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Individual differences in semantic priming and inhibitory control predict performance in the Remote Associates Test (RAT)

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ABSTRACT

Creative thinking is a complex cognitive ability that requires the combination and integration of information in the memory to produce original ideas. Previous creativity research has suggested that semantic memory, attentional focus or inhibitory control might be engaged when performing creativity tasks. In the present study, we tested whether stronger global attention, larger semantic priming and better ability to inhibit interfering information were related to performance in a creativity task such as the Remote Associate test (RAT). With this aim, 124 participants performed a lexical decision task in which the degree of semantic association (strong and weak) was manipulated. They also performed Navon's global-local task, in which global precedence and global/local interference indexes were calculated, and an adapted selective retrieval procedure from which an inhibition index was obtained. The results indicated that better creative performance was predicted by larger semantic priming between strong associates and by larger inhibitory effects, while attentional style was not associated with performance in the RAT. These findings support the role of semantic activation and inhibition during creativity.

1. Introduction

When facing problems in daily life, we usually rely on previously successful ideas and experiences to solve them (Cushen & Wiley, 2018). However, this strategy does not work when the problem requires novel and creative solutions. Creativity is defined as the ability to generate original, useful and innovative ideas or solutions to problems by accessing and combining distantly associated concepts (Mednick, 1962). Interestingly, people differ in their creative potential, and some individuals are more imaginative and original than others (Beaty et al., 2014; Kenett et al., 2016; Schilling, 2005). Since creativity is a complex process, individual differences in the cognitive functions supporting it might underlie individual differences in creative potential (Abraham et al., 2012; Beaty et al., 2020; Thakral et al., 2021).

Dual-process models suggest that associative and controlled processes play a key role in creativity (Benedek & Jauk, 2018; Sowden et al., 2019). During creative generation, associative processes allow a stimulus (externally presented or internally generated) to activate other stimuli's representations through their already established connections. This kind of spontaneous process allows individuals to come up with new ideas based on previous knowledge (see Benedek et al., 2023 for a review). Controlled processes, such as inhibitory control, are thought to be key to prevent typical thinking paths and facilitate the search for new ideas (Beaty et al., 2014).

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Hence, the recombination of associated pieces of information and the downregulation of conventional ideas would promote the creation of unusual or original concepts and ideas (Volle, 2018). Following this view, the general goal of the present study is to contribute to our understanding of individual differences in associative and controlled processes underlying creativity. Specifically, we examine the roles of semantic memory structure, attentional scope and inhibitory control (over interfering episodic memories) in producing creative responses in a widely used creativity task such as the Remote Associates Test (RAT; Mednick, 1968).

Associative processes are reliant on semantic memory (Abraham, 2014; Benedek et al., 2023; Friedman & Förster, 2002; Kenett, 2018), which includes concepts, facts and their associations that we have accumulated over the course of our lives, in interconnected networks (Collins & Loftus, 1975; McRae & Jones, 2013). According to Mednick's associate theory (1962), more creative people have flatter associational hierarchies of concepts, while less creative individuals have steeper associational hierarchies. In this view, creative people have richer and broader associations among concepts that allow them to connect distantly related ideas more efficiently, while less creative people have fewer and more common associations between concepts that may limit these combinations (Rossmann & Fink, 2010). From this perspective, closely related concepts or ideas are less creative than remotely associated concepts (Gruszka & Necka, 2002; He et al., 2020). Recent associative views stress semantic richness as a key factor associated with creativity. In a recent relevant study, for example, Beaty et al. (2022) had participants perform a creativity task, the Alternative Uses Task (AUT), in which they were required to produce as many alternative uses of a common object as possible (e.g., brick, shoe). Critically, the semantic richness (number of semantic associates) of the objects was manipulated. The results indicated that participants produced more ideas for objects with a larger number of semantic associates (high semantic richness), even though these ideas were less original. Hence, semantic memory structure (specifically, the number of interconnected concepts) had a differential impact on participants' ability to generate creative ideas.

From an associative perspective, Mednick (1968) developed the RAT as a tool to assess creative thinking. In this test, three unrelated words (e.g. CHEESE–COMPUTER–ELEPHANT) are presented and the participant has to come up with a single fourth word relating all of them (e.g. MOUSE). The RAT is thought to rely on convergent thinking (it requires finding the correct single solution for a specific triplet) but also on divergent thinking because it requires thinking of alternative, less common meanings of the words to find a possible relationship between them (Cortes et al., 2019). Specifically, when solving RAT problems, participants initiate a semantic search from the provided items that implicitly activates many other associated concepts in semantic memory (divergent stage). This process ends when a weakly associated concept to the three words provided in the problem is selected as a potential solution (convergent stage; Schilling, 2005; Smith et al., 2013; Topolinski & Strack, 2008). In line with this, a number of studies have shown that individuals who score high in creativity (compared to less creative people) (a) have a more interconnected semantic memory with shorter distances between concepts (Kenett et al., 2014; Luchini et al., 2023), (b) judge pairs of unrelated words as more semantically related (Rossmann & Fink, 2010), and (c) are able to come up with more ideas (and more quickly) and, in doing so, retrieve more uncommon ideas than participants with lower creative potential (Benedek & Neubauer, 2013).

Several studies have used verbal fluency tasks to estimate participants' semantic memory networks and explore their association with creative performance (Kenett, 2018; Kenett et al., 2014; Luchini et al., 2023). However, as highlighted by Volle (2018), verbal fluency relies on associative but also executive processes (i.e., word selection according to a criterion, not repeating words, switching among semantic categories; Diamond, 2013; Lee & Therriault, 2013; Marron et al., 2018). Hence, fluency tasks might not be the most appropriate tool to determine the relevance of semantic memory on creativity. Indeed, other studies have used semantic priming as a tool to measure participants' semantic memory structure (Kumar et al., 2020; Levy et al., 2021). Although controlled processes might also contribute to it, semantic priming is thought to rely, first and foremost, on automatic processes (Lerner et al., 2014) and to be modulated by the number of associated concepts and their interconnectivity (Kenett et al., 2017; Nelson et al., 1993). Hence, in the present study, we focus on strong (between closely related concepts) and weak (between more distant concepts) semantic priming indices to examine the relationship between semantic memory structure and creativity. According to Mednick's (1962) proposal, more creative people would exhibit larger semantic priming effects than less creative people. In support of this, Gruszka and Necka (2002) demonstrated that more creative participants (compared to less creative ones) exhibit a higher predisposition to judge unrelated words as more associated and to exhibit larger priming effects. Similarly, Radel et al. (2015) observed that reducing inhibitory control enhanced priming effects for weakly related word pairs as well as creative performance. In summary, associative processes seem to be involved in creative performance, and semantic priming (especially when the semantic distance between the prime and target is manipulated) emerges as an interesting tool to investigate the association between semantic memory and creativity.

Regarding controlled processes, some studies support the idea that the way in which the context is attended (and consequently perceived) may affect creativity through the semantic search process (Förster & Dannenberg, 2010; Martindale, 1999; Mendelsohn, 1976). The rationale behind this idea is that a narrow attentional scope might hamper creativity because the spreading activation process from one concept to another is limited, and only stronger and closer concepts are activated (e.g. 'lighter' strongly activates 'match'), while more remote but related concepts are less accessible (e.g. 'halo'; Friedman & Förster, 2008; Wronska et al., 2018). When attentional scope is broad, more concepts are potentially activated, even though the activation level of each piece of information is lower and larger amounts of information become accessible, thus leading to the consideration of remote concepts (Chiu, 2015; Liu, 2016). Consistent with this idea, Colzato et al. (2017) showed that meditation techniques that broaden the scope of attention enhance creativity compared to meditation techniques aiming to narrow attentional scope. Liu (2016) manipulated participants' attentional scope and showed that participants in the narrow attention condition (performing a category-based fluency task that constrained their attention) were less creative than participants in the broad attention condition (performing a free association task).

The results from a study by Zmigrod et al. (2015) also support the idea that attentional scope relates to creativity. They examined whether individual preferences in attending to visual stimuli could predict participants' creative performance. To assess visual attention styles, participants completed the global-local task (Navon, 1977), wherein they were instructed to identify the global or local feature, in separate blocks, of congruent and incongruent stimuli configurations (e.g. large letters S or H composed of small letters S or H). This task provides three behavioural indexes: a) global precedence—participants' performance is better in responding to the global level than the local level of the stimuli, meaning an advantage attending to broad stimulus; b) global interference—incongruent information at the global level hinders performance at the local level, meaning that local processing is hampered by the global aspects; and c) local interference, which refers to an impairment when responding to the local level generated by the global level or, in other words, how attending to details interferes with perceiving the 'big picture'. To assess creativity, Zmigrod et al. (2015) used two tests: the RAT and the AUT. The results of the study indicated that higher global interference was associated with better performance in the RAT and that better performance in the flexibility measure of the AUT (number of different categories used in responses) was negatively related to local interference, which suggests that enhanced attentional bias to the global aspect of visual stimuli promotes creative responses.

A recent study by Liu and Peng (2018; Exp. 1), however, found no evidence of an association between attentional style and performance in a creative task. In this study, participants first performed an adapted global-local task (Navon, 1977) so that they had to uniquely respond to either local or global conditions, but not to both. Afterwards, they performed the AUT. This manipulation was expected to bias the participants' attentional style to a narrower (local condition) or broader (global condition) scope. However, the results failed to show any effect of the scope of attention over the AUT, suggesting that attentional scope might not be critical for performance in creativity tasks. Other study (Zabelina et al., 2016; Exp. 2) failed to find an association between response times (in a task similar to global-local) and creativity measured with the Abbreviate Torrance Test for Adults (ATTA: Goff & Torrance, 2002). Hence, the mixed pattern of previous results suggests that more research is necessary to determine the extent to which attentional style is involved in creative ability.

Other control processes such as inhibition could also contribute to the production of creative responses, although the available evidence shows mixed results regarding this possibility (Beaty et al., 2019; see Chrysikou, 2019 for a review; Gupta et al., 2012; see also Radel et al., 2015). Of special relevance here, a recent study reported data indicating that inhibitory control of memory representations regulates the activation of possible solutions and influence their accessibility during creative problem resolution (Gómez-Ariza et al., 2017). In this study, participants performed the adaptation of the selective retrieval task (SRT) followed by RAT resolution. First, participants studied a list of category-exemplar words and then repeatedly retrieved some of them before finally solving a set of RAT problems. Critically, the solutions to the RAT problems were words from the previous phases of the experiment: namely, they could be either only-studied words (baseline), practiced (repeatedly retrieved) or competitor words (words that were related to the practiced ones and thought to be inhibited to prevent them from interfering during selective retrieval). The results showed that practiced words were more often chosen as solutions than the only studied words. More relevant here, competitor (inhibited) words become significantly less produced as RAT solutions compared to baseline items (see also Valle et al., 2020a, 2020b; Valle et al., 2019).This effect resembles the standard retrieval-induced forgetting (RIF) effect that it is usually obtained with explicit memory tests and that have been interpreted as the result of an prefrontally-mediated inhibitory mechanism that reduces the activation level of competing items to facilitate access to target items during selective retrieval (SR; Anderson & Hulbert, 2021; Bajo et al., 2021). This experimental procedure and the subsequent inhibitory effect that is usually observed with it are especially relevant to explore the role of inhibition and memory accessibility in the resolution of creativity problems.

During RAT resolution, the search for weakly related novel responses will necessarily activate multiple ideas and concepts, especially strongly related ones that might interfere with and impair the creative process. The ability to inhibit (or suppress) this interfering information is thought to be crucial in producing creative ideas. Thus, for example, for a RAT problem such as ARCHIPELAGO–CAGE–BANANA, MONKEY might be activated, given its strong association with CAGE and BANANA. However, MONKEY is not related to ARCHIPELAGO, so it should be put aside to facilitate the finding of a more suitable solution (e.g. CANARY; Storm & Hickman, 2015). Further support to the relevance of inhibition during semantic search comes from a study by Marko and Riečanský (2021) in which they investigated the association between semantic network connectivity (structural properties) and semantic control functions (i.e. semantic inhibition and switching). To measure semantic control processes, participants performed the Associative Chain Test (ACT; Marko et al., 2019), whereas a sematic judgement task (SJT) was used to estimate semantic network structure. In the ACT, participants have to generate words' chains under specific criteria: an associative condition (generate semantically related words) that provides information about associative semantic ability; a dissociative condition (generate unrelated words) that is considered to tap inhibitory control; and an associative–dissociative condition (participants switch the retrieval rule from one word to the next) used to determine switching costs during word generation. The results indicated that better structural properties of the semantic network (i. e. tighter clustering and shorter average path length between concepts) requires more inhibition of interfering information but benefits flexible switching among clusters. Furthermore, as previously discussed, Beaty et al. (2022) showed that semantic richness was associated with an increase in the number of ideas that, however, were less original. Therefore, while associative processes are critical to activate different pieces of information, (inhibitory) control processes might be determinant in the process of selecting original ideas. In this sense, some studies have shown that inhibitory control is a plausible mechanism to facilitate the search for creative responses by reducing interference from highly associated or misleading ideas (Benedek et al., 2019; Benedek et al., 2012; Storm & Hickman, 2015).

Results from other studies, however, suggest that inhibitory control might not be necessary during semantic search (Michalko et al., 2023). Marko et al. (2019; Exp 2) explored the role of lexical-semantic measures and executive functions in solving RAT problems. Specifically, participants were asked to solve these problems after performing an Associative Chain Test (ACT; Marko et al., 2019). The results showed that it was only semantic associative ability that predicted the ability to reach remote associates in the RAT, so that neither inhibition nor switching cost measures were responsible for individual differences in RAT performance. In summary, the role of inhibition in creativity tasks remains an issue that deserves further research.

To sum up, although semantic associative processes, inhibitory control and attentional scope seem to play a role in creativity, the available evidence on this issue is mixed, and further research is necessary. Importantly, no study to date has explored the relative role of these factors on creative performance in the same group of participants. The main goal of the present study was to contribute on this issue.

1.1. Aims of the study

In the present work we aimed to examine the role of semantic memory organization, attentional styles and inhibitory control in people who differed in creativity. Participants performed a lexical decision task (LDT), wherein we manipulated the degree of semantic relatedness among the primes and targets to obtain two semantic priming indexes (strong and weak). To measure attentional style, we used the global-local task and obtained global preference, global interference and local interference as indexes. Finally, our participants performed the adapted Selective Retrieval Task (SRT) used by Gómez-Ariza et al. (2017), which provides an index of inhibitory control (retrieval-induced impairment in RAT problems) as well as an index of baseline performance in creative responses.

Based on the results of previous studies, we expected that creativity (as measured with the baseline problems of the RAT) would be positively related to the semantic priming indexes (i.e. more facilitation in the semantically related conditions than the control condition in the LDT). In particular, we expected this association to appear for both strong and weak semantic priming indexes, but we were most interested in priming with weakly related associates since it might be a good index for capturing associations among distant semantic concepts. Additionally, assuming that there might be a relationship between conceptual and attentional scope, we expected a positive association between creative potential (higher RAT scores) and global interference and precedence indexes in the global-local task, but a negative association with local interference in this same task. Since previous studies have shown that manipulating the

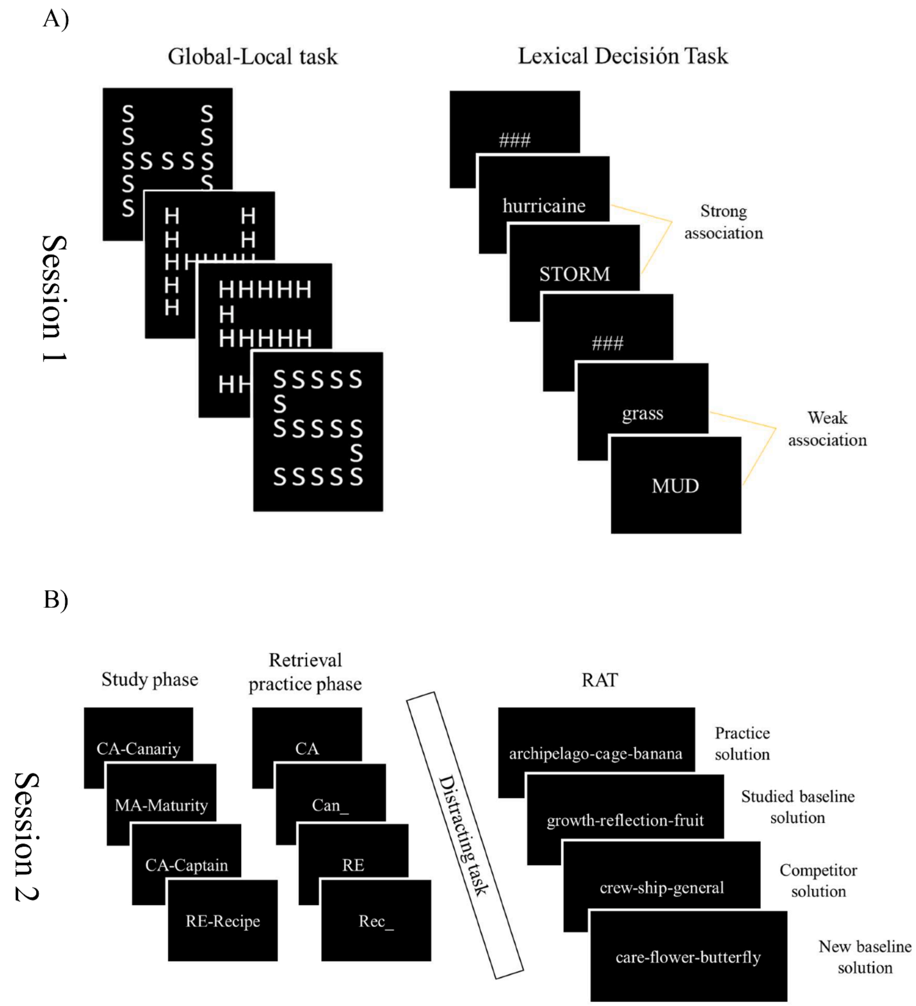

Fig. 1. Graphic representation of the experimental procedure. A) In session 1 participants performed the lexical-decision task and the global-local task, counterbalance order was applied across participants. B) In session 2, participants performed the selective retrieval practice followed by the RAT.

attentional scope in a semantic fluency task influenced performance in a creative task (Liu, 2016), we expected a mediational role of attentional scope so that more global attention might modulate semantic priming and this, in turn, influence RAT scores. Moreover, we expected a mediation effect of the weak semantic priming index in the association between strong priming index and creativity. Finally, if inhibitory control is a key process for reducing interference from irrelevant information, it would be expected that greater retrieval-induced impairment (a by-product of inhibitory control during selective retrieval) would align with better creative performance.

2. Methods

2.1. Participants

A total of 124 undergraduate students (mean age = 21.62 years; SD age = 5.65 years; 107 women) were recruited to participate in the experiment in exchange for course credits. Invitations to participate were sent to students at the University of Granada and at the University of Jaen, two similar and geographically close public universities where the authors are affiliated. Due to the pandemic restrictions of COVID-19 during the data collection process, we used the Gorilla Experiment Builder platform (https://app.gorilla.sc/) to program the tasks and to have participants complete the tasks online. Participants acceded Gorilla using SONA SYSTEMS, an online platform which is used by the University of Granada to provide students with the opportunity to participate in experiments. The sample size was calculated in advance using G*Power (Faul et al., 2009). The analysis indicated that a sample of 98 participants was large enough to detect a medium-sized effect ($f^2 = 0.15$; $\alpha = 0.05$; power = 0.80) with six predictors (the tasks' indexes). Because we expected that some students would not answer the invitation to participate and that some would fail to complete the set of experimental tasks, we sent the invitation to 290 students to ensure an appropriate sample size. From the invited sample, 126 participants abandoned the study (they started the first session but never completed it, did not continue with the second session or interrupted their participation during this session). Since part of the tasks in the second session were completed by verbal response, additional control of participants' performance was applied through audio recordings. Forty additional participants were removed from the analysis for the following reasons: (1) they misunderstood the RAT (they interpreted from the instructions that they had to think of a chaining word to the three provided in the problem or they had to think about something personal being suggested by the words in the problem, $n = 5$); (2) they discussed possible solutions to the RAT problems with someone else, $n = 7$); (3) there were errors in data recording ($n = 2$); or (4) they noticed that some of the RAT problems could be solved with words that were previously presented in the experimental session ($n = 26$). The final sample comprised 124 participants from the Universities of Granada ($n = 80$ mean age = 22.55 years; SD age = 6.65 years; 67 women) and Jaén ($n = 44$; mean age = 19.95 years; SD = 2.37; 40 women).

2.2. General procedure

The study was conducted in two sessions that were performed online by the participants (see Fig. 1 for a representation of the general procedure). Participants were instructed to be completely alone during their participation in a quiet room. In the first session, participants accomplished the LDT and the global-local task, with their order counterbalanced across participants. About a week later ($M = 9.3$ days; SD = 3.5), participants completed the second session, in which they performed the adaptation of the SRT, followed by the RAT developed by Gómez-Ariza et al. (2017). At the end of the second session, in the debriefing, participants were asked whether they used strategies (and if so, which ones) to memorize the words in the study phase. They were also asked to report whether they noticed any relationship between the two tasks in the session. If they did, they were encouraged to provide further details about the specific time they noticed it. As in Rivera et al. (2023; Exp. 3), to control for participants performance during the online experiment, mandatory fullscreen mode was required. We set 35 min as maximum time to complete the first session. In the second session participants had a maximum of 1 hour and 15 min to complete.

2.3. Materials

2.3.1. Lexical decision task

We used the same materials as the study by Sánchez-Casas et al. (2006). In their study, they firstly selected pairs of semantically related words to be used as primes and targets using a similarity rating task and a feature generation task. Through these two tasks they obtained prime-target pairs that varied in semantic relatedness (weakly related and closely related pairs). Afterwards, they performed a lexical decision task (Experiment 1) and a semantic decision task (Experiment 2) to test the pairs in different set of participants. The results revealed that both types (closely related and weakly related) generated semantic priming effects. Moreover, they observed that the priming effect of closely related pairs was larger than in weakly related pairs. These materials contained 72-word triplets in which one word was the target and the other two were the primes, one with a strong semantic association (semantic distance, mean = 0.73; SD = 0.21) and the other with a weak semantic association (semantic distance, mean = 1.03; SD = 0.15) with the target (e.g., swallow–sparrow and swallow–squirrel). During the task, each target word appeared only once and was presented under one of the four possible counterbalanced experimental conditions: (a) identity condition, prime and target were the same (e.g. sparrow-SPARROW); b) control condition, prime and target did not have semantic relationship and prime and target words from different triplets were selected (e.g. trousers-SPARROW); (c) weak semantic association condition, the target and prime had a weak semantic association (e.g. squirrel-SPARROW); or (d) strong semantic association condition, the target and prime had a strong semantic association (e.g. swallow–SPARROW).

In addition to the original experimental materials, we created 72 new fillers prime–target pairs with no semantic association. We then reduced the percentage of semantically associated pairs by approximately 25 %. Finally, we created 144 prime and nonword target pairs with a similar structure to the original experimental set. Specifically, we created triplets that were formed with words that were similar in lexical frequency and letter numbers (primes: mean frequency = 41.2, SD = 104.22; mean letter number = 6.3, SD = 1.79; targets: mean frequency = 56.1, SD = 99.77; mean letter number = 6.3; SD = 1.76). Subsequently, we selected 288 concrete words from the Spanish frequency dictionary to work as distracters and took special care to create pairs similar in lexical frequency and number of letters to those in the experimental set.

Similar to Sánchez-Casas et al. (2006), we designed four experimental versions with 288 trials each. Hence, no prime–target pair was presented twice to any participant, but each experimental target was presented across the four possible experimental conditions of counterbalance. The filler pairs and the word–nonword pairs were the same for the four experimental conditions.

At the beginning of each trial, a "#" symbol appeared for 1000 ms. Then, the prime word in lowercase was shown for 250 ms followed by the target word in uppercase for 1000 ms. As in Sánchez-Casas et al. (2006), the SOA was of 250 ms. The words appeared in the center of the screen in white font on a black background. Participants were instructed to respond whether the string letter in uppercase was a word or not as quickly and accurately as possible. They responded by pressing the keyboard buttons 'z' or 'm'. The yes and no response buttons were counterbalanced across participants. The task started with a practice block of 12 trials containing all the different kinds of conditions in the same proportions as the experimental block. After practice, the experimental block took place, in which word pairs were presented in random order and feedback was provided after every trial.

From each participant's responses, we calculated two semantic indexes. One was computed by subtracting the mean response times (RTs) in the weak semantic condition from the mean RT in the control condition (weak semantic index), and another (strong semantic index) was computed by subtracting the mean RT in the strong semantic condition from the RT in the control condition.

2.3.2. Global-local task

For this task, we followed the procedure developed by Zmigrod et al. (2015). Two large letters, S and H, were created from 5 × 5 matrixes that also included the small letters S and H. The stimuli were congruent when the same letter was contained in the local and global levels (i.e. large S formed by little S) or incongruent when the letter at the local level was different from the global level (i.e. large H formed by little S).

First, a fixation cross was presented in the center of the screen for 500 ms, after which the stimulus was shown for 3000 ms. Participants were instructed to identify the global (large) or local (little) letter in two separate blocks. Each experimental block contained 72 trials. Before the task, there was a practice block, and participants received feedback after each trial. The stimuli were randomly presented in the center of the screen in a white font on a black background, and the presentation of the two blocks was counterbalanced across participants.

From the global-local task, we obtained three different indexes of attentional style: the global precedence index, calculated as the subtraction of mean RT to trials in the global block from those in the local block; and the global and local interference indexes, estimated by subtracting the mean RT to congruent trials from incongruent trials in local and global blocks, respectively.

2.3.3. Selective retrieval practice and remote associates test

2.3.3.1. Study phase. Participants were told to memorize pairs of syllable-exemplars of orthography-based categories (e.g. CA-Canary, MA-Maturity, CA-Captain, RE-Recipe; See Fig. 1B) because afterwards they would be tested. Each pair was presented for five seconds, with a one-second interval between pairs. They watched 36 pairs of stimuli (category-exemplar) twice in random order, always using the same four filler pairs at the beginning and at the end.

2.3.3.2. Selective retrieval phase. Here, the participants had to repeatedly recall half of the items of half of the categories presented in the encoding phase. As can be seen in Fig. 1B, every trial began with the presentation of a category cue (e.g., CA) for two seconds; after a one-second interval, a three-letter exemplar-fragment appeared for five seconds (e.g., Can_). Participants were asked to say aloud a single word from the previous phase that matched the fragment. Participants' voice was recorded through a specific setting available in Gorilla that allows researchers to record audios using computer microphones. Previous consent regarding this issue was always obtained before starting the experiment. The words were divided into blocks of three items, always with a filler word at the beginning and at the end of each block. Each trial was practiced five times in the above-mentioned blocks pseudo-randomly, in which only one category appeared at a time. Subsequently, the participants performed a distracting task. They had to circle two different letters (k and w) in a text written in a foreign, unfamiliar language for five minutes.

2.3.3.3. Remote associates test (RAT). Participants solved creative problems composed of three words with no apparent association between them. They were instructed to come up with a fourth word related to all of them under different kind of association; contextual co-occurrence, descriptions, synonyms, semantic association, and compound words. Before starting, they were presented with two pre-solved RAT problems to familiarise them with the process. To avoid creativity constrains (Smith et al., 1993) and to assure that participants would not try to mimic the same type of relationship, different kind of associations were used in the examples. In one of the examples (*carbon-humor-pelo*; coal-mood-hair) the association between the solution (*negro;* black) and the problem cues was description for two, and compound word for the other, in the other problem (football-quotient-cellular) the association with the answer (division) was contextual co-occurrence for two cues and compound word for the last. Subsequently, participants had to solve

18 filler RAT problems that were selected from the normative study of Peláez-Alfonso et al. (2020) to enhance the implicitness of the task. Then, they solved 54 problems in random order (see RAT in Fig. 1B), divided into two different blocks based on lexical frequency. In the first block, the solutions to the problems were high-frequency words (competitors and items from both baseline conditions: studied and new). In the second block, problems were presented that could be solved with low-frequency items (practiced and items from the studied and the new baseline conditions). Participants were given one minute per problem and pressed the space bar to continue once they had said their responses. To record participants' response, the same protocol as the previous phase was followed. When no response was provided, the next problem appeared automatically after one minute.

From the RAT that followed the SRT, we computed two scores for each participant: (1) an inhibition index (calculated by subtracting correct solutions to problems to be resolved with competitors from correct solutions to problems to be solved with studied baseline items, in which higher values above zero reflect better inhibitory control); and (2) a basic creativity index (correct responses to problems that could be solved with never-presented solutions; averaged performance to medium-low and medium-high-frequency from new baseline items) that was independent of previous presentations of solutions. All participants went through the three main phases of the SRT: study phase, retrieval practise phase and RAT. Participants were instructed that they would perform two different and unrelated tasks: A memory task first and then a creativity task.

Regarding the stimuli, we used the list of items used by Bajo et al. (2006; see also Gómez-Ariza et al., 2017). The experimental set consisted of 54 words belonging to nine different orthographic categories (e.g. DI, RE, TA). Additionally, two filler categories with two words each were created to be used at the beginning and end of the presentation to avoid primacy and recency effects. Each orthographic category included six words that shared the first two letters (e.g. rebaño, receta, relámpago, regalo, reserva, retrato, for the category RE). Each word was chosen according to its lexical frequency from the normative database of Alameda and Cuetos (1995). All categories included three medium-high-frequency words (range = 34–98, $M = 58.7$) and three medium-low-frequency words (range = 10–34, $M = 20.1$). Moreover, the included words met the following criteria: (a) between two and five syllables long; (b) no semantic or associative relationship with the other words; and (c) uniqueness in the third letter within the category.

The medium-high lexical frequency words were counterbalanced across the following experimental conditions to assess the effect of inhibitory control during selective retrieval (SR) on the resolution of RAT problems: (a) competitors during SR (items that were presented during the first phase of the experimental session but belonged to the same lexical category as the practiced items, although they were never practiced themselves); (b) studied baseline (items that were presented during the first phase of the experimental session but neither belonged to the same lexical category as the practiced items nor were practiced themselves) that served as the standard control condition to assess the negative (inhibitory) effect of selective retrieval on RAT problems solving; and (c) new baseline (items that were not presented during the first phase of the experimental session, nor belonged to the same lexical category as the practiced items, nor were practiced themselves) that served as the control condition for the studied baseline items to determine the effect of the previous presentation of solutions to RAT problems.

Medium-low lexical frequency words were counterbalanced across the following conditions: (a) practiced (targets) during SR (items that were presented during the first phase of the experimental session and were to be repeatedly retrieved during SR); (b) studied baseline (items that were presented during the first phase of the experimental session but neither belonged to the same lexical category as the practiced items nor were practiced themselves), which served as the standard control condition to assess the positive (facilitatory) effect of selective retrieval on RAT problem solving; and (c) new baseline (items that were not presented during the first phase of the experimental session, nor belonged to the same lexical category as the practiced items nor were practiced themselves). Again, these baseline items served as the control condition for the studied baseline items to determine the effect of the previous presentation of solutions to RAT problems.

Six different counterbalanced sets were created to rotate every category across the practiced, non-practiced and non-presented conditions. In each counterbalanced set, three categories were studied and practiced (e.g., DI, RE, TA), so they generated the practiced and competitors' items during SR, while the three categories were studied but not practiced (e. g., BA, MA, DE) and they brought out the studied baseline items; the three remaining categories were not studied (e. g., CA, PE, FA) and produced the new baseline items.

For the RAT, 54 problems were created. Each problem could be solved with one of the 54 words from the nine categories previously described (e.g. growth-reflection-fruit for maturity). Prior to these problems, we presented 18 additional filler problems extracted from the normative study of Peláez-Alfonso et al. (2020) to minimize the probability of participants recognizing the connection between the RAT and the previous (memory) task. As in Gómez-Ariza et al. (2017), the associative strength between RAT problems' words and their solutions was moderate (forward/backward associative strength < 0.20). The nature of the relationship could be synonymy, compound word, contextual co-occurrence or semantic relatedness.

2.3.3.4. Statistical analysis. To analyze performance in the LDT, we took error rates and (logarithmic, log) response times to correct trials as dependent variables. We used a repeated-measures analysis of variance (ANOVA) with conditions (identity, control, weak and strong semantic associates) as the within factor for each dependent variable. In the global-local task, we considered hits and log RTs to correct trials as dependent variables. A factorial ANOVA was performed with block (global, local) and congruency (congruent, incongruent) as the within factors for each dependent variable. For the SRT, we calculated the mean percentage of correct recall across retrieval attempts. Performance in the RAT was analysed on correct responses to the different conditions of the solutions to the problems (i.e. practiced, competitors, studied baseline and new baseline) by using ANOVAs and *t*-tests. Analyses were conducted by considering two different scoring criteria: a strict criterion (only solutions that matched the items studied in the first phase were considered correct) and a lenient criterion [solutions that were similar (i.e. synonyms) to the correct solutions and served as plausible solutions were considered correct). To accept solutions following the lenient criteria, plausible solutions were first selected (words with the same meaning as the primary correct solution and that maintained the same type of relationship with the words in the problem, such as compound word, semantic relationship, description, etc.). Thus, for example, for the problem "border-limit-fence" with the primary solution being "barrier," the accepted alternative solutions were "division," "wall," or "separation." As a second stage in the process, the proposed alternative solutions were agreed upon by the authors to ensure a standard criterion. The words accepted as solutions by the lenient criterion, as well as the problems and primary correct solutions, are shown in the supplementary material.

For descriptive purposes, bivariate correlations between all the variables were run using the Benjamini–Hochberg method to correct for multiple comparisons (false discovery rate = 0.15). The results from these analyses have been included in the appendix. To test our hypothesis that strong creative performance is associated with semantic memory organization, inhibitory control and global attentional style, we performed stepwise multiple regressions analyses over the creativity performance by entering as predictors our indexes of semantic structure, global attentional style and inhibition. Descriptive statistics for these indexes are reported in Table 1.

3. Results

3.1. Lexical decision task

Errors: The ANOVA performed on errors showed a significant effect of type of prime, $F(3, 123) = 11.07$, $p < 0.001$, $\eta^2 = 0.08$. Planned comparisons revealed statistically significant differences between the identity condition and the control unrelated condition, $t(123) = 5.63$, $p < 0.001$, $d = 0.50$. Participants made fewer errors in the identity condition ($M = 0.02$; $SD = 0.04$) compared to the control condition ($M = 0.06$; $SD = 0.07$). Similarly, participants made fewer errors in the strong semantic prime condition ($M = 0.04$; $SD = 0.063$) compared to the control condition ($M = 0.06$; $SD = 0.07$), $t(123) = -3.11$, $p = 0.01$, $d = -0.28$. However, there was no difference between the weak prime condition ($M = 0.05$; $SD = 0.06$) and the control condition ($M = 0.06$; $SD = 0.07$), t(123) = 1.99, $p = 0.28$, or between the strong and weak conditions, $t(123) = 1.12$, $p > 0.9$.

Response times: The ANOVA on response times revealed a significant main effect of priming, $F(3, 123) = 105.67$, $p < 0.001$, $\eta^2 = 0.46$. There were significant differences between the identity condition ($M = 2.77$; $SD = 0.07$) and the control condition ($M = 2.82$; $SD = 0.06$), $t(123) = 15.96$, $p < 0.001$, $d = 1.43$, and between the weak prime and the control condition ($M = 2.81$; $SD = 0.06$) and strong conditions ($M = 2.82$; $SD = 0.06$), $t(123) = 2.67$, $p = 0.04$, $d = 0.24$. The difference between the strong prime and the control conditions did not reach statistical significance ($t(123) = -2.14$, $p = 0.19$) .[1]

3.2. Global-local task

Accuracy. Analyses on the correct responses revealed a reliable congruency effect $F(1, 123) = 42.84$, $p < 0.001$, $\eta^2 = 0.11$. Participants were more accurate when responding to congruent ($M = 0.97$; $SD = 0.04$) than to incongruent stimuli ($M = 0.91$; $SD = 0.10$). The interaction between block and congruency approached to statistical significance and we followed it up, $F(1, 123) = 3.70$, $p = 0.06$, $\eta^2 = 0.008$. Post-hoc analyses indicated that participants showed better performance in the global block for congruent ($M = 0.97$; $SD = 0.04$) than for incongruent trials ($M = 0.90$; $SD = 0.10$), $t(123) = 6.12$, $p < 0.001$, $d = 0.68$. In a similar vein, in the local block participants exhibited better performance when responding to congruent ($M = 0.96$; $SD = 0.06$) than to incongruent trials ($M = 0.93$; $SD = 0.15$), $t(123) = 3.52$, $p = 0.003$, $d = 0.27$.

Response times. The analyses on the log-response times to correct responses showed a reliable block effect $F(1, 123) = 51.19$, $p < 0.001$, $\eta^2 = 0.179$. Participants were slower responding to local ($M = 2.71$; $SD = 0.05$) than to global trials ($M = 2.68$; $SD = 0.05$). There also was a reliable congruency effect, $F(1, 123) = 320.13$, $p < 0.001$, $\eta^2 = 0.18$, which was modulated so that participants were faster responding to congruent ($M = 2.68$; $SD = 0.05$) than to incongruent trials ($M = 2.71$; SD = 0.05). The interaction between block and congruency also was statistically significant $F(1, 123) = 59.50$, $p < 0.001$, $\eta^2 = 0.042$. Further analyses revealed that all simple effects yielded statistically significant results, but they differed in effect sizes, which accounted for the reliable interaction. Thus, although participants were faster in congruent ($M = 2.69$; $SD = 0.05$) than in incongruent trials ($M = 2.73$; $SD = 0.06$) in the global block [$t(123) = -17.61$, $p < 0.001$, $d = 1.70$] as well as in the local block (congruent: $M = 2.67$; $SD = 0.06$; incongruent: $M = 2.68$; $SD = 0.06$; $t(123) = -6.26$, $p < 0.001$, $d = -0.52$), the effect was three times as large in the global block.

Additionally, participants responded faster to congruent trials in the local ($M = 2.67$; $SD = 0.06$) than in the global block ($M = 2.69$; $SD = 0.05$; $t(123) = 4.09$, $p < 0.001$, $d = 0.37$), and the same pattern appeared for incongruent trials (local block: $M = 2.68$; $SD = 0.06$; global block: $M = 2.73$; $SD = 0.06$; $t(123) = 8.37$, $p < 0.001$, $d = 0.75$), with the size of this block effect being twice as large for the incongruent trials.

3.3. Selective retrieval phase and RAT

The mean proportion of correct responses during the retrieval practice phase was 0.57 (SD = 0.20). All participants included in the analyses reached a minimum of 15 % correct responses to ensure their engagement during the task.

We performed analyses to determine if participants exhibited the expected retrieval-induced impairment (our inhibitory index)

[1] Since we were interested in individual differences, no measures were taken to minimize the influence of outliers to estimate priming effects at the group level. However, an analysis after winsorizing outliers (from 4 participants) revealed a reliable strong priming effect, $t(123) = 3.07$, $p < 0.01$, $d = 0.20$.

Table 1
Descriptive statistics (means and standard deviations) of the indexes obtained from the three experimental tasks.

Lexical decision task		Global-local task		Selective retrieval task/RAT	
Strong semantic priming log-RT index	0.006 (0.03)	Global precedence RT index	-0.30 (0.04)	Inhibitory Index	0.07 (0.24)
Weak semantic priming log RT index	0.008 (0.03)	Global interference RT index	0.017 (0.03)	Creativity index	0.27 (0.14)
		Local interference RT index	0.047 (0.02)		

when solving RAT problems (see Gómez-Ariza et al., 2017). This was done by comparing the proportion of correct responses to problems whose solutions were competitor items during the selective retrieval phase (i.e., problems whose solutions did not appear during the selective retrieval phase but belonged to the practiced category) with the proportion of correct responses to baseline studied problems (whose solutions were studied items belonging to categories that were not presented during the practice phase).

Retrieval-induced impairment: When considering a strict scoring criterion, the analysis indicated that participants solved fewer problems whose solutions were competitors during the selective retrieval phase ($M = 0.27$; SD = 0.17) than problems whose solutions were baseline items ($M = 0.34$; SD = 0.20), $t(123) = 2.96$, $p = 0.004$, $d = 0.26$. The same pattern of results was obtained when the analysis was performed considering a lenient criterion to score the responses (competitors with $M = 0.33$ and SD = 0.16; baseline with $M = 0.40$ and SD = 0.18), $t(123) = 3.58$, $p < 0.001$, $d = 0.32$).

3.4. Regression analyses

We ran a stepwise multiple regression analysis over the creativity performance (in non-studied solution problems). In the regression analysis, we included the strong semantic priming index, the inhibition index, the weak semantic priming index, and global precedence as predictors. Importantly, because the global precedence and global interference indexes were correlated (see supplementary material), we only included global precedence as the index of global attentional style. As seen in Table 2, the results of the regression model revealed that only the strong semantic priming index and the inhibition index significantly accounted for variability in the creativity index, which suggests that only semantic priming and inhibitory control (see Figs. 2 and 3) would contribute to creative performance.

The same analyses were conducted on correct responses to RAT problems after using a lenient scoring criterion, with the results remaining essentially the same. Again, Pearson correlations between the tasks' indexes and performance in the RAT revealed that only the strong semantic priming and the inhibition indexes correlated with RAT performance and that both contributed to accounting for the variance in creative performance.

3.5. Mediation analyses

We also conducted analyses to test whether attentional style and weak semantic priming played a mediating role in creativity performance. We used strong semantic priming and inhibition as predictors, global precedence and weak semantic priming as mediators, and creativity as the outcome variable. However, the results failed to confirm a mediation effect for global attentional style or weak semantic priming ($Bs < 0.09$; $ps > 0.1$).

4. Discussion

Current theories envision creativity from an integrative perspective in which associative and controlled processes might play a role in producing innovative and original ideas (Beaty et al., 2022; Benedek et al., 2019). In the present work, we specifically aimed to investigate the relative weight of semantic memory structure, attentional style and inhibitory control on creative thinking from an individual differences approach. To do this, 124 participants were enrolled in a two-session online study in which they performed three different tasks: a lexical decision task, the global-local task and an adapted selective retrieval paradigm followed by the RAT.

In line with previous studies (Kenett et al., 2014; Rossmann & Fink, 2010), we predicted that semantic memory, as measured by semantic priming for strong and weak associates, would correlate with better performance on the RAT. Specifically, we expected that participants with better performance in the new baseline problems would exhibit larger semantic priming for strong and weak associates. We also expected that semantic priming for weaker associates would more strongly predict RAT performance than semantic

Table 2
Summary of the stepwise regression analysis with the creativity index (new baseline) as the outcome and the semantic priming, inhibitory control and global attentional style indexes as predictors.

Model	R^2	B	*SE*	β	*F*	*p*
SSP index	0.05	0.98	0.38	0.23	6.67	0.01
SSP index + Inhibitory index	0.09	1.03	0.37	0.24	5.63	0.04
		0.11	0.05	0.18		

Note. SSP index = Strong semantic priming index. Weak semantic priming and global precedence indexes did not reach statistical significance as predictors $ps > 0.3$.

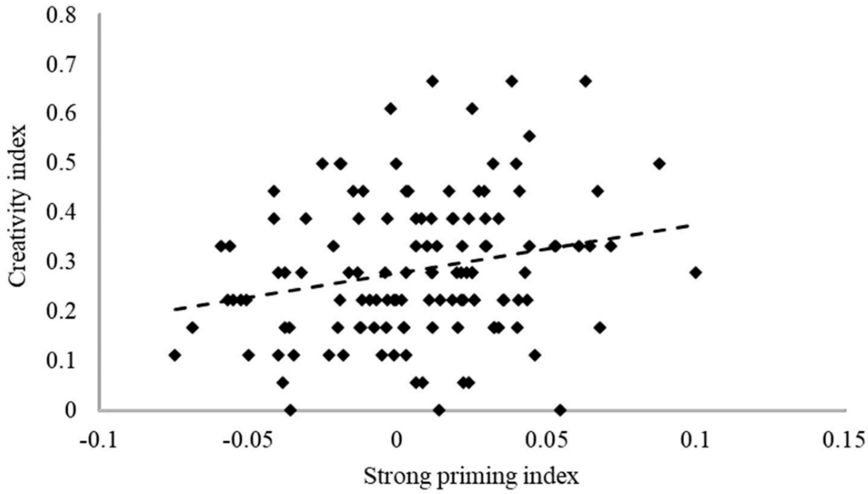

Fig. 2. Creativity performance plotted against the strong priming index.

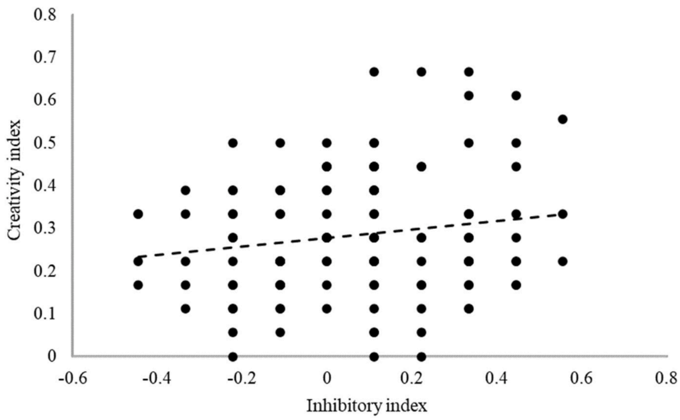

Fig. 3. Creativity performance plotted against the inhibitory index.

priming for strong associates. The results supported our predictions, but only partially. We found evidence for a relationship between the strong semantic priming index and performance on the new baseline problems, but there was no evidence of an association between priming with weak associates and RAT performance, which suggests that the general level of activation in the network might contribute more to RAT performance than the spread of activation to weaker associates.

The finding of an association between semantic priming (strong associates) and RAT performance is in line with the results of a recent meta-analysis on the interplay between semantic memory and creative thinking. In fact, this meta-analysis reveals correlations of similar magnitude to the one reported in this study between semantic priming and creativity (Gerver et al., 2023). Thus, our results support previous work indicating that the structure of semantic memory is critical for creative thinking (Kenett, 2018; Mednick, 1962). In the LDT, the presentation of a prime word related to the target word 'preactivates' the target representation so that its recognition is facilitated when it is later presented (Balota & Lorch, 1986; Neely, 1976). Similarly, when participants face creative RAT problems, the processing of the problem cues initiates a guided search through semantic memory, which facilitates responding to the problems. This activation might constrain the semantic search and make it more efficient (Kenett et al., 2014). Thus, our results show that people with larger sematic activation effects are also better at finding RAT solutions. Interestingly, Smith et al. (2013) investigated how the search process in the RAT takes place. In their study, the participants were asked to perform the RAT, but they were instructed to type each word that came into their minds while trying to solve the problems, regardless of whether the word was considered a solution. The analysis of the response protocols indicated that the search was semantically guided. Thus, participants focused on one RAT cue at a time, and the search for that cue proceeded sequentially through semantically related words so that responses tended to show a chain of semantically related words. This evidence suggests that the search proceeds semantically so that strong semantic activation may facilitate the semantic search.

The fact that priming with weak semantic associates did not facilitate performance in RAT problems may be due to several reasons. Our expectations were that participants with better creative potential would exhibit more priming effects of weak associates due to the more interconnected structure of their semantic network (Beaty et al., 2020; Li et al., 2021). That is, more interconnected semantic structures would facilitate the semantic search process and, if so, would also facilitate RAT performance. On the one hand, the weak semantic index is calculated between distant associate prime and target words. However, it is possible that more remote associations might not be beneficial due to the possible interference generated by multiple other concepts related to the prime and the target (Anaki & Henik, 2003; de Groot, 1983).

Mednick's (1962) model of creativity assumes that, to reach creative ideas, there must be a spontaneous activation and new combination of concepts. Specifically, the recombination of further associated concepts stored in memory would be the building blocks of more creative outcomes. According to more recent versions of the theory, a structural organization of semantic memory, wherein nodes of information are more interconnected and have shorter path lengths, would enhance associative processes (Benedek et al., 2023). The present results, however, do not seem to entirely align with this model. During the LDT, the advantage of responding to targets strongly related to primes is thought to be due to the closeness between both representations in participants' semantic memory network, which would benefit the search for creative responses while completing the RAT. However, our failure to observe an association with the weak semantic priming index limits the implications of remote associations in producing creative responses.

Nevertheless, generating and evaluating possible solutions could not be a necessarily fast process. In fact, response times are not usually considered in creative thinking tasks (Kenett, 2018; Zmigrod et al., 2015). If so, it is possible that to be creative does not necessarily involve fast semantic access to weak associates (as represented by semantic priming with weak associates), but slower access to and evaluation of concepts until remote concepts are reached. Thus, reaching far concepts may be what enhances the creative potential, and this might be facilitated by the stronger semantic activation represented by priming with strong associates and not so much by the fast-spreading activation of remote concepts represented by semantic priming with weaker associates. In this sense, Benedek and Neubauer (2013) observed that participants with higher creative potential were able to retrieve more associated concepts during a verbal fluency task (higher associative fluency) in which they had to produce as many words related to a target word as possible. This is considered a measure of creative potential given that associative fluency has been strongly linked to ideational fluency, an indicator of creativity (Benedek et al., 2012). Similar to their results, our participants with higher RAT scores were indeed faster answering the strong related condition due to the close association between prime and target, which, eventually, might allow them to reach remote relationships when facing creative problems. Hence, it is possible that strong semantic priming, like high verbal fluency, mirrors efficient access to related ideas that can influence creativity on the basis of how information is associated/interconnected.

Regarding attentional style, we did not find any association between global interference, global precedence or local interference with creative performance. A number of previous studies have provided evidence that a global attentional style aligns with more original responses in creative tasks, supporting the idea that a wider focus of attention facilitates the activation of remote concepts, which might be out of focus when a narrower attentional style is predominant (Finke et al., 1992; Martindale, 1995). However, it has been suggested that the relationship between attentional style and creative thinking might not be general but task dependent. First, recent studies (e.g. De Luca et al., 2022) have shown that global/local attentional styles captured through a given task transfer to other tasks that also require global/local processing only if the two tasks are closely related and resemble each other. Substantial changes from one task to the other reduce or eliminate transfer. Hence, it is possible that the evident differences between the global/local task and the RAT might reduce the potential predictive power of global/local attention.

Second, some research has suggested that the type of attentional processing required varies for different creative tasks. For example, inventing a creative title for a picture or a story (Förster & Denzler, 2012) or imagining an animal that lives on another planet (Liu, 2016) might not require the same processes as solving creative problems with a single correct solution like the RAT. While in the first task, correctness might not be a relevant feature of the response, in the case of RAT it is determinant, and narrower attention might be important to evaluate whether a solution is optimal or not (e.g. Simon, 1985). Simultaneously, however, in this task, a wider attentional focus might favor reaching distantly related solutions, so global styles might also benefit performance. In other words, during RAT resolution, the participant starts by conducting a semantic search in which a wide attentional style might help find a remote concept related to the problem words. However, once activation has occurred, a narrower attentional style might be more helpful in selecting the correct solution than a broader attentional style. Hence, it is possible that the lack of association between attentional styles and creative performance is a consequence of the joint engagement of the two types of attentional processes related to attentional styles in different ways. In the idea generation phase, a wide attentional style benefits the process, but during the idea evaluation of the candidates, focused attention enhances the decision. Further research should be directed towards addressing this possibility and disentangling the relative role of attention in the search and selection processes.

Finally, a relevant additional observation in this study is the positive association between our inhibitory control measure and the creativity index. When participants try to solve RAT problems, several ideas are considered potential solutions, while strongly related inappropriate responses must be discarded. To do this, participants may have to trigger inhibitory processes to reduce the level of activation of these activated competing concepts. Our results indicate that the ability to inhibit misleading information to reduce its accessibility is positively related to performance in a creative task such as the RAT. Although the nature of our study does not allow us to draw conclusions about the causality of inhibitory control and RAT performance or about the exact nature of the inhibitory mechanisms underlying selective retrieval and selection in RAT problems, the idea of inhibition during selection is consistent with other studies in which the ability to suppress strong semantic associations is related to creativity (Abraham, 2014; Chrysikou, 2019; Gupta et al., 2012). For example, Storm and Angello (2010) explored whether a stronger ability to overcome memory interference was related to the ability to overcome induced interference in creative problem solving. They correlated their inhibitory index (retrieval-induced forgetting) with RAT performance. Critically, the participants had previously been exposed to incorrect associates of half of the RAT problems they had to solve. The activation of these incorrect responses was shown to produce fixation effects and hamper the search for the correct response (Smith & Blankership, 1991). The researchers observed that RIF was related to performance in the fixated problems of the creativity task (RAT), but not in the control RAT problems, suggesting that inhibition is triggered to suppress strong competitor responses and to facilitate creative performance.

From another perspective, our study joins others in demonstrating that inhibitory control might also impair performance in RAT problems. In the present study, studied baseline words were more often selected as a solution to the RAT problems than competing RP-related words. This effect suggests that the repeated cycles of retrieval attempt during the practice phase made competing words less accessible in the subsequent RAT resolution phase. This effect was described by Gómez-Ariza et al. (2017) and further replicated in analogy problems (Valle et al., 2019, 2020a, 2020b; see also Bajo et al., 2021). From an inhibitory theory account (Anderson & Hulbert, 2021), our results align with previous evidence showing that inhibitory control is the mechanism responsible for competitive memory selection.

The present study has some limitations. First, we did not collect measures of complexity or connectivity to estimate semantic memory structure, which could be of relevance to delve into the link between semantic memory and creativity (Beaty et al., 2022). Future research should consider more complex measures of semantic networks. A second limitation has to do with the type of task used to tap attentional scope that could have contributed to make it difficult to observe an association between attentional scope and creativity. While this null finding adds to previous ones (De Luca et al., 2022), it is possible that other tasks (e.g., inducing mental sets) can be more sensitive and suitable to examine such an association (see Madore et al., 2015, 2016 for a related approach).

5. Conclusions

To summarize, the results of this study support the idea that creativity involves a number of cognitive processes that involve semantic memory and executive control. People with stronger semantic activation, as reflected by larger priming effects, are also better at performing creativity tasks, and we suggest that this might be because stronger activation facilitates the search process in semantic memory. Second, inhibitory control also seems to be related to better performance in the RAT. People with larger inhibitory indexes also obtained larger creativity scores, suggesting that the inhibition of competitors might be a critical function of creative problem solving. Finally, attentional styles do not seem to predict performance in the RAT, which might suggest that this is not an important factor underlying individual differences in creativity. However, the lack of relationship between global/local style and performance in creativity tasks, in our view, should be taken with caution, since it is possible that a global attentional style benefits the idea generation process, whereas a local style of attention might facilitate the selection and evaluation processes that are also needed for a task such as the RAT (Martindale, 1999). Further research should attempt to disentangle the role of these processes in explaining individual differences in creativity.

Supplementary materials

RAT problems, the primary correct solutions and the words accepted as solutions by the lenient criterion.

CRediT authorship contribution statement

Raquel Lezama: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft. **Carlos J. Gómez-Ariza:** Conceptualization, Methodology, Supervision, Funding acquisition, Writing – review & editing. **M.Teresa Bajo:** Conceptualization, Methodology, Supervision, Funding acquisition, Writing – review & editing.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability

The full data set is openly availeble on https://osf.io/my2kv/?view_only=cc279d8931ae477a8df387c5288bd04d

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.tsc.2023.101426.

Appendix

Table A1
Bivariate correlations between every index obtained from the experimental tasks.

	Creativity index	Creativity overall index	Inhibition index	Strong priming index	Weak priming index	Global precedence index	Global interference index	Local interference index
Creativity								
Creativity overall	0.89***							
Inhibition index	0.17 ^	0.05						
Strong priming index	0.23*	0.26**	-0.06					
Weak priming index	0.07	0.11	-0.01	0.55***				
Global precedence index	-0.05	0.01	-0.014	0.07	0.04			
Global interference index	0.05	-0.001	0.03	0.11	0.13	0.24**		
Local interference index	-0.01	-0.07	0.18	-0.11	-0.08	-0.34**	-0.11	

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ^ $p = 0.06$. Table 2 reports the correlations between the semantic priming (weak and strong), global-local and inhibitory indexes, and the creativity indexes. The creativity index always refers to correct responses to RAT problems whose solutions were neither targets nor competitors during retrieval practice. Because there were two types of RAT problems as a function of whether or not their solutions were previously studied, correlation analyses were performed considering them as a single variable (creativity overall index), but also considering only new baseline items. Because the latest was not contaminated by episodic retrieval (the problems were never presented in the context of the experiment), we used new baseline items (creativity index) for further analysis. Only strong semantic priming positively and reliably correlated with the two measures of creativity while inhibitory index was marginally correlated with the creativity index .

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