Creative Cognition: Conceptual Blending and Expansion in a Generative Exemplar Task

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Abstract

Creativity is a multifaceted and complex human trait that allows one to generate and explore unlimited novel ideas and artifacts. One method to study creativity is to use a creative cognition approach (Finke, Ward, & Smith, 1992; Smith, Ward, Finke, 1995; Ward, Smith, & Finke, 1999), which examines the cognitive processes and structures that lead to the generation of creative ideas. Participants in this study were asked to draw and describe a creature on a distant planet, similar to a prompt used by Ward (1991). Results suggest that the participants relied on what has been termed, structured imagination (Ward, 1994, 1995), or a repertoire of existing knowledge that constrains the production of imaginative ideas. Five responses were then selected for deeper analysis to show how two cognitive processes, conceptual blending (Fauconnier & Turner, 2002) and conceptual expansion, are used to blend and expand known concepts in order to produce a novel idea. This paper discusses implications this research has for theories of creativity and its real world applications, as well as its importance for educational objectives.

Keywords: creativity, structured imagination, conceptual integration, blending

Introduction

"Nil posse creari de nilo" Lucretius stated before the Common Era that nothing is created from nothing and this applies to creativity in the modern sense. Creative ideas do not suddenly or magically appear to the individual, but are imagined, crafted, and developed through one's knowledge structures. Two common ways to creatively explore an idea is through conceptual integration and conceptual expansion. In this paper, I illustrate these two processes through analyzing a set of journal writing prompts that asked student participants to draw and describe a creature on an imaginary planet. Responses show the combinatorial ability of blending known concepts together in new ways where novel ideas emerge and the process of elaborating and magnifying known structures. The work presented here uses two theoretical frameworks from the cognitive sciences for understanding these thought processes, namely creative cognition (Finke, Ward, & Smith, 1992) and Conceptual Integration Theory (Fauconnier & Turner, 2002).

Creative Cognition Approach and the Role of Structured Imagination

In the creative cognition approach to creativity, Finke et al. (1992) coined the term, the Geneplore model, which is a portmanteau of the words generate and explore. This blended word emphasizes the interplay between the generative process of producing many ideas (to use their term, *preinventive structures*) with varying creative potential and the exploratory process that judges these initial candidate ideas and then expanding, modifying, and interpreting them.

Some of these generative processes that have been identified include simplistic and often automatic processes like retrieval and associative mechanisms to more complex and richer varieties like mental synthesis, conceptual combination, and mental transformation. During this generative phase, *preinventive structures* might be created and one type of these is a mental blend, which they describe as referring to "a class of structures that include conceptual combinations, metaphors, and blended mental images" (Finke et al., p. 22). For the purposes of this paper, I focus mainly on conceptual combinations and blended mental images that fuse two distinct concepts into a new and emergent entity. According to this model, properties such as novelty, ambiguity, incongruity, as well as meaningfulness, enhance creativity in these preinventive structures since they are commonly held properties that are representative of creativity (see Boden, 2004; Koestler, 1964). For instance, incongruity, which requires a certain semantic distance between the two concepts, allows for a greater possibility of new meanings to emerge and thereby making creative discovery more likely (Wisniewski, 1997). Novelty and meaningfulness may seem on one level contradictory, but innovative ideas involve novelty that allows for the recoverability of the familiar (Giora, 2003). That is to say, there has to meaning within the novelty or it is more likely anomalous than creative. In sum, during this generative phase, *preinventive structures* are possibly created, one type being a mental blend that develops from combining concepts or blending mental images together that are novel, semantically distant, but still meaningful. From these candidate *preinventive structures*, an exploratory process ensues. This process may include attribute finding, conceptual interpretation, functional inferences, and contextual shifting with the goal of discovering emergent and meaningful insight from these generated ideas.

The cognitive resources available to combine, analogize, and blend requires having a repertoire of existing known concepts and categories. The impact this existing knowledge has on the process of imagined entities is referred to as *structured imagination* (Ward, 1994, 1995). In short, creative ideas are heavily structured by existing concepts and this prior knowledge

constrains and limits these creative ideas. For instance, Ward (1994) asked participants to imagine, draw, and describe novel animals that might exist on an imaginary distant planet and the results showed that these imaginary animals possessed characteristics similar to earth animals (i.e., sensory organs: eyes, ears, nose; appendages: arms, legs; and bilateral symmetry). In a follow-up study, Ward and Sifonis (1997) found similar results, despite the fact that participants were explicitly instructed to make these animals wildly different from animals found on earth. Therefore, when tasked with a generative problem like the one above, knowledge from existing known concepts and categories (i.e., animals) are projected onto these newly generated exemplars. In essence, the ability to generate a creative idea begins with known concepts. In order to make the mental leap from these known and familiar concepts to novel and creative ones, this paper examines two possibilities, generating *conceptual blends*, which produce an emergent entity from two or more established concepts, or some form of *conceptual expansion* (Ward, 1994; Ward, Smith, & Vaid, 1997) whereby the boundaries of a given concept are elaborated on in novel ways in order to develop a newly crafted exemplar. Conceptual blends have attracted much attention in the field of cognitive science and this paper utilizes one influential theory, Conceptual Integration Theory, as a way to model these generative processes.

Conceptual Integration Theory: An Analysis of Blending for Creativity

Conceptual Integration Theory (CIT), at times referred to as blending theory, developed primarily from the work of Fauconnier and Turner (2002; see also Birdsell, 2014 for a summary). Their analysis of creative blends borrows from and expands earlier theories of creativity most notably Koestler's (1964) model of creative thinking, which he termed "bisociation". Bisociation is the bringing together or fusing of two matrices of thought (which refer to frames of references or associative contexts) where new and emergent meaning arises often from conflicting information. His aim was to distinguish this creative act as something different than the pedestrian "associative" style of thinking. Associative thinking is the habitual linking of routine knowledge from experiences in life (e.g., cloudy – rain) that have accrued over long periods of time.

Bisociation requires multiple matrices. A matrix, in CIT, is closely related to what Fauconnier and Turner (2003) called a "mental space", which is a small conceptual packet constructed as we think and talk. A mental space is an associative packet of information constructed as we think and thus creative ideation often involves the mapping of two or more (as in bisociation) of these conceptual spaces together. Elements and structure from these two "input" mental spaces fuse together in a "blended space" resulting in new and emergent structure. This new meaning is not the sum of the two input spaces for it did not exist in either space independently, but arose from the combinatorial process of blending. In CIT, an additional "generic space", which is a highly abstract and topological space, is also used in order to show the elements and structure that are shared between the two input spaces. Although CIT is used to analyze thinking in general, it is also especially useful for modeling the thought process of creativity. Creativity typically utilizes the mental operation of conceptual blending called double-scope networks (or multiple-scope networks). The inputs in these types of networks are often clashing for they use different organizing frames and the blend includes parts from each frame and thus the emergent structure in the blend can be highly creative and challenging to the imagination (Fauconnier & Turner, 2002).

The field of advertising often makes extensive use of creative visual blends, typically in the form of pictorial and multimodal metaphor types (see Forceville, 1996; Forceville & Urios-

Aparisi, 2009 for more examples) in order to grab viewers' attention and cognitively engage them with the content of the advert. Consider the following advert for donating clothes (Figure 1).

Figure 1: Don't let your clothes turn into food for moths: Donate
Credits: ***Advertising Agency***: BZZ Propaganda, Florianópolis, Brazil; ***Creative Director / Art Director***: Leandro Tuxo; ***Copywriters***: Katiany Pinho, Paula Ende; ***Photographer***: Michel Teo Sin***; Post Production***: DPI Soluções (Source: https://www.adsoftheworld.com/media/print/shopping_itaguacu_sushi)

This advert creatively fuses a human conceptual space with a moth's and recruits encyclopedic knowledge we have for both of them. For instance, in the human input space, clothes are garments worn by people and sushi is a gastronomic delicacy. In the moth input space, clothes that are not frequently worn by humans are food, which results in tension or a clash in structure between these two organizing frames. This integrated network is illustrated in Figure 2 with these two input spaces, the generic space, and the blended space. In the blend, clothes, as garments worn by humans, and as food for moths are blended together. Features (rolled, as in a sushi roll) and attributes (viewed as a delicacy) from the food input space 1 are projected into the blend, so the food from input space 2, as in clothes, takes on these features and attributes. One likely assumes based on the context of the advert that the intended interpretation is for people to take heed and donate clothes not frequently worn before they become a delicacy for moths.

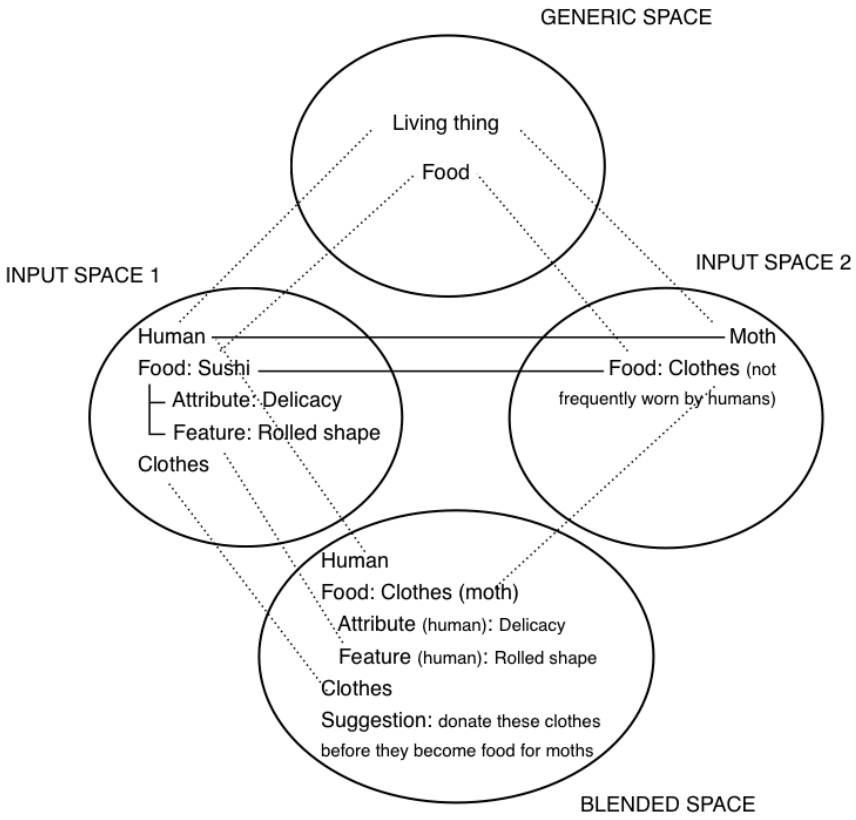


Figure 2: A conceptual integration model of the "Don't let your clothes turn into food for moths: Donate" advert

This is a creative example of a conceptual blend with the aim of firstly grasping the viewer's attention and secondly persuading the viewer to donate unneeded clothes. The world of advertising frequently uses such creative techniques for rhetorical purposes of persuasion. In this paper, in contrast, I aim to examine how student participants develop and produce visual and textual responses to an ill-defined prompt that requires them to creatively generate and explore possible ideas "on the fly". Then using the before mentioned theories, creative cognition and CIT, I analyze the cognitive processes of coming up with these novel responses.

Exemplar Generation: Imagining Life on a Distant Planet

Method

In order to examine the creative process, student participants (n=34) in an advanced English writing class were asked to generate an exemplar of a living creature on an imaginary planet as part of a writing assignment. This prompt was similar to the one used in the study by Ward (1991). Below is the one used in this study:

> Imagine a planet that exists somewhere else in the galaxy that is different to earth in size, terrain, and climate. Imagine and draw an animal that lives on this planet. Describe the diet, habitat, sensory-organs, and appendages of the creature and provide any other information or details you feel important in describing this creature.

Results and Selection of Responses for Analysis

As common with many productive tasks, a number of the student participants failed to provide a response or only provided a text response. Consequently, the final total of completed responses was 25. Similar to the findings of Ward (1991), legs (72%) were the most common appendage of these generated creatures and eyes (88%) were the most common sensory organ (see Figures 3 and 4 for the complete list).

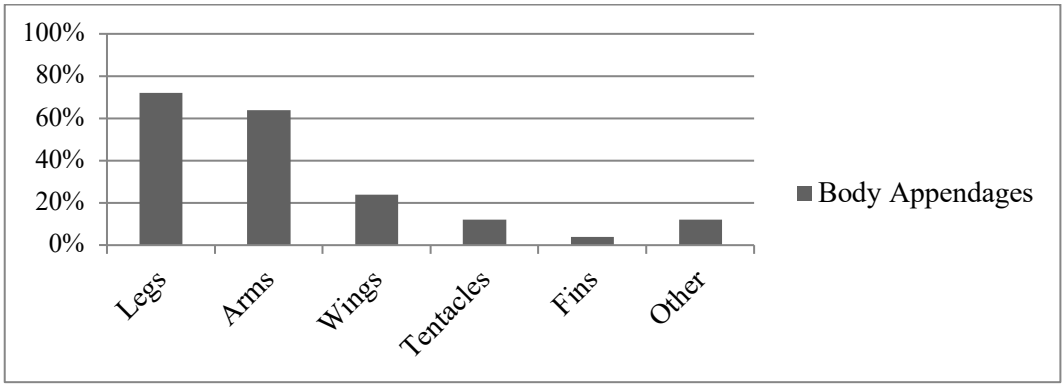


Figure 3: Percentage of common appendages for the imaginary creatures

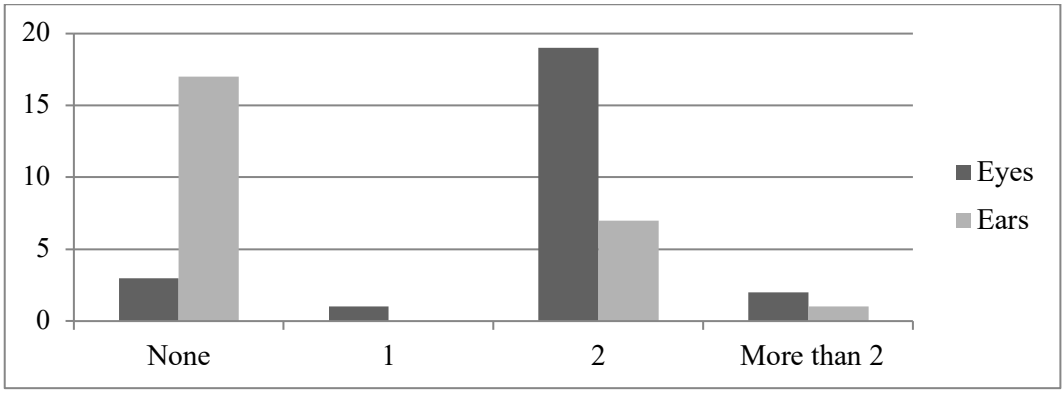


Figure 4: Number of imaginary creatures that had no eyes or ears, one eye or ear, two eyes or ears, or more than two eyes or ears

In regards to the body and overall shape of these imagined creatures, just over half the participants generated one that is similar to a typical earth animal and only 20% provided an idiosyncratic or more unpredictable response (see Figure 5). These included conceptualizing this alien creature to have the shape of a balloon, autotroph, dust particle, chocolate bar, or parasol. These typically are non-animate objects that the individual gave animation to through using common features of animate objects such as sensory modes and appendages (i.e., chocolate bar with eyes and legs and arms or a balloon with eyes).

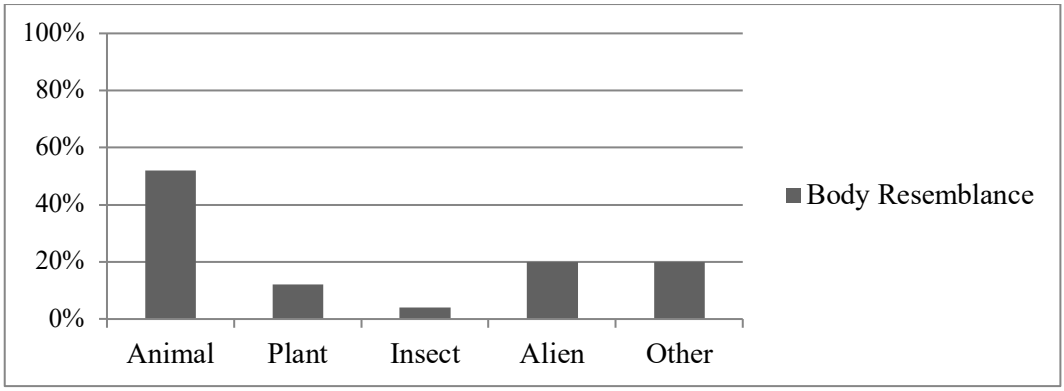


Figure 5: Percentage of imaginary creatures whose body resembles an animal, plant, insect, alien, or other shape

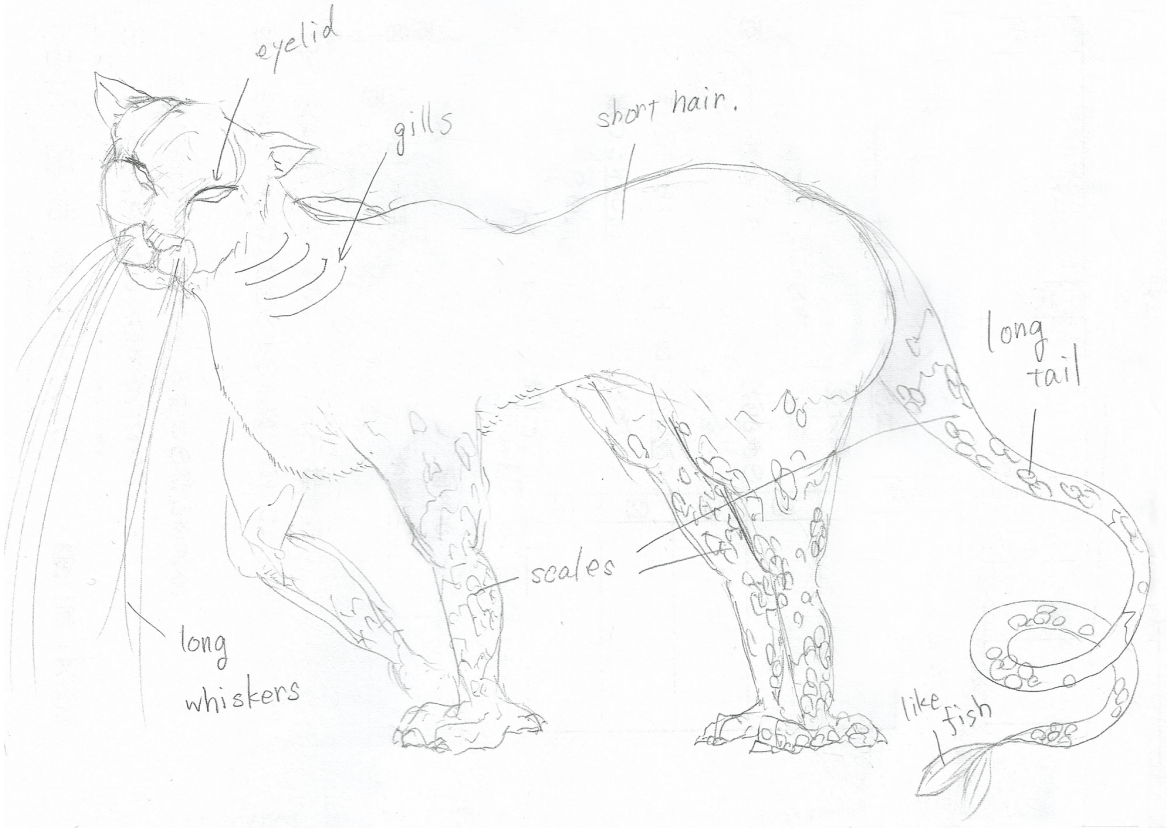
These results presented above are not surprising for they confirm what Finke et. al (1992) have pointed out, "the use of imagination to generate new exemplars of a category appears to be highly structured by the characteristic attributes of known category members" (p. 120). In order to look more closely at this structured imagination, selected responses from this pool were chosen for a more in depth analysis. When talking about creativity it is often viewed as the production of a perceivable product that is both novel and useful (Plucker, Beghetto, & Dow, 2004). Assessing creativity typically falls under two varying umbrellas, one viewed as being more objective since it utilizes standard criteria based on a set of defined norms (i.e., The Torrance Test of Creative Thinking; Torrance, 1972) and the other being more subjective, but ecologically valid, since it uses a technique whereby a group of independent judges assess the creativity of the product (i.e., The Consensual Assessment Technique; Amabile, 1982). I have selected five exemplar responses in this paper for analysis not because they have been assessed (objectively or subjectively) as being highly creative, but rather as a way to highlight the creative process of generating a novel response, specifically those that exemplified conceptual integration and/or conceptual expansion.

An Analysis of Five Selected Responses

In the following five responses, the first three responses focus primarily on conceptual integration and the final two responses focus on conceptual expansion. As for the formatting, each response includes both the drawing and the description. The descriptions were transcribed verbatim from the responses (completed as a paper-pencil task) and as these participants first language is Japanese, some of the English might not appear entirely grammatical. The drawings were scanned from the paper format into digital files.

A blend between two distantly related concepts: Terrestrial and aquatic animal. When asked to imagine an animate creature on a distant planet, one is primed to think about animals in general on this planet, but at the same there is a conflict for one knows that there is a high probability that this creature will be dissimilar to those found here on earth. Therefore, to resolve this conflict, participant 5 (as shown in Figure 6) blended two knowledge structures of animals found on earth to create this imaginary creature. This resulted in an animal that has semantic features of both a feline land animal and an aquatic animal. Contrary to the whiskers on cats, the ones on this alien creature are extremely long. This individual likely generated these whiskers intentionally during the drawing process, but the emergent properties of them were discovered later by exploring possible functions, and in this case, "for detecting the tides". So similar to terrestrial animals, they mediate the tactile sense. In addition, this creature also

has other aquatic properties like gills and scales on the lower part of its legs, but the overall structure of its body resembles a four-legged mammal of the feline family.



(Participant 05)
The image of my planet is that there is a lot of water; the area of water is 98% of the planet. This creature eats fishes or aquatic animals. When he eats fish, he dives deeply and finds the big (20 cm ~ 50 cm) fish, and eats. When he wants to eat the big aquatic animals, he uses his tail; he moves his tail like fish and picks the big creature, like an alligator. He usually sleeps in the cave, which he made from the rock wall. His hair is short because he can swim easily, but his whiskers are really long for detecting the tide. And he has scales on his limbs and tail, his pectoral muscle develop for swim. He can breathe in the water. He has gills.

He is the strongest monster in this planet, but his weak for infection. The fishes have a lot of parasites, his digestive organ can kill most the parasites, but some are strong enough to survive in his gastric juice, they multiply and do harm.

Figure 6: An imaginary alien creature ***(terrestrial/aquatic animal integration)***

This response is a good example of how generating a blend is a common and effective way to imagine and create a new entity. The process of creating this blend involves aligning features between input space 1 (the terrestrial animal) and input space 2 (the aquatic animal) and then projecting features from both into this blended space (see Figure 7).

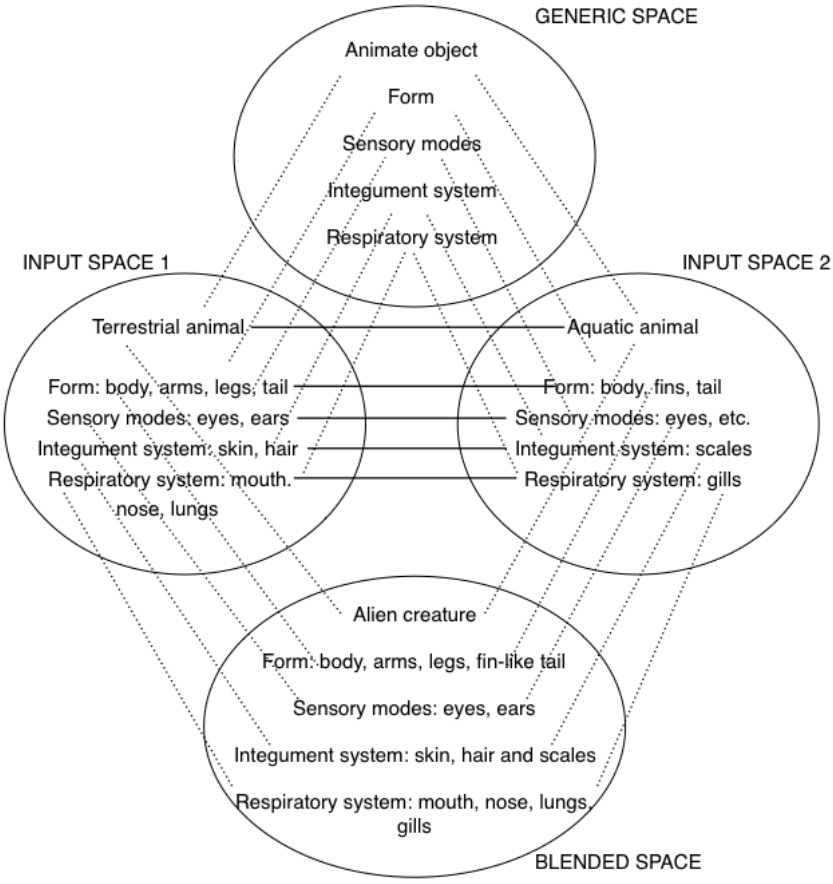


Figure 7: The conceptual blend for the alien creature ***(terrestrial/aquatic animal integration)***

In this example, participant 5 used two concepts from distinctly different classes of animals, terrestrial and aquatic, in comparison to blending together two terrestrial animals (i.e., a dog and a horse). Therefore the semantic space between these relations is greater and more distant, resulting in higher tension between the two concepts and making the creature appear to be more creative. Yet this example uses two knowledge structures that share a similar taxonomic category, animals. In comparison, the following example goes one step further and makes a greater semantic leap by blending an animal with a plant in order to generate this alien creature.

A blend between two distantly related concepts: Animal and plant. When prompted to think of an alien creature, exemplars from the animal category on earth, as seen in the previous example, are the closest and most accessible semantic concepts since they themselves are creatures. Participant 19 likewise used an earth-like animal in the form of a reptile, but in this case, blended it with a plant, which provided this extraterrestrial animal to have unique features not common for earthly animals, such as the ability to generate energy from the sun through photosynthesis (see Figure 8).

(Participant 19)
I am an astronaut, and I had been a faraway planet from the Earth until last year because of a project. The project was to find new creatures in a faraway planet from the Earth. It took two years, and out team finally found out an animal there. It is the following (the drawing).
The planet we went was like a desert. There are a lot of stones, rocks and sand, but there is one huge tree with a lot of green leaves. By the way, I talk about the animal we found there. It is like a lizard, but it has big ears like a leaf. They are green color, and there are blood vessels like the vein of a leaf. Surprisingly, our team discovered a fact that the animal generates energy by photosynthesizing with its ears.
Our team guesses its ears contain chloroplast in its ears. The animal seems to eat sand including abundant mineral. The color of whole body except ears is white. It has big ears, so it is very sensitive to sound We had difficulty catching it. And finally, we are now researching the relationship between the huge tree and the animal too.

Figure 8: An imaginary alien creature (***animal/plant integration***)

What makes this interesting is Participant 19 actually replaced the sensory mode, ears, with leaves. These ears can both generate energy through photosynthesis and can also take in a wide range of auditory sounds, typical of ears, but not typical of leaves on a plant, so they have dual function. Again the blending can be modeled with two input spaces, one for the reptile creature and the other for the plant. In the blended space, this newly generated creature emerges (see Figure 9).

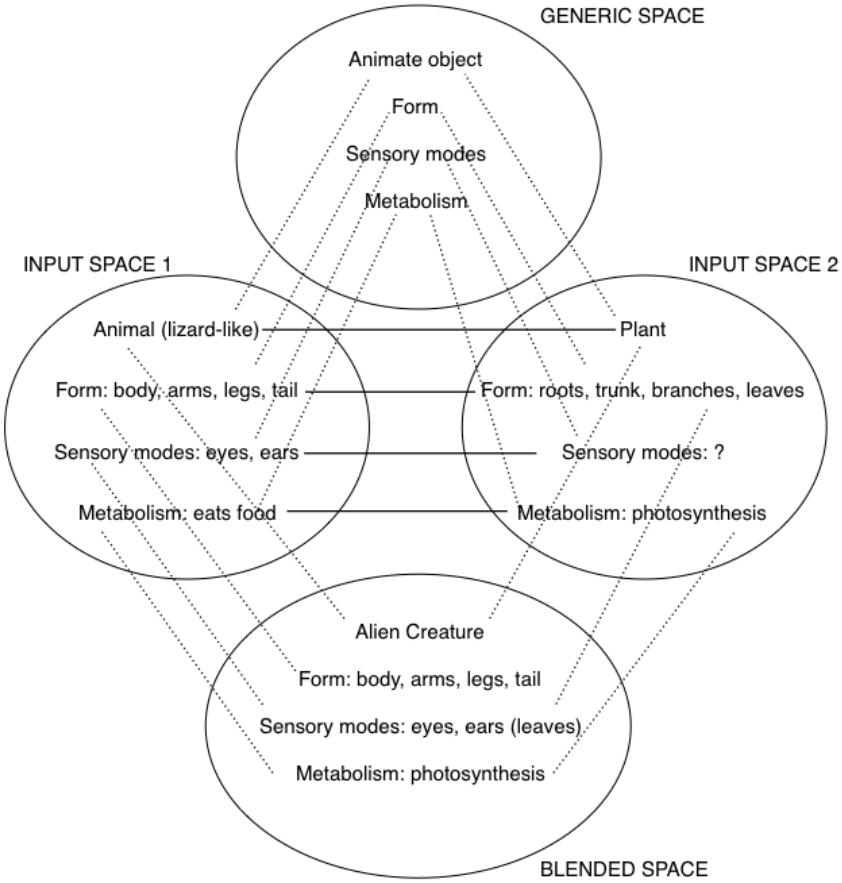
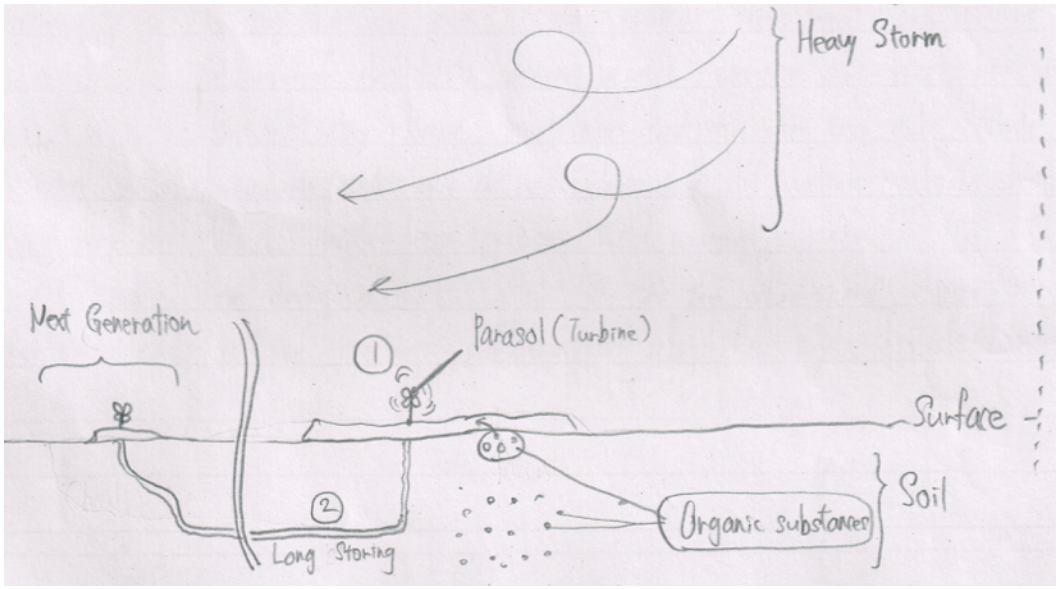


Figure 9. The conceptual blend for the alien creature (***animal/plant integration***)

In the blend, the leaves inherit properties of the sensory organ, ears, that is to say they have auditory abilities, which is a property that they do not have in input space 2. Moreover, these ears in the blend also inherit properties from input space 2, as in they can photosynthesize in order to generate energy, which again does exist in input space 1. Consequently this is a clear example of emergent properties in the blend and how novelty arises from our capacity to integrate discrepant concepts together.

A blend between two distantly related concepts: Wind power and animate life. So far, these examples have involved two mental spaces involving animate forms of life, but in this last example of a conceptual blend, participant 34 imagined this creature to resemble a parasol that generates energy like a wind turbine. That is to say, this turbine is a living creature. Moreover, it extends a long string, which resembles a root, to a distant part of the planet where it produces the next generation of these alien species. This may at first seem more closely resembling a plant, but the individual describes how the energy harvested from these storms on the planet, as well as organic substances in the soil, provide the source of energy to build body tissue. Here this individual produced a creature that does not resemble any earth-like animal, but still used the knowledge structures of animals, plants, and wind power and blended them together to generate this response.



(Participant 34)
The size is much larger than the earth, and because of that, there is so big atmospheric pressure differences between one side and the other side of the planet (this is because the solar energy is different depending on the different sides of the planet). And therefore, so heavy storms are always happening on the surface of the planet. In such a planet, creatures like (above) can live and survive.
Basically, in order to survive, creatures only have to generate energy to lead their lives and to make their tissues of bodies. The creature has a small parasol, in other words a turbine (1), and stick to the surface of the ground in order not to be flied away by heavy storms. They generate energy by rotating the parasol. This system is just the same with "wind power plant". And then, using the energy and the organic substances in the soil, they create their body tissues. Also they create a long string-shaped tissue (2), in the ground and stick it out in other distant place. This will become next generation of creature. Finally, when one of them used up the organic substances it could get from the soil, it dies and remains as "organic substances" itself, when there is already next generation of it in other distant place. Long after that, one of the creatures can use the "organic substances" derived from a dead body of another, it can also survive by using that. Like this circulation, these creatures can survive in the planet forever.

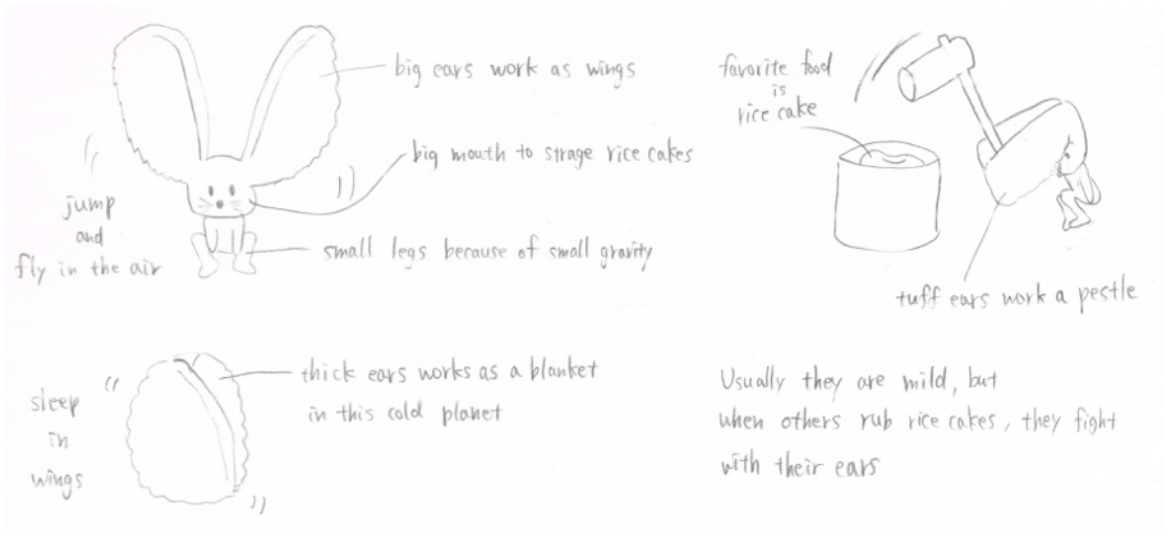
Figure 10: An imaginary alien creature **(*plant/wind power turbine integration*)**

In the first two examples, the conceptual integration involved two clear input spaces, but this example there are multiple mental spaces interacting to provide structure to this imagined creature. In this example, I highlight the importance of knowledge structures in order to generate this novel idea. First, one begins with some general knowledge of living creatures; they have bodies, they need energy to sustain these bodies (metabolism), and they reproduce. In addition, creatures evolve by adapting to their environments. Specifically, creatures on this imaginary planet due to the strong winds are bound to the surface much like a plant and consequently take various features of a plant, such as getting nutrients from the ground. In contrast to earth-like plants, this creature is in the shape of a turbine. Therefore secondly, one utilizes a mental space involving wind-power generation and projects this into the blend. So this creature, instead of relying on photosynthesis or a food-based metabolism for energy, relies on the strong windstorms on this planet. Finally as for reproduction, this individual describes this "long string-shaped tissue", which reaches under the surface to a distant part of the planet and produces the next generation of this creature. This idea seems to emerge from a blend itself between the placental mammalian umbilical cord and the roots of a plant, which again indicates the integration of these two mental spaces, along with the mental space of wind power turbines.

Consistent with previous research that found that the dissimilarity between the two concepts yielded more emergent properties (Wilkenfeld & Ward, 2001), this discrepant combination of an animate creature with a technological innovation like a wind turbine seems more creative and complex than the more stereotypical combination (land-aquatic creature, as in example 1). This example shows how the creative process alters existing concepts through widening and integrating conceptual knowledge structures in order to generate a novel idea for an alien creature.

In sum, the previous three examples showed how conceptual combination between two or more distinct semantic concepts is a common way to generate a creative product. Another process is conceptual expansion, which refers to the ability to widen the conceptual structures of known concepts and is also critical for the creation of a novel product or idea (Ward, 1994; Ward, Smith, & Vaid, 1997). A common example in the literature (Kröger et al., 2012) on conceptual expansion is the use of an alternative uses task, which asks the participants to come up with as many alternative uses of a common object like a shoe as possible, resulting in responses like it can be used as a flowerpot. This study required the participants to create an alien creature, which constrained the participants to think of an animate living thing including prototypical features of a living being such as having sensory organs. Similar to the alternative uses task, in this task the participant needed to suppress the functional fixedness of these sensory modes and extend their semantic functions in unconventional ways, as can be seen in the following two responses.

Conceptual expansion of the sensory mode: The size of the ears. Conceptual expansion extends the boundaries of a concept by mentally crafting novel instances of it, in the example presented here, this entails extending the properties of the creature's oversized ears in unusual and novel ways. For instance, they can be used to fly, sleep in, and to hold and use tools like hands (see Figure 11). That is to say, when the ears become wings, they now assume a new set of properties, as opposed to the conventional sense of ears as the auditory sensory mode, so in short, they allow the creature to fly. This may seem rather ordinary since wings are a common feature of many animals, but this participant extended the properties of these oversized ears to include other more unusual functions such as a blanket for sleeping in and as a limb to grasp things like a pestle in order to make its favorite food, rice cakes.



(Participant 23)
(The student did not provide a description of this planet and animal, but provided the above text in order to describe characteristics of this animal)

Figure 11: An imaginary alien creature (***oversized ears***)

The organizing frame for this blend is the mouse-like animal, which provides the creature some shape and structure (sensory organs like eyes, nose; appendages like head, arm, and legs). The other three input spaces provide extended functions for these unusually large ears from other animate creatures and an inanimate object, which then gets projected into the blended space resulting in this imagined creature (see Figure 12).

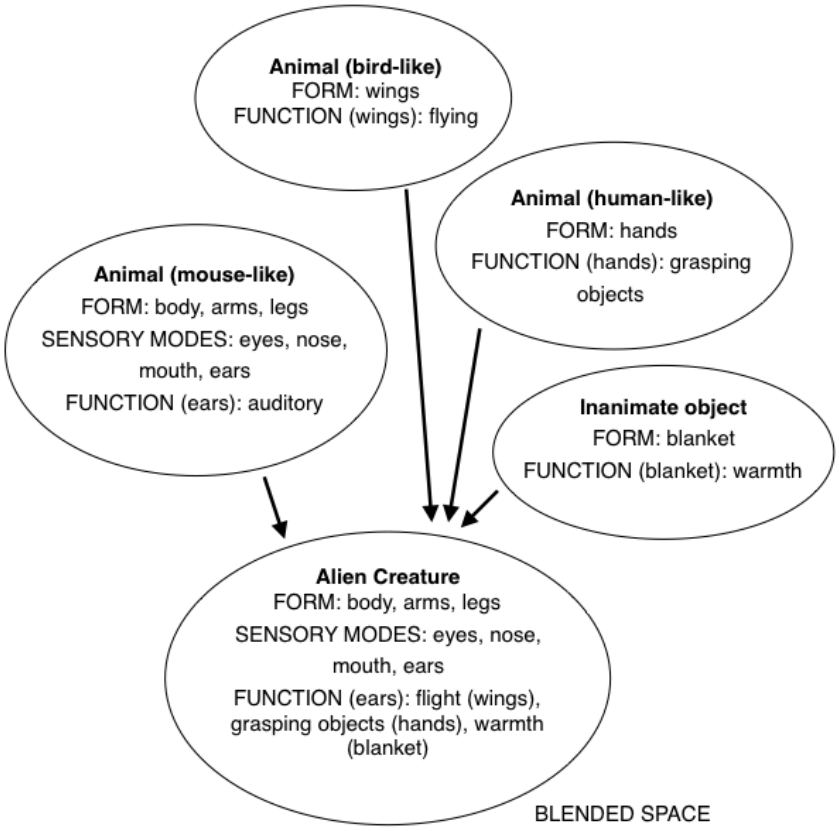
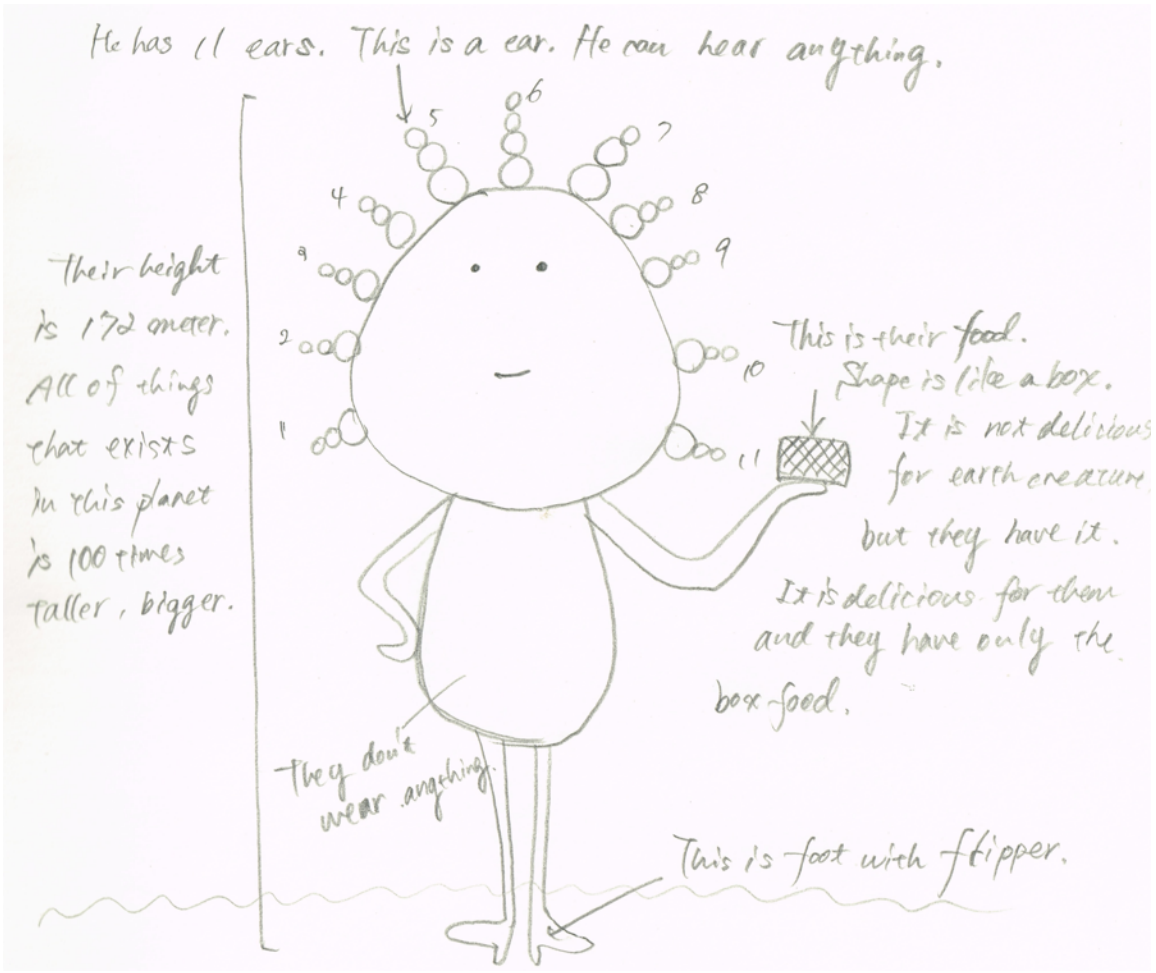


Figure 12: The conceptual blend for the alien creature ***(oversized ears)***

The example outlined here utilized a strategy, which I refer to as "amplified deviation", in order to generate a novel response to this prompt. Deviance has been studied for a long time in the social sciences and commonly refers to a disjunction from order or violation of normative expectations (Cohen, 1965). This behavior closely overlaps with views of creativity, which has been described as the departing from the status quo (Mumford & Gustafson, 1988). Consequently, deviance or the act of deviating from conventional norms in order to construct a new idea is part of the creative process, especially in regards to conceptual expansion. Another example of amplified deviance is another example with ears, but does this in a very different way.

Conceptual expansion of the sensory mode: The excessive number of ears. One way to creatively generate an alien creature is to choose some structure or property of a known concept (body, sensory organs, etc.) and then to elaborate, explore, and experiment with possible ways to break from common somatic norms, as shown in the previous example with the oversized ears. A common feature of animate creatures on earth is the binary norm of the auditory and optical sensory organs (as indicated in Figure 4, 75% of respondents' creatures has two eyes and while most did not include ears for their creatures since these modes are not as salient, those who did, 88% had two ears). In another example of amplified deviation in regards to the auditory sensory mode, participant 27 generated a creature that has 11 ears (see Figure 13).



(Participant 27)
They have human-like organs, but they don't have nose. Their planet is very safe and their diet is all box food, so they don't have to feel smell. At first, their ancients had a nose, but it has disappeared. They live in water. The water's color is white. They don't know where their family is because white color keeps them from finding the others. They recognize others by sensitive ears.

Figure 13: An imaginary alien creature (***11 ears***)

Exploring and pursuing the purpose of these ears, the participant described how they are used to "recognize others". This attribute overlaps with other sensory modes that most animals on earth usually use to recognize others (i.e., the visual or olfactory modes). Another deviation involves the lack of a nose, which through evolutionary change disappeared since their food is in the form of a box and does not have any smell. Again, this participant uses knowledge about how evolution works to creatively play with the sensory modes of this alien creature. Another element of amplified deviation in this example involves the size of these creatures, as in being a hundred times taller than a typical human. Moreover, the water is white on this distant planet, compared to the translucent waters on earth, which thereby requires these creatures to use their ears to recognize others due to the lack of visibility. Despite this deviation from the stereotypical, the other features of this alien appear rather ordinary, as in the eyes, shape of the head, and body (save for the feet that integrate features of an aquatic animal, see Figure 6 for a similar example). So there appears a need to still be able to recognize the familiar within the imaginative.

As shown in the previous two examples, conceptual expansion is important for generating new ideas. It involves extending the conventional norms of concepts by including new features and attributes (i.e., large ears used as blankets). In fact, Ward et al. (1999) suggest that based on anecdotal and historical accounts in real-world settings novel and creative ideas often develop from minor extensions of familiar concepts. The familiarity of concepts reflects the psychological entrenchment of them through conventionalization and conceptual expansion is one process of deviating from these norms and extending them in unfamiliar and imaginative ways.

Discussion

This article aimed to investigate the creative process of generating an imaginary creature and then to analyze and model this process focusing on conceptual blending and conceptual expansion. Previous research suggests associative processes (Benedek, Könen, & Neubauer, 2012; Koestler, 1964;), as well as both semantic (Abraham & Bubic, 2015) and episodic (Addis, Pan, Musicaro, & Schacter, 2016) memories play an important role for creative idea generation. The importance of associative processes for creative ideation has been around since early research into creativity (Koestler, 1964; Mednick, 1962), as Mednick suggested, "any ability or tendency which serves to bring otherwise mutually remote ideas into contiguity will facilitate a creative solution" (p. 222). The more discrepant the combinations, the more creative possibilities emerge compared to stereotypical combinations (Ward, 2007). In addition, episodic and semantic memories constitute one's knowledge structures of the world gained through embodied experiences interacting with the environment and others. Using these knowledge resources, the constructive process of conceptual integration involves selecting and then projecting partial structural features from two or more mental spaces into a blended space, yielding emergent structural features that are not the mere sum of its constituent parts (Fauconnier and Turner, 2002). As for conceptual expansion, this involves inhibiting stereotypical instances of the concept and looking for ways to elaborate, augment and broaden the structure and properties of the concept. This is similar to the "alternative uses" task for measuring divergent thinking, which requires one to deviate from conventional instantiations of a common object like a brick. In the case of this study, this deviation involved a sensory mode or some other bodily attribute of an animate creature.

Although this study used imagery for the process of conceptual combination, conceptual combinations are quite common in everyday language, especially as a way to create new categories. For instance, *wind farm*, this combination involves wind turbines and a physical location where crops are harvested. In the blend, the wind turbines are positioned in rows on this specifically designated land and the wind is harvested, as a product, not for human consumption, as in food, but for energy consumption (other examples include*; carbon footprint, helicopter parents, eye candy*, etc.). The key point here is that this is a normal process for expanding our knowledge of the world and crucial for the development of novel ideas.

As illustrated in this study, combining concepts, especially those distantly related, are important for generating novel ideas, and developing these skills is important and has real world application. For instance, Ward (2004) discusses the practical side of conceptual combination for entrepreneurs who are perpetually looking for new ideas or marketers who look to effectively sell a product. Again consider Figure 1, and how the creative designers used conceptual combination to blend the knowledge structures of humans and moths in order to capture the viewers' attention and effectively communicate the intended message in a novel and imaginative way. Moreover, conceptual combination is a common technique used in

producing pictorial or visual metaphors. These visual metaphors are widespread in the world of advertising (Kaplan, 2005) and economics (see Birdsell, 2019). There are many examples and different techniques used to produce such visual metaphors. One is called a *hybrid model*, whereby two concepts are visually blended together in the image (Forceville, 1996). This is very similar to the drawings by participants in this study, specifically the land/aquatic animal (Figure 6) and land/plant animal (Figure 8). In a similar way, a Toyo Tires advert highlights the gripping force of their tires by blending them together in the image with octopus legs (car tires/octopus legs).[1] So conceptual combination, as well as conceptual expansion, are important cognitive tools that humans use to create and produce novel ideas in real world situations from entrepreneurs and inventors to advertisers and marketers. In short, conceptual combination is important in the creative process for it involves "the creation of new knowledge structures through the integration of previously distinct concepts" (Scott, Lonergan, & Mumford, 2005 p. 80).

In summary, this study took a further step forward in showing the two common techniques of creative cognition, conceptual combination and conceptual expansion. These cognitive skills are part of the everyday (Richards, 2007) and distributional (Sternberg, Grigorenko, & Singer, 2004) aspect of human creativity. Interest in using the creative cognition approach has recently been applied to such diverse fields as neuroscience (Abraham, Rutter, Bantin, & Hermann, 2018) and education (Pang, 2015). Pang, for instance, discusses how identifying generative processes (like conceptual combination) as a possible classroom activity for teachers to promote the potential for student creativity. Generative processes like these promote learners to experiment and explore conceptual boundaries and novel combinations. Developing these skills offer new possibilities that might enhance the overall creativity of the learners. Creativity skills are economically paramount not only within the changes in modern economy (Florida, 2002), but also socially and environmentally more important than ever before for generating novel ideas to solve the many global issues facing modern society.

[1] See here for the print ad: https://www.adsoftheworld.com/media/print/toyo_octopus

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