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CREATIVITY COMPARISONS BETWEEN JAPANESE AND EUROPEAN AT THE CONCEPT CREATION STAGE

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Abstract: The study presented in this article aims to measure the impact of sensory, cognitive and affective modalities and the influence of designer's culture on the association of ideas phase during creative concept creation stage. It was made possible through the collaboration with the "Kansei Design" department of Toyota Motor Europe (KD-TME). Starting from areas of the identity territory mapping of future hybrid vehicle interiors, defined in a previous research we conducted, participants were asked to create concepts according to their perception of the design brief. The originality of the experimentation is that the stimuli used for the creation of their concepts were referring to human senses: touch, hearing and smell. Having participants from Japan and Europe allows us to compare and discuss their association logics for 3 different directions of the identity territory of future hybrid vehicle interiors (named "technological", "fluidity" and "organic nature"). The results outline similarities and differences of the two populations in term of sensory stimuli (sight, touch, hearing and smell), values and emotions linked with concepts they created. The methodology and the results will facilitate the development of future concepts that will be able to better take into account cultural specificities.

Keywords: *Association stage, Multi-sensory stimuli, Japanese-European Comparison, New concept creation*

1. Introduction

In the globalized world we live in, worldwide successes for consumer product are rare. In the car industry, manufacturers are currently amplifying their logic of adaptation to local markets. Of course regulations are one reason but other include habits of use, driving conditions, needs in term of functionality, taste in style and interaction. This article tackles this issue from the creative process point of view by comparing at the early stage of the concept creation process (find idea scope, organize it, introduce them into concept (Gentner et al., 2012b)) the creativity of European (EUP) and Japanese (JPP) participants all working in the vehicle development process. This stage of the new concept development process is the one having the most operations of association of ideas (Tassoul, 2006), which is also the characteristics of creativity that we will observe. The novelty of this study from a research point of view is that it combines in a single approach, creativity, cultural differences and multi-sensory perception, concerns that are generally only tackled in pairs.

2. State of the art

Sensory stimulations and motor reactions are in- and outputs of human experiences (Norman, 2004). From the human side these input stimulations imply cognitive and affective operations (Crilly et al., 2004) leading to a behavioural response also described in the creative cognition *associationism* approach (Smith et al. 1995). We will therefore discuss how sensory inputs, cognitive operations and affective processes are put into relation by conscious and unconscious processes at the concept creation stage as well as the different elements that have an influence on them. Finally, the ways to cluster these elements, in particular cultural differences, will be detailed.

2.1 Response to perception at the creativity stage

2.1.1. Sensory inputs

People use all their senses to explore around them and all the senses together create an overall product experience after having been processed by the brain (Fenko et al., 2010). At the same time all of our senses are not used in the same way and are not sensitive to the same type of stimulation (Schifferstein et al., 2008). Knowing the roles that the different senses play in people's interactions with products, designers have now the key to choose the best sensory channel to communicate through their products (Lindstrom, 2005). Studies about product evaluation have shown the importance of the different senses in the perception process and encourage a synesthetic approach earlier in the design process (Ludden, 2008). These sensory inputs lead for humans in general and for designers in particular (see Figure 1) to cognitive and affective operations.

2.1.2. Cognitive, affective and behavioural responses

The cognitive process can be divided into the semantic interpretation (what an object says about its function, values and qualities), the aesthetic impression (resulting from the (un)attractiveness) and the symbolic association (perception of what a product says about its user) (Crilly et al., 2004). These cognitive operations can be structured into 3 levels of design information during the concept creation: from concrete to abstract. The low level composed of basic information such as colour, shape and texture, the middle level grouping information about the function, context and names of classifying cluster. The high level contains more complex data such as style, analogy, semantic descriptors, and values. These creative design information are then organized using three distinct cognitive categorization operations: memory retrieval, transformation and association: the last one being the scope of this article (Kim et al., 2009).The affective process groups cerebral "functions" with an affect on their beholder. They have a lifespan from few seconds to days and include reflexes, sensations, feelings, thoughts, dreams, emotions, moods and drives that are made possible by different human control mechanisms (Salem et al. 2006, 2009). These cerebral "functions" are often summarized with the term "emotions". On the designer side the affective process within the creativity stages consists of the same cerebral "functions" triggered by the design thinking process. Links could be established with motivation and these "functions". Combined they seam be a key component of creativity: provoking teams to go beyond certain states of knowledge and concepts (Kröper et al., 2010). In order to classify these emotions (subjective and uncontrolled) tools have been developed such as the "Geneva emotions wheel" (Scherer, 2005) in which emotions are organized in concentric circles corresponding to their intensity and distributed following *control* and *pleasantness* dimensions. The affective and cognitive processes are then externalized in a behavioural response corresponding to an action made by the perciever. In the case of the creative phase of concept creation this action can for instance be sketching or in our case associating and assessing (Figure 1).

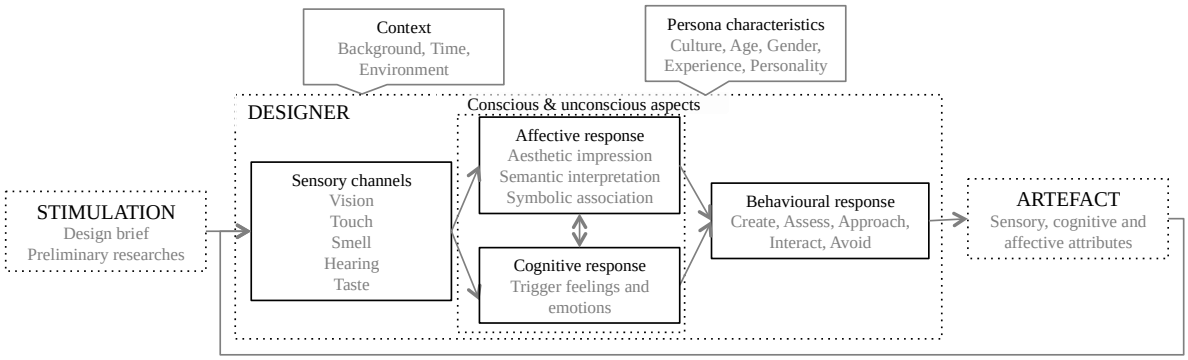


Figure 1: Framework for the designer's activity of creation

2.2. Influences on creativity

In this paragraph, we will discuss the different possible influences on a person's creativity and on what makes it unique. Creativity is formed by an individual including its subjective pictures to an existing situation, product or idea (Lindemann, 2010). Its description is highly influenced by the design situation (Gero & Sosa, 2002) that encompasses the interrelations between the design, the design agent, the evaluator, the context and the period of time. The tacit knowledge, that has an important role in design processes, leads to unconscious decision (Rust, 2004). Combined with the memory, representing the conscious representation of past experience, they form the whole knowledge of an individual. The influence of this knowledge on creativity is so strong that even "when faced with a new design problem, designers may tend to reproduce solution approaches they used in past designs and may not consider alternative and more effective design solutions" (Bonnardel, 2011). Rieuf (2011) presented a model that combines perceptual, cognitive and affective aspect and that takes into consideration this unconscious-conscious duality and divides the process into 2 complementary paths (summarized on Figure 1). The dominance of one path on the other depends on the situation. The reasons behind the dominance of one or the other remain nevertheless unclear. The generative phase of design is highly based on analogical reasoning that uses the designer's knowledge as source of information. Analogical reasoning skills are therefore gained through experiences and major differences concerning these skills could be observed while comparing novice and expert designers (Bonnardel & Marmèche, 2004). Leung et al. (2008) highlighted the highly positive influence of rich personal experiences, such as immersive experiences in foreign countries, on creativity: both creative performance and creativity-supporting cognitive processes.The personal background such as leanings from work and education influences as we could see to the design process but according to Woelfel et al. (2010) the designer's socio-cultural references that are not gained that much from work and education, play an even more important role. In this area differences between the Western "instrumentalism" and the Eastern "spiritualism" could be observed for creation, perception and purification (Lee & Ho, 2008), the 3 components of the aesthetic pleasure framework by Jauss (1982).

2.3. Creative cultural clusters of subjectivity – The example of Japan and Europe

Nevertheless different stakeholder such as knowledge background, culture, age, gender allow to cluster to some extend this subjective aspects within categories named "zeitgeists" that take into account trends, culture, religion or a particular political climate shared by a specific group of people (Salem et al., 2009) (Sternberg, 1988). Let's take the example of ageing. Because of the functional losses it causes, the experiences it makes gain and the socio-cultural changes it implies, ageing influences the human perception and action processes and divides the population between groups having different needs and expectations towards products (Medeiros et al., 2008). Grouping people into cluster in order to represents a market is for instance a common activity for the marketing divisions of companies. It permits to identify target users as well as their needs and expectations. There are multiple ways of grouping a population. As the scope of this article is the differences between a Japanese and a European populations we will now focus on cultural differences. Hofstede

was one of the first researchers to develop a cultural classification. He used five dimensions masculinity, uncertainty avoidance, power distance, individualism and long term orientation to differentiate cultures all around the world. In the design research different studies have been done and tackle different domains like the comparison of existing objects or living experiences (Song et al., 2008)(Fenko et al., 2010), the specific role of colour (Kommonen & Yan, 2008) or user interfaces (Reinecke & Bernstein, 2009). They are all meant to provide data to influence new designs but they are more centred on design evaluation or trends researches than directly on the design process itself.

3. Experimentation

3.1 Introduction

We built the experimentation using as playground a previous research (Gentner, 2012a) that defines areas of investigation combinating visual (shapes, patterns, colours) cognitive and affective (metaphors, inspirational pictures, keywords) information. These are mapping the identity territory of "future hybrid car interiors". The areas are divided into *families* (named) having a clear visual interpretation because of their link to aesthetic perception and *nuances* (named "simplicity", "refinement", "energy" and "unexpectedness") centered on values and emotions. For confidentiality reasons, no details will be given about the content of these design briefs.

3.2. Hypothesis

Our first hypothesis is that designers' process of association is related with their cultural background. Comparing Japanese and European populations, differences will be observed in term of sensory channels preferred, concerning the physical characteristics of the stimuli associated as well the as the associated values and emotions. Our second hypothesis is that the area of investigation defined by the design brief will have an influence on our first hypothesis so that the conceptual distance of the final designs will be different depending on the design brief focus ("technological", 'fluidity" or "organic nature").

3.3. Methodology

66 participants spent separately one hour each to answer the three briefs. One third of them were Japanese (22) and the others were European (44). The repartition of male and female and of participants in the age clusters 20-30, 30-40, 40-50 and 50+ were the same for the 2 populations. They were all involved in new concept or vehicle development projects and had a good knowledge of hybrid cars' driving experience. Participants were asked to build their image of a future hybrid car interiors using sensory, cognitive and affective stimuli and investigating 3 concept directions or families: "1: technological" (concrete in the automotive context), "2: fluidity" and "3: organic nature" (abstract in the automotive context). The collection of quantitative data, is adapted to the association of modalities operation of the concept creation phase : in our case sensory, cognitive and affective modalities. Participants had to reproduce the experimentation process presented hereafter for each of the 3 briefs (Table 1). The starting point was the confrontation with four Mood-boxes (MB) representing nuances of "future hybrid car interior" and designed specifically for each brief. In total 12 MB were developed by designers from the Kansei Design team. They are based on transparent cuboids (37x26x6cm) with low height that display a composition of inspirational elements such as fabrics or products as well as metallic and paint samples. This representation creates a tangible identity territory in a small space and is otherwise used for the evaluation of style directions at early ideation stage. After having experienced all of them, participants had to select the one that fitted the most with their idea of future hybrid interior according to the direction of the brief. They had then to go through 5 free association stations. The blind touch station has been developed using Sensotact®, a haptic evaluation tool, and was composed of samples classified in 4 categories: perceived temperature, orthogonal hardness, tangential grain density and tangential fiber roughness. The hearing station and the smell station were developed both in collaboration with experts in the field and covered the initial identity territory. Finally the participants had to associate keywords (values and emotions) to their concept in order to organise their ideas on the cognitive and affective levels. The lists we proposed them was refined from the literature through a pilot survey. Participants associated

each of the stimuli having using the scale *not at all*, *somewhat* or *completely* with their envisioned design solution (Table 1).

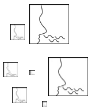
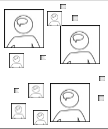
	Experimentation						Result
Stimuli	4 Mood-boxes	15 Touches	14 Melodies	7 Scents	23 Values	18 Emotions	Final design
Flow							
Modality: Explicit(Implicit)	Sight, Touch, (Cogn., Aff.)	Touch, (Cogn., Aff.)	Hearing, (Cogn., Aff.)	Smell, (Cogn., Aff.)	Cogn.	Aff.	All
Action	Select 1 out of 4	Associate stimuli completely  , somewhat  or not at all					Result creation

Table 1: Experimentation process (Cogn.=Cognitive, Aff.=Affective, (..)=Implicit association)

3.5. Results

In order to analyze the data we proceed in 2 steps: first from a stimuli point of view and then from a modality point of view. One mapping of associations was created for each of the 3 directions (see Figure 2 as example). Scales representing the global degree of association of the stimuli (*not at all*, *somewhat*, *completely*) to the design brief for the JPP (X-axis) and for EUP (Y-axis) are used. By making the axes cross at *somewhat* the graph is divided into 4 areas corresponding to stimuli globally associated both by JPP and EUP in their final design (2), stimuli positively associated only by EUP and not by JPP (1), the ones only associate by JPP (4) and the ones that are in average neither selected by EUP nor by JPP (3). In order to get a precise knowledge of the stimuli being significantly differently associated by the two populations we proceed to an analysis of variance (ANOVA). The one having a 95%+ interval of confidence are marked on Figure 2 (for Family 3) and listed on Table 2.

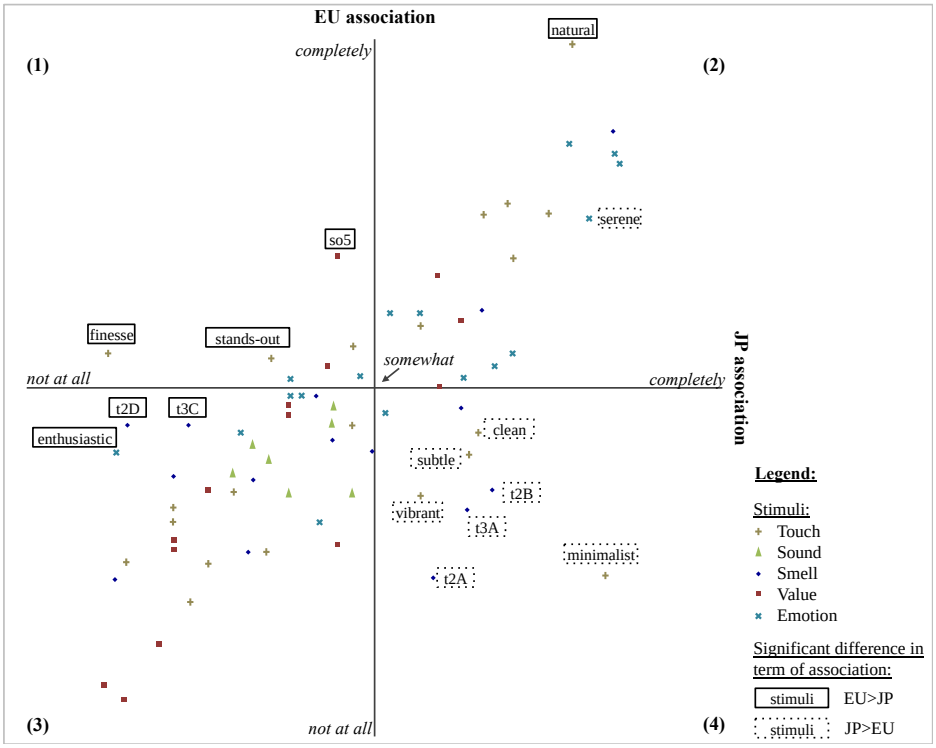


Figure 2: Example of mapping for the family 3 (“organic nature”). Significant differences for European and Japanese are highlighted

Table 2: Significant differences obtained by ANOVA

		Family 1: "technological"	Family 2: "fluidity"	Family 3: "organic nature"
Touch	**JPP**	very soft,low grain density		very soft,soft, scattered grain
	EUP	cold, mildly hard,hard	mildly hard,hard	hard,medium grain density
Sound	**JPP**		refined acoustic strings, drums composition, airy electronic	
	EUP			nature sound based rhythm
Smell	**JPP**	woody powdery scent	woody powdery scent	
	EUP			
Value	**JPP**		authentic,harmonious	clean,minimalist,subtle,vibrant
	EUP	clean,elegance,harmonious, minimalist, precise,radical,subtle,vibrant	energized,lightweight,radical,soft, subtle	finesse,natural,stands-out
Emotion	**JPP**		Gratified	serene
	EUP	confident,enthusiastic,peaceful,relaxted, safe,satisfied	enthusiastic,joyful,stimulated	enthusiastic

We will now look at the results from a macro point of view by comparing the association ratio by modality. Vision, the traditional sense used in the creation of a design is not analysed in this study in order to give more space to the emerging senses. This ratio corresponds to the percentage of stimuli *completely* associated by participants to their concept. The ranking of the sensory, cognitive and affective modalities have been classified according to the 3 directions of the design brief and to participant's culture (Table 3).

Table 3: Associated modalities

		Most associated modalities…				…Least associated modalities
Family 1: "technological"	**JPP**	Touch (26%)	Affective (25%)	Cognitive (24%)	Smell (20%)	Hearing (17%)
	EUP	Cognitive (40%)	Affective (34%)	Touch (28%)	Hearing (20%)	Smell (14%)
Family 2: "fluidity"	**JPP**	Cognitive (31%)	Hearing (25%)	Affective (24%)	Touch (23%)	Smell (20%)
	EUP	Affective (36%)	Cognitive (35%)	Touch (26%)	Hearing (21%)	Smell (13%)
Family 3: "organic nature"	**JPP**	Affective (40%)	Cognitive (33%)	Touch (31%)	Smell (20%)	Hearing (18%)
	EUP	Affective (37%)	Cognitive (30%)	Touch (24%)	Smell (23%)	Hearing (22%)

4. Discussion: Creativity comparison

In order to discuss the cultural influence on the creativity process, different parameters will be taken into consideration such as the individual stimuli associated, the modality naturally involved by the participants to express themselves and the design briefs.

4.1. From the modality point of view (Table 3)

By looking at the last results presented, we observe significant differences between the EUP and JPP creative approach towards the modalities presented (sight, touch, hearing, smell, cognitive and affective). In average EUP tend to by more "stimulated" as they associate more affective and cognitive stimuli (average of 35% for EUP vs. 29% for JPP). For JPP, there is a better balance between the association ratios of the 3 modalities whereas for EUP cognitive and affective modalities are dominating sensory modalities. For EUP it is only easy to take a sensory modality into account when it has for them a concrete link with the direction explored by the direction: like smell with "organic nature" and touch with the 3 directions. On the contrary EUP link only few smells with the "technological" and "fluidity" directions. These observations correspond well to the "rational and logical" Western culture approach described by Lee and Ho (2008). JPP seam more stimulated (value and emotion associations) by nature-oriented briefs ("fluidity", "organic nature"). They fit better with the specific place of nature in Eastern culture "spiritualism". Not only present in surrounding and customs the theme of nature is at the core of creation for Japanese literature and traditional arts. Reputed Japanese designers such as Mihara Yasuhiro, Issey Miyake, Kenzo have as well created inspired by the theme of nature (Addiss et al., 2006). At this stage the differences observed validate our first hypothesis about the creative process.

4.2. For the stimuli point ot view (Figure 2 and Table 2)

For a stimuli, a significant difference in term of association can either be valid for the 3 briefs (*mildly hard* and *hard* touches for EUP) or can depend on the direction such as the values *clean, minimalist, subtle* associated to the "organic nature" direction by JPP and the "technological" one by EUP. By looking at the other stimuli associated to the "technological" concept by EUP we notice well-being related emotions (low control on the Geneva Emotion Wheel), that are absent for JPP, as well as emotions associate with high control (*interested, inspired*), that are only mild for JPP. Concerning the touch feelings associated, *flat, slick* and *lukewarm* materials are commonly appreciated but opposite direction of association were strongly present: EUP associated *cold metal* and *hard* touches to the concept whereas JPP were interested in *soft* and *low grained* surfaces. It is for this family that the differences are the strongest and cover in fact all the modalities. For the "fluidity" direction, the fact we have the significantly different sensory stimuli being in or close to the area (3) means a difference of intensity of rejection and not of association. On the contrary there are many commonly high-appreciated sensory samples (*warm, lukewarm touches, refined and joyful melodies*). This common base also exists for emotions and values but is nuanced with some more active and dynamic keywords (high control) specific for EUP and passive and contemplative (low control) specific for JPP. For the "fluid" direction the 2 populations have common sensory taste but which conduct to different ways of interpretation.

Finally the "organic natural" direction is characterised by many commonly associated passive and focusing on well-being values and emotions (low control on the GEW). Complementary values such as *clean, minimalist, vibrant and clean* are only perceived by JPP. Both reverence of nature and affirmation of physical cleanliness are among the 4 fundamental beliefs of Shinto religion (Schadé, 2006). The other values are also linked with the specific relation Japanese have with nature. The specific touches: *soft, very soft* and *low grain density* could be explained by how Japanese surround themselves with natural elements in their everyday life: "unpainted floors and walls, wooden posts and grass mats" (Lewis, 2007). From the EUP side, specific preferred stimuli compared to JPP are only for them mildly associated. It makes us suppose that European participants' sensory, cognitive and affective understandings of the "organic nature" design brief are included in the JPP ones. We saw here that ways of approaching the design briefs through creative association operations are different for EUP and JPP. The collected data also outline that these approaches depend on the references in the brief, which confirms our second hypothesis.

5. Conclusion

By investigating 3 components of the identity territory of future hybrid vehicle interiors through the creative process of association, we were able to identify common and different sensory, cognitive and affective stimuli for European and Japanese participants. Discussions were centred on the specific of approaches of the two populations towards the modalities proposed and on the similarities and differences of stimuli association for the 3 design brief directions "technological", "fluidity" and "organic nature". At this early stage of the design process a holistic user-centred approach and cultural user studies are recommended. The right management of these parameters appears like another challenge for success global product strategy. In this context a better understanding of the associations processes involved in the designer's creativity at the concept creation phase is a must but only a first step. Further researches in this direction should encompass more creative operations such as research of information, memory retrieval and transformation.

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