Finding Creative New Ideas: Human-Centric Mindset Overshadows Mind-Wandering

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Abstract

Finding creative new ideas requires both release from fixation and a productive search mindset. Recent research has shown that messy desks, walking, and mind-wandering can lead to more new uses for old objects. Here we show that a human-centric mindset is superior to mind-wandering for generating more alternative uses and more creative uses because it provides both release from fixation and an effective search strategy. A human-centric mindset entails perspective-taking, and perspective-taking is likely to be an effective general strategy for enhancing creativity, problem-solving and innovation.

Keywords: creativity; design; mindset;

Introduction

How do you get an original idea? One way to catalyze the creative process is to recombine or transform old ideas into new ones. But starting with established ideas can often be counter-productive, leading to fixation (e.g., Jansson & Smith, 1991; Finke, Ward, & Smith, 1992; Smith, Ward, & Schumacher, 1993; Purcell & Gero, 1996; Chrysikou & Weisberg, 2005). Finding new associations is regarded as key to overcoming fixation (e. g., Finke, 1990; Finke, Ward, & Smith, 1992; Jansson & Smith, 1991; Mednick, 1962; Smith, Ward, & Finke, 1995).

Recent studies have shown a variety of ways to stimulate new ideas for alternative uses of ordinary objects, a classic creativity task (Guilford, Christensen, Merrifield & Wilson, 1978) that is also frequently used in design classes as a warm-up activity. Messy desks in contrast to tidy ones have enabled people to think of more new uses for ping-pong balls (Vohs, Redden, & Rahinel, 2013). Messy desks create ambiguous configurations and ambiguous configurations are deliberately used by designers to generate new ideas and successful in doing so (Tversky & Suwa, 2009). Taking a walk rather than sitting has helped people generate more novel uses for common objects (Opezzo & Schwartz, 2014); taking a walk exposes people to new stimuli that might inspire new associations. Mind-wandering has facilitated creative incubation for finding new uses for common objects (Baird, Smallwood, Mrazek, Kam, Franklin, & Schooler, 2012; Smallwood & Schooler, 2006) though this strategy has not always been successful (Hao, Wu, Runco, & Pina, 2015). The proponents of mind-wandering use neuroscience research on the default network to argue for mind-wandering (Baird, et al., 2012). The default network is activated when the mind turns inward rather than responding to external stimuli (Mason, Norton, Van Horn, & Wegner, 2007; Smallwood, Beach, Schooler, & Handy, 2008). Wandering in the mind, like wandering in the world, can bring new stimuli, and consequently new responses.

Messy desks, taking a walk, and mind wandering succeed in releasing thinkers from fixation by bring in new stimuli. An even simpler manipulation, interleaving different design problems rather than blocking them, accomplishes the same (Tversky & Chou, 2010)—remember the old adage: Take a break. But bringing in new stimuli doesn't by itself provide a productive way to search for new ideas. Innovators need effective search strategies as well as release from fixation. Designers in prominent design firms, notably IDEO, have developed a systematic approach, Human-Centric design, to do exactly that. They have instituted elaborate practices to enable their designers to put themselves in the shoes of potential users in order to design effective systems, procedures or products for the target community (Kelley & Littman, 2006). Although widely adopted, the human-centric approach has not been systematically evaluated.

Here we evaluate the Human-Centric approach by using a design task that laypeople frequently need to do, finding new uses for everyday objects. In our daily lives we often find ourselves improvising, to grasp an object out of reach by twisting a coat hanger or to tie a shoe together with a paper clip when a shoelace has snapped. This improvised design requires finding new uses for familiar objects. The new uses task has been used in considerable previous research, including the studies that stimulated our own. It is also used as a warm-up exercise in design course typically asking students to come up with many ways to use a brick. We asked participants to find new uses for ordinary objects under three mindsets: Human-Centric, Mind-Wandering, and a control condition with no special mindset. For the Human-Centric mindset, for each object, we directed participants to think of how different human roles might use the object. We chose roles that participants would be familiar with in their everyday interactions, such as artist, chef, physician, mechanic, and athlete. We pretested the roles to make sure our intuitions were correct. We selected six objects, also after pretesting to make sure that laypeople could generate alternative uses for the objects.

Adopting the perspectives of many roles should fulfill both requirements for original ideas. Changing perspective should lead to release from fixation and taking new

perspectives should provide effective ways to search for new ideas. The Human-Centric group was asked "to imagine how different people in different roles might reuse the objects in their activities." The Mind-Wandering group was given the instructions of Baird et al. (2012) "to simply relax and let your mind wander." The control group was given no special mindset.

Measuring Fluency and Originality of Ideas

Here ideas generated by participants were evaluated on quantity or fluency and on creativity, that is degree of originality. The primary interest is in fluency, as in design evaluating suitability can only come after ideas are generated. Evaluating originality or creativity has typically been based either on judgments of creativity or on statistical rarity in the larger group (e.g. Hennessey & Amabile, 2010; Runco & Jaeger, 2012; Runco, 2004). Judgments of creativity can be biased and unstable (e.g. Kaufman, Baer, Cole, & Sexton, 2008). Here we use the Sample-Specific Percentage Score of Mouchiroud and Lubart (2001) derived from Torrance's classic paradigm (1968). One point is given to each idea given by 2-5% of the sample and two points to each idea given by less than 2% of the sample. This method has been criticized for failing to differentiate the quality of originality from the fluency of responses. For example, a participant who gave 10 common responses might get a higher total originality score than a participant who gave only 2 answers, even if the 2 answers were more unusual. However, this did not seem to be a problem in the present study as the people who gave original ideas also gave many ideas.

Methods

Participants

Participants (N=105) were recruited through Amazon Mechanical Turks Web service, receiving $5 for approximately 40 minutes of time. Participants' ages ranged from 21-65, with a mean of 33.19 and came from a wide range of educational backgrounds. Participants were randomly assigned to the three mindset conditions. There were 18 women and 17 men in the Mind-Wandering Group, 15 women and 20 men in the Human-Centric Group, 18 women and 17 men in the Control Group.

Stimuli

The objects were selected from a review of objects in previous research and from a pilot study to make sure that they could be decomposed and would stimulate new uses from ordinary people: broom, flashlight, chair, umbrella, shoe, and smartphone. A smartphone is representative of contemporary and future design challenges.

Procedure

The first screen that greeted participants described everyday ingenuity, such as using a hanger to grab an out of reach object or rolling up a magazine to swat flies. Then participants were invited to discover and generate uncommon uses for six ordinary objects. All three mindset conditions next read general instructions: "On each trial you will be presented with the name of the object. Your job is to produce as many different novel uses as you can, uses that are different from the normal use. You will type your ideas in a text box, using only a few words, one idea at a time. Please do not repeat ideas. Eventually, you may run out of new ideas and then you will have a chance to proceed to the next object and generate new ideas for it. There are SIX objects. You will have 5 minutes to generate novel uses for each object. Please do not use any resources besides your own creative mind in this task." Participants were also told: "It's OK to use more than one of the objects and it's OK to use parts of the object."

Participants in the Mind-Wandering group were told that "One proven way to generate new ideas is to simply relax and let your mind wander. Please use that mindset to generate as many new uses as you can think of." Participants in the Human-Centric group were told that "One proven way to generate new ideas is to imagine how different people in different roles might reuse the objects in their activities. Other roles might include various kinds of athletes, gardeners, artists, chefs, musicians, mechanics, craftspeople, dancers, teachers, police, firefighters, plumbers, tailors, architects, physicians, writers and more. Please imagine the mindset of a variety of roles to generate as many new uses as you can think of." The Control group was not given any specific strategy or exemplars. Each participant had a practice trial with clothes hanger for 3 minutes before starting the real experiment. The screenshot of the human-centric mindset condition are shown after participants entered responses in Figure 1. Each response was assigned a position number by the system.

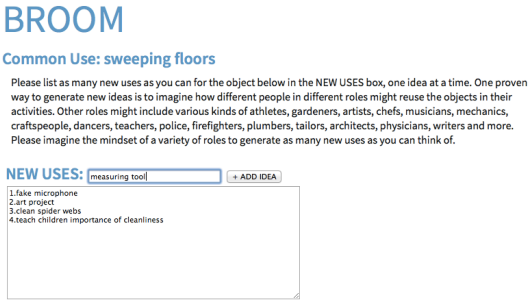

Figure 1: Screenshot of the Human-Centric mindset condition after entering new responses.

Participants were then presented with the names of six objects, one at a time, for the unusual uses task: Broom, Flashlight, Chair, Umbrella, Shoe, and Smart Phone. Each of those 5 objects except for Smart Phone was randomly ordered for each participant. For each object, the common use was presented under the name of the object on the screen After generating ideas for those 5 objects, the Smart

Phone was presented along with a new instruction by adding a paragraph, "Now that you've warmed up generating new uses for old objects, try your mind at generating new uses, including new apps, for a smart phone."

After participants finished generating new uses, participants responded to a questionnaire asking whether they used the mindset strategy suggested and how easy, how helpful it was to follow. The control group was asked if they used a mindset strategy, and if so, what?

Results

Coding Counting ideas was a two-step process. Responses were first put through a spreadsheet that (a) counted the total number of answers, and (b) identified the likely original answers by eliminating all duplicates (repeated identical answers). During the initial examination, all duplicate answers were removed; total numbers generated for each participant were accurate, and all the unusual / unique answers were identified. Generalized items (e.g., "a broom to clean off the cobweb on the ceiling") were counted toward a participant's total number of responses but were not coded as original. To measure the originality of ideas, the task was coded with Sample-Specific Percentage scoring method derived from the classic Torrance's (1968) paradigm. Examples of both original and ordinary examples are provided in Figure 2.

Objects	More Original Examples	Most Ordinary Examples
Broom	Mini golf course with multiple brooms; Wood flavoring source by shaving the stick; Fragrance holder;	Clean cobwebs off the ceiling; Animal deterrent; Weapon;
Flashlight	Martini Shaker; Meat Tenderizer; Wrapping longhair with decorative lighting;	Weapon; Signal; Starting a fire;
Chair	Use folding chair hinges in extending arm array; Spokes for a ring loom; Water Strainer;	Step stool; Weapon; Firewood;
Shoe	Stack up to use as soundproofing; Voice disguiser; Bottling lace grommets as a baby rattle;	Weapon; Planter; Animal Deterrent;
Umbrella	Cutting the fabric into strips to tie things together; Use mental spokes as shish kabobs;	Weapon; Walking cane; Protection from the Sun;
Smartphone	Physical obj.: Wrist splint; Cutting board in wilderness; Digital/Physical obj.: Smoke detector; Stud finder; Steak doneness tester;	Paperweight; Flashlight; Camera;

Figure 2: Examples of original and ordinary ideas

Fluency of Ideas The 3 mindsets differed substantially in fluency (i.e. total number of ideas); the Human-Centric group (M = 54.06, SD = 27.30) generated far more ideas than the Mind-Wandering (M = 38.77, SD = 15.52) and Control groups (M = 36.54, SD = 17.05) in Figure 3. Because Levene's test was significant ($p < .001$), revealing that variances in the Human-Centric group were differed, violating the assumption of homogeneity of variance, a more robust Games-Howell method (instead of Tukey HSD) was applied to interpret the F statistics for the post hoc results.

Welch's Robust ANOVA showed significant differences in fluency of three mindset groups, F (2, 65.38) = 5.407, p = .007. Continuing, the Games-Howell post hoc testing revealed that the Human-Centric mindset group generated more ideas than the mind-wandering mindset group a mean increase of 15.229, 95% CI [2.18 to 28.27]. There was also a mean increase of 17.514, 95% CI [4.42 to 30.61] between the Human-Centric and Control groups, but there was no significant mean difference between the Mind-Wandering and Control groups, 2.229, 95% CI [-7.11 to 11.57]. The mean number of ideas generated by each mindset condition for each object can be viewed in Figure 4.

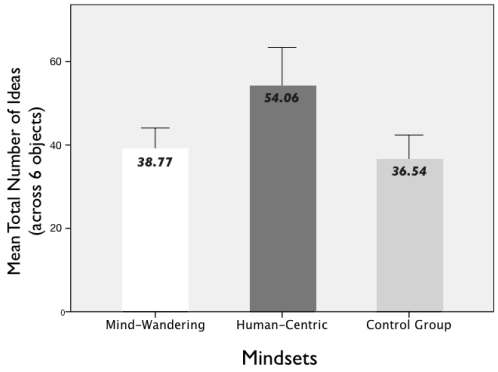

Figure 3: The Human-Centric mindset group generated more uses than Mind-Wandering and Control groups.

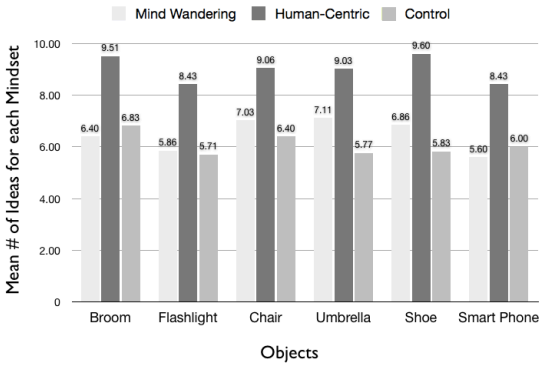

Figure 4: The Human-Centric mindset group generated more uses than the other groups for each object.

Originality of Ideas For originality, Levene's test was significant, and the assumption of homogeneity of variance was violated. The Welch test table was applied. There was a significant effect for the three mindset conditions differed significantly in originality of ideas F (2, 67.21) = 4.34, p = .017. The post-hoc comparison using the Games-Howell test indicated that the mean score of originality for the Human-Centric group (M = 31.89, SD = 21.67) was significantly different from the Mind-Wandering group (M = 20.43, SD =

16.61) and from the Control group (M = 18.77, SD = 17.12). There were no differences between the Mind-Wandering and Control conditions, as shown in Figure 5.

Fluency of Original Ideas Two Pearson's product-moment correlations were run to assess the relationship between the quantity and originality of ideas. The first correlation refers to the total number of ideas, a summation of the number of ideas that each participant generated across 6 objects (5 min per object) and the sum of the originality score for those ideas. There was a strong correlation between the quantity of ideas generated by a participant and the overall originality scores irrespective of mindset conditions in the study, r (103) = .885, p < .001. The overall originality score (i.e. 2 points for each idea given by less than 2% of the sample; 1 point for each idea with a frequency seen in 2% to 5% of the sample; 0 points for ideas given more than 5% of the sample) is a summation of the originality score for 6 objects. The average participant generated approximately 43 ideas in the 30 minutes of the idea generation task. The second correlation refers to the total number of ideas and the average originality of ideas for each participant. There was a moderate positive correlation between the quantity of ideas and the mean originality score (sum of originality score divided by total number of ideas), r (103) = .434, p < .001.

There were no differences in quantity of ideas and originality of ideas for the different objects.

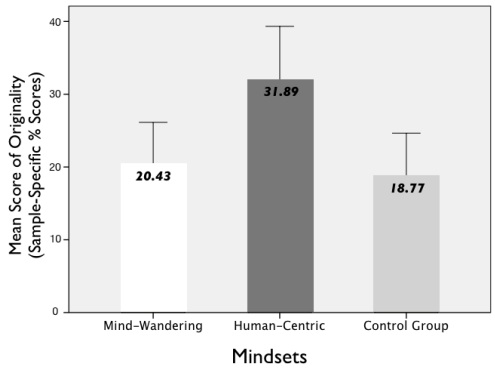

Figure 5: The Human-Centric mindset group generated more original ideas than the Mind-Wandering and Control groups.

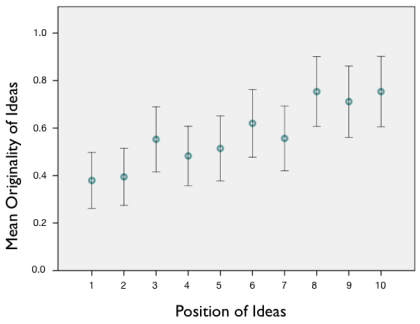

Figure 6: Participants who generated at least 10 ideas for any object were more likely to produce more original ideas.

Position of Ideas: Original Ideas Come Later Many studies have found that ideas generated later tend to be better than early ideas since Christensen, Guilford, & Wilson (1957) first demonstrated the effect. This result aligns with those from prior studies (Beaty & Silvia, 2012).

Two methods were used to confirm that original ideas do come later. The graph in Figure 6 shows the mean score of originality (from 0 to 2) for ideas that appear in the ith position, i = 1, 2,...10, regardless of conditions and objects for this study. It was reasonable to choose 10 positions, because about half of the sample size generated at least 10 ideas. It appears that participants came up with more original ideas at the later position. Another bar graph Figure 7 is to show the percentage of ideas that were original (less than 5% of the sample generated the idea) for each position.

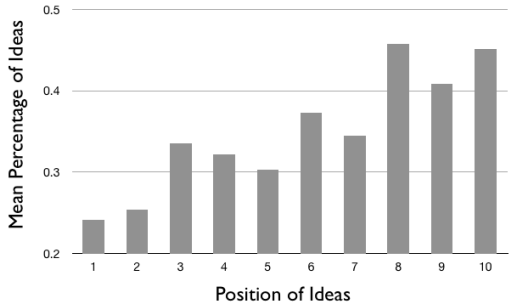

Figure 7: Original ideas tended to come later.

Self Report / Manipulation Check Regarding whether participants used the suggested mindset strategies to generate ideas; it appears that more than 75% of participants in both Human-Centric and Mind-Wandering groups claimed that they did follow the instruction. 69% of participants in the Human-Centric group and 60% of participants in the Mind-Wandering group did think it was helpful with the suggested strategy. Regarding how easy participants used the suggested mindset strategies to generate ideas; it appears that more than 50% of participants in both Mind-Wandering and Human-Centric groups self-reported it was easy for them to use the mindset. 89% of participants in the Control group self-reported that they simply let things come to mind, using a mind-wandering mindset strategy.

Discussion

Designers and problem solvers--and we are all designers and problem solvers--often get stuck. They/we get fixated on one idea or a set of them and then thinking goes in circles. Breaking fixation, breaking that circle, finding new ideas requires new associations. Messy desks, walks, and mind-wandering have all proven helpful for finding new uses for familiar objects. They work because each leads to new stimuli and new stimuli can bring new associations and perhaps new ideas.

Although wandering eyes, wandering bodies, and wandering minds can expose us to new stimuli, the paths of

search are still wandering, not directed in any meaningful way. There is no guarantee that the meandering and the associations are in any way related to the design or problem. Designers and problem solvers also need productive ways to search for and generate new ideas that are relevant to the problem at hand. The human-centric mindset does just that. The human-centric approach entails taking the perspectives of others, here diverse roles that participants are familiar with. Participants could make use of their knowledge of the roles to generate relevant uses: what could a gardener do with an umbrella? An artist with a shoe? An athlete with a chair? Participants with the Human-Centric mindset did use the roles that we gave them, and invented new roles of their own. Using a high criterion for relevance, nearly half the ideas generated by the group using the Human-Centric approach were directly related to one of the roles provided and another 10% derived from roles they invented, presumably because they used the mindset to take the perspectives of various roles. The most productive role was artist, followed by gardener, athlete, policeperson, mechanic, chef, and musician.

Consistent with that analysis, the Human-Centric mindset yielded more ideas than either the Mind-Wandering mindset or the no-mindset control. In fact, the Mind-Wandering mindset was no more successful than the no-mindset control group at generating new uses. This turns out to be unsurprising; in response to a question about how they searched for new ideas, many in the control group reported that they just let their minds wander.

Participants using the Human-Centric mindset generated more new uses and also generated more original new uses than those who adopted the other mindsets. Original new uses tended to come later; it's as if participants have to first get the ordinary alternative uses out of their heads in order to free their minds to find unusual ones. Sadly, one of the most common uses suggested for most of the objects was *weapon*. The vast majority of original responses were not only reasonable and appropriate, but clever, even if unusual. Remember that the instructions allowed using more than one of the objects. For a shoe, sound-proofing; for a chair, a water strainer; for a smart phone, a wrist splint, for a flashlight, a martini shaker.

Because of the overall quality of the original ideas, it is apparent that participants were editing their own responses. That process, of generating ideas and evaluating them, is supported by neuroscience research (Beaty, Benedek, Silvia, & Schacter, 2016; Chrysikou, in press; Ellamil, Dobson, Beeman, & Christoff, 2012; Mason, Norton, Van Horn, Wegner, Grafton, & Macrae, 2007). The neuroscience findings suggest that creative problem solving is characterized by alternating activation in the default network, indicative of internal processing, and the frontal system, indicative of executive control. This iterative process, of generating ideas and evaluating them coincides with the experience of designers and problem solvers. It remains to be seen whether the neuroscience tools are sensitive enough to detect the large differences in mindset demonstrated here. In the meantime, it should be clear that Mind-Wandering is not to be recommended as a general mindset for finding innovative ideas. A Human-Centric mindset is far more productive.

The Human-Centric mindset clearly has wide applicability. Diplomats negotiating peace agreements take the perspectives of each party, as do lawyers. Writers of books and screenplays take the perspectives of their readers or viewers. Product designers think deeply about the ways different users will interact with their products. Using the Human-Centric mindset entails adopting relevant and varying human roles. Yet there are many problems that demand creative solutions but do not involve humans, except as thinkers. Problems in mathematics or physics. Design of machines or robots for tasks that do not involve humans, except as designers. Taking different human perspectives might help, but that is probably not be the best way for those problems. However, taking different human perspectives is at its foundation taking different perspectives, and that mindset might just work for everything. Or nearly everything. Mathematicians reframe problems algebraically or geometrically. Temple Grandin, in designing runways for cattle, famously adopts the perspective of the cattle (Grandin & Deesing, 2008). Taking different perspectives might sound simple, but deciding which alternative perspectives are relevant and productive also requires creative thought.

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