dividing a fixed amount of activation among the non-zero slots of the vector, the suppression of object properties produced by Level 2 and Level 1 generalizations would increase the number of "zero" slots in the content vectors, thus increasing the weight allotted to the relational concepts that convey the structural commonalities between the abstracted base and a distant target analog (see, e.g., Gentner et al., 2009). Keeping with the example provided for classifying responses, generalizing *company* in terms of the more abstract concept of *group*, will redistribute weight initially allotted to attributes of companies, such as human, economic, etc. Hence, current computational modeling could potentially account for the observed advantage of re-representing a base analog via a schema that, from a strict conceptual viewpoint, does not neatly apply to the target. In a similar vein, while Level 4 generalizations of a base analog may be sufficiently broad to encompass non-analogous target situations, the suppression of surface-level properties may grant additional weight to structural features, thus compensating for the elimination of some diagnostic constraints, even when core relational predicates remain available.

The above considerations bear implications for education. Because generalizations that extend beyond immediate superordination increase the odds of retrieving a base situation, educators interested in promoting future transfer should encourage abstraction of learned contents, even when students do not produce an "ideal" generalization, that is, one that achieves the highest possible level of generality without sacrificing structural features.

Even though our self-implementable training led to a 70% increase in the proportions of Level 2 and Level 3 generalizations as compared to the prompted abstraction condition, the fact that the Level 2 and Level 3 generalizations by the trained group were somewhat less retrieval-efficient than those of the same kind produced by the prompted group prevented the trained group from achieving a net retrieval advantage over the prompted condition. We conjecture that one of the reasons behind this trade-off between the quantity and intrinsic effectiveness of transfer-appropriate instances of generalization may involve some difficulties for integrating very general schemas to the LTM encodings of base situations. As a contrast, consider the case of Level 1 (shallow) generalizations, where the highest abstraction arising from the original base concepts involved their immediate superordinates. When recasting a base situation wherein "a promising young soccer player acquired by a club was left aside important matches in order to preserve him from injuries, with the result that he felt frustrated and migrated to another club", a Level 1 generalization substituting "sportsman" for "soccer player" or "dangers" for "injuries" looks well-suited for replacing the original situation by the novel reformulation in LTM, such that participants might conceivably even forget the basic-level concepts of the original situation. In terms of models like MAC/FAC, this new reformulation could plausibly "update" the content vector of the situation, thus achieving a humble but straightforward reallocation of weight from the now deleted surface features (e.g., "soccer-related") to structural components of the situation. In contrast, a Level 3 (i.e., highly abstract) reformulation would involve something like "an organization acquired a valuable resource and withdrew it from challenging situations to preserve its integrity, but with the consequence that such resource lost motivation and sought for alternative places to work". While technically capable of encompassing a very broad range of analogous situations, a schema of this kind would unlikely substitute for the original situation as the default LTM encoding of the base analog. As representations of this complexity will not acquire a stable encoding as separate entries in the LTM record upon a single exposure, even participants who capitalized on a brief training to construct this kind of representations might still resort to the original, concrete-level representation of the base analog during the processing of the target situation.

Given the relevance of one-shot generalization for cognitive abilities ranging from concept acquisition to analogical retrieval, future research should build on the present effort to revitalize the study of how humans—and not only machine learning systems—achieve this hallmark accomplishment of high-level cognition.

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