Primed to fail: How cognitive biases undermine your creativity

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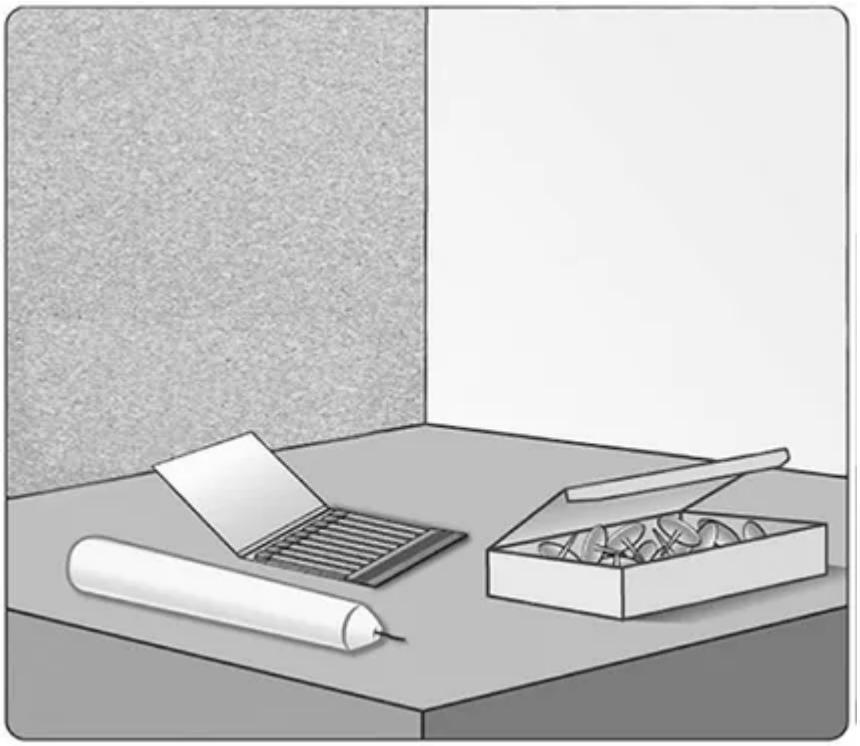
Innovation demands "out of the box" thinking. But have we ever stopped to think about how the box — or, more precisely, how it's presented — might be the problem making our ideas less original?

The Treachery of Images (1929), by René Magritte. A prescient title.

In 1945, Gestalt psychologist Karl Duncker created a task to test people's creative problem-solving: The Candle Problem. The test is to fix a candle to a wall in such a way that when the candle's lit the wax won't drip onto the table below. To do this you can use only the following:

- the candle
- a book of matches
- a box of thumbtacks



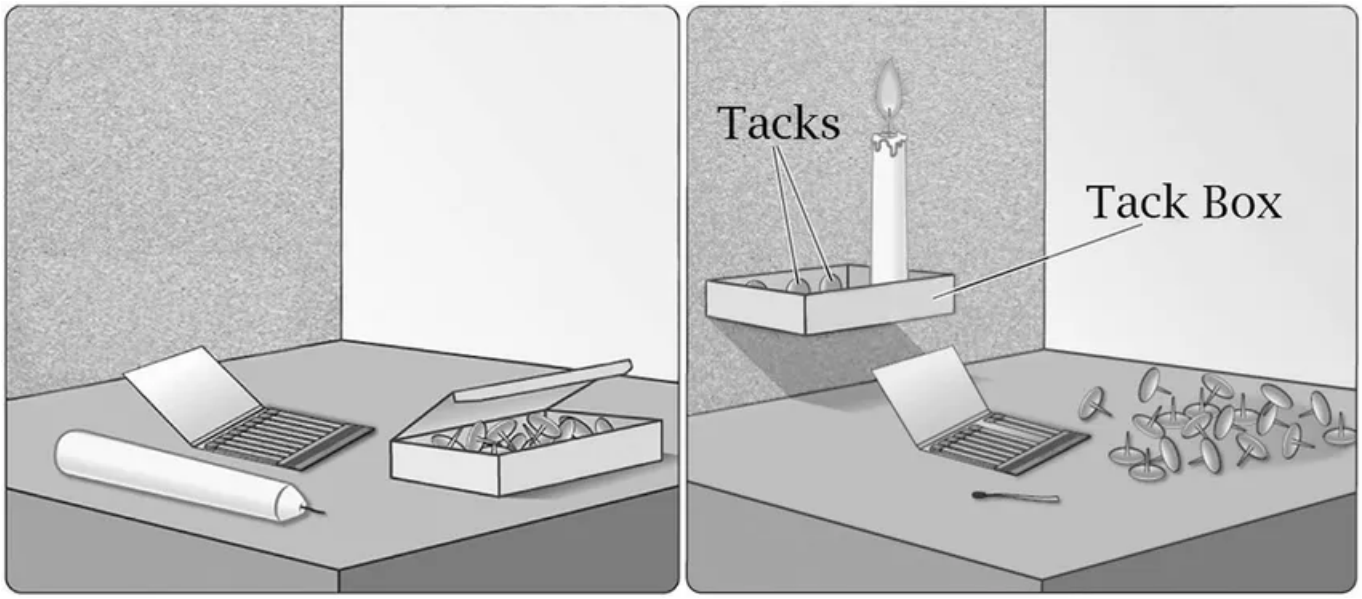
Your mission, if you choose to accept it...

Take a moment to think about how you would solve Duncker's Candle Problem. (Seriously, give it a try — the rest of the article will be way more fun if you play along right now.)

Got your answer? Okay, let's see how you fared!

In testing, participants come up with lots of different solutions. Some try to tack the candle to the wall, while others attempt to melt some of the wax and use it as an adhesive to stick the candle to the wall.

(Spoiler: neither method works.)



Left: Candle Problem. Right: (Hopefully your) Candle Solution.

The most optimal solution is to empty the box of thumbtacks, use the thumbtacks to pin the box to the wall, put the candle into the box, and then light the candle with a match.

If you employed Duncker's solution to the problem: bravo! And if you didn't, do not despair — you are perfectly normal and may just be suffering from *Functional Fixedness*.

What is Functional Fixedness?

> *Functional fixedness is a cognitive bias that limits our ability to perceive utility in things beyond their original, intended function.*

It's a phenomenon found in problem-solving psychology that affects our ability to innovate and be creative when solving challenges. When functional fixedness is in play, we tend to have a narrowed interpretation of what is possible with the resources we have at hand in order to solve a particular challenge. We become 'fixated' on our representations of things, and overlook the latent potential for forms to change function and be utilised in

different ways. In The Candle Problem, the 'box' could represent "something to hold thumbtacks," so would not be immediately perceived as a separate and functional component available to solve the problem. But it could also simply represent "a container," in which case it gains valuable utility in overcoming the challenge. The reason there's a difference between these two perceptions of 'box' is because our representations are constructed by subjective meaning, memory, and experience — all of which have limits, and all of which are prone to bias and skew.

Now you might be thinking that I induced functional fixedness with my instructions (and you'd be partly correct). If, for instance, the task was presented with the tacks piled *next* to the box rather than inside it, or described separately (i.e. "book of matches, box, thumbtacks, etc."), virtually everyone would achieve the optimal solution (Glucksberg & Weisberg, 1966). This brings me to the crux of functional fixedness when it comes to creativity, innovation, and problem-solving...

The way in which problems are communicated to us impacts our ability to solve them.

Stimuli bias

When information is conveyed to us, our semantic memory is activated and brings forth the many related associations we have about what's being presented. How many things — and what types — enter our awareness can be limited by the kind of stimuli presented. This process appears to be particularly pronounced if we are primed with visual stimuli: **when creative problems are presented with visual aids, these stimuli fixate our thinking and make our ideas less original by increasing conformity to the primer** — 'copying,' basically (Chrysikou & Weisberg, 2005). Participants who are shown visual examples tend to conform their ideas to the examples, even

after completing a distractor task prior to generating their solutions, or being instructed to avoid reproducing example solutions (Smith, Ward, & Schumacher, 1993; Ward, Patterson, & Sifonis, 2004). Even design professionals aren't exempt from the effects: one experiment found that mechanical engineers who were shown example (visual) solutions to problem statements were more likely to incorporate seen elements into their designs — even if these elements were engineeringly sub-optimal to solving the problem — whereas those who only received the written problem statement didn't suffer the same issue (Jansson & Smith, 1991). Newer research suggests fixation effects become even more pronounced if we are primed with *behavioural depictions* — scenarios demonstrating or communicating the way things function or are used (Camarda et al., 2018).

The opposite, however, appears to be the case with verbal stimuli. While our semantic associations are still activated, our thinking behaves differently: it fixates *less quickly*, and stays a little more *fuzzy*. In a study looking at the effect of stimuli type on generative thinking, Chrysikou and colleagues (2016) presented participants with a series of familiar objects and asked them to come up with typical, alternate, and uncommon uses for the objects. They presented objects as either (i) the object's picture, (ii) the object's picture + name, or (iii) the object's name only (see below).

The researchers found that while people had no difficulty generating typical and alternate uses for objects, **those presented with the verbal (name only) primer tended to generate more divergent and uncommon uses than those presented with a visual primer.** (The 'picture + name' condition was somewhere in-between.) Most interestingly, **stimuli type led to differences in the type of cognition used:** when primed visually, participants showed a bias towards 'top-down' processing in their idea generation, and when primed verbally participants showed a bias towards 'bottom-up' processing.

Top-down & Bottom-up processing

Our cognition both constructs and dissect meaning from stimuli, and these two modes serve different purposes. Both have benefits in creativity and problem-solving, but one seems to be better suited to the task of invention.

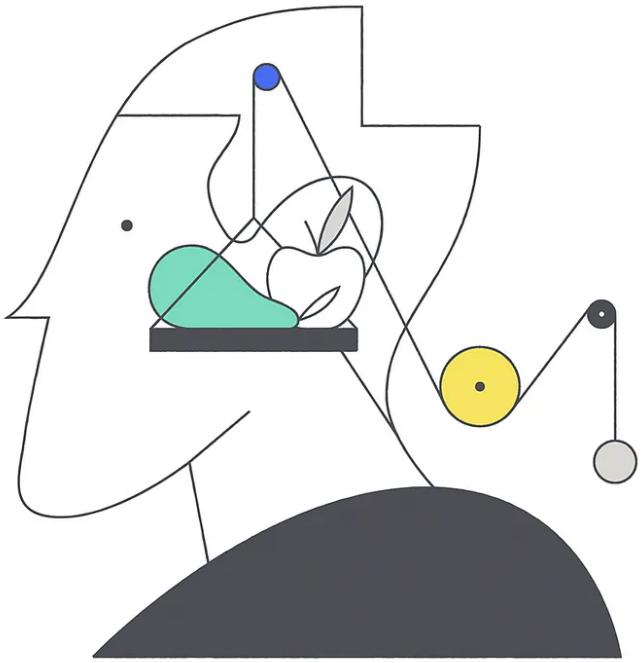


Illustration by Timo Kuilder.

> *Top-down processing is when perception begins with the most general features before moving towards the specific. As we begin to take in information, our*

> *initial impressions are based on previous experiences and expectations. This type of processing can be useful when we are looking for patterns in our environment, but can hinder our ability to perceive things in new and different ways.*

When generating ideas and using resources in novel ways, top-down processing activates concepts *associated with our experiences*. A top-down view of a 'toothbrush' would perceive it as "a hand-held object used for brushing or scrubbing teeth." When we naturally think about a toothbrush in this way — or are primed visually and then asked to generate different uses— we might suggest using it to clean fine jewellery, apply shoe polish, scrub tile grouting, or comb a moustache (all creative uses, but all associated with 'brushing' and thus quite functionally fixated). Or we could look at the toothbrush's form and find other uses: it could be an impromptu magic wand, a mediocre egg whisk, or even a very disappointing pool cue (here we are less fixated on the intended function and so are generating more novel uses, but not *that* novel because we are still somewhat fixated on the form).

> *Bottom-up processing is when perception starts with the smallest components of incoming stimulus, and works upwards until a representation of the object is formed in our minds. In this process, perceptual experience is based entirely on sensory stimuli pieced together using data that is only available real-time from our senses.*

With bottom-up processing, our perception pays more attention to differences in components and elements, divorced from representations gained from our experience. The starting point for perception could be said to begin at an almost 'atomised' level. A bottom-up perception of a 'toothbrush' would perceive it as "a thin, oblong form, commonly made of plastic, shaped to fit a hand, usually white in colour, occasionally with a

flexible tip, adorned with tightly-packed bristles." When objects are broken down in this way their function is not at the fore, and so it opens up the potential for more inventive utility: if we were asked to come up with creative uses for the toothbrush now we may suggest heating the plastic to mould it into another object, like an incense holder; we may shred the material into small pieces and make a faux puka shell necklace; or we might remove the bristles to use as grass flocking for our miniature railway dioramas.

Reducing Functional Fixedness in creative problem-solving.

As we learn about how stimuli-information processing influences our cognition, we come to understand the extent to which "out of the box thinking" is contingent on how the 'box' itself is presented. Like Duncker's Candle Problem earlier, information framing and stimuli priming can bias our cognition and trigger different modes of information processing, ultimately increasing functional fixedness and reducing our creativity. But now that we are aware of these mechanisms, are there things we can do to train ourselves to be more *functionally fuzzy* and divergent in our thinking?

Absolutely. Here's what I recommend:

#1: Be mindful of how you use language

It may be tempting to articulate problems in concrete terms, but language is itself a limiter: it separates, categorises, and compartmentalises — all very useful for analytical work, but somewhat unhelpful for fuzzy, imaginative thinking. The more specificity we introduce in language, the more fixation we induce in thought.

Language creates representations; representations create reality.

Take this (eCommerce) design challenge and note the difference in phrasing:

'Help people check-out quicker' *vs.* 'Reduce payment friction'.

Both suggest the same thing, but the *specificity* of the former increases the likelihood that we'll fixate our thinking on the checkout function alone, and ignore alternate ways in which payment can be expedited.

Tips:

- Try to abstract the problem so that you have removed any indication of a solution from the way it's worded.
- Use analogies and metaphors rather than realistic narratives (some research suggests they aid in positive transfer of solutions; Solomon, 1991).

#2: Keep stimuli simple

As stimuli richness increases, so too does the strength of our fixed, top-down associations; the more vividness we introduce into problem framing — through imagery, example solutions, behavioural depictions, etc. — the more likely it is that we will converge our thinking to what is shown.

Tip: Avoid the temptation to 'bring the problem to life' with stimuli. The less stimuli you consume at the time you need to generate ideas, the better.

#3: Build up your semantic catalogue

Our ability to create and invent stems from our knowledge and experiences. If we create habits of openness — to more stimuli, ideas, insights, disciplines, knowledge domains, etc. — then we can increase the breadth and diversity of associations in our semantic memory, which in turn allows us to subconsciously draw inspiration from unexpected places.

Tips:

- Continue to explore and expose yourself to a diversity of things in your down-time. It may be easy to consume things already aligned to your interest and expertise, but that echo chamber won't spark new ways of seeing the world or thinking about problems.
- Reach out to experts in different fields. Like drawing inspiration from afar, bringing diverse people with different experiences into the creative process can help reduce functional fixedness and improve problem-solving within your own domain.

#4: Break things down

Just as we did using the example of the toothbrush, if we begin problem-solving by inducing bottom-up processes then we can decouple function

from form and increase our divergent thinking. McCaffrey (2012) shows a highly effective technique for doing so:

> *"As you break things into their parts, ask yourself two questions:*
>
> *1.* "Can I subdivide the current part further?" *If yes, do so.*
>
> *2.* "Does my current description imply a use?" *If yes, create a more generic description involving its shape and material.*
>
> *For example, initially I divide a candle into its parts: wick and wax. The word* 'wick' *implies a use: burning to emit light. So describe it more generically as a string.* 'String' *again implies a use, so I describe it more generically: interwoven fibrous strands. This brings to mind that I could use the wick to make a wig for my hamster. Since* 'interwoven fibrous strands' *does not imply a use, I can stop working on* 'wick' *and start working on [my perception of]* 'wax'*."*

This technique systematically strips away all the layers of associated uses from an object and its part, and people trained in this technique solved 67% more problems that suffered from functional fixedness within the control group (McCaffrey, 2012).

The ability to see things as they truly are, and not as our projected representations, is a skill. It requires us to become more aware of our subjective experience of the world, and temper it with a broader, more diverse view. When our thinking can encompasses more than just our singular perspective, it's not just our creativity will benefit: the rest of our

lives will too. We will look at old things anew — our time and labour, our relationships, even ourselves — and see the latent potential everything has for transformation and new ways of functioning. If we can do that, there won't be a problem on Earth we cannot solve.

Thanks for reading my first article! If you have any thoughts or ideas on the content, or have hacks that you've found helpful in overcoming Functional Fixedness, please share them below for the benefit of the creative community. And if you'd like to connect, drop me a note on LinkedIn.

Happy innovating

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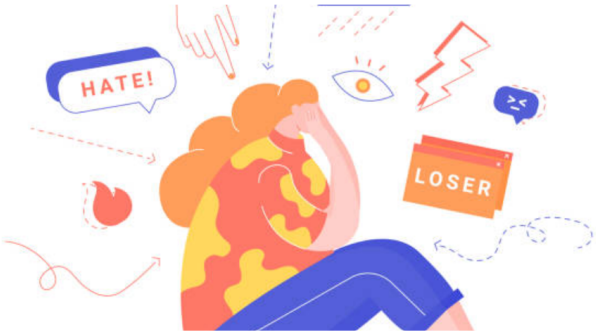

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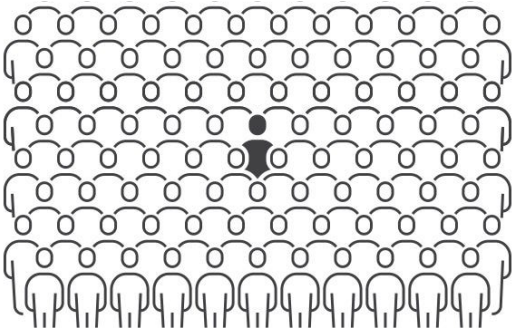

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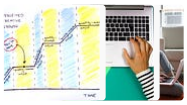

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