

## Object vs. Relation: Understanding the Link between Culture and Cognition with the Help of WordNet

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### Abstract

*This study was conducted to provide empirical evidence to the proposed relationship focus in Asia versus the proposed object focus in North America during cognitive processes. The study has analyzed WordNet category occurrences in free word associations of Japanese and North American samples after exposure to animal pictures. It was observed that the Japanese word associations included relation and group related categories, unlike the North American word associations where shape, state, and substance related categories were common. This variation in word associations indicates that culture directly influences categorical thinking and suggests that the culture of the perceiver plays an important role in object judgments.*

### Keywords

*Wordnet; Free Association; Culture and cognition; Japan; USA*

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*"Westerners and Asians literally see different worlds. Like ancient Greek philosophers, Westerners see a world of objects--discrete and unconnected things. Like ancient Chinese philosophers, modern Asians are inclined to see a world of substances--continuous masses of matter." (Nisbett, 2003, Geography of Thought, page 82)*

### 1. Background

There are currently more than 300 definitions for the word *culture*. Though it is hard to define and operationalize, we can accept its existence and look at its impact in everyday life. Today, it is known that people from different cultures think and act differently in similar conditions. Although there are a number of factors that influence human behavior, including genetics and environment, culture has a significant importance, especially in explaining behavioral patterns in large groups (Hofstede, 2003). Additionally, on an individual level, culture, along with language, directly influences the way information is processed, interpreted, and judged by a receiver.

It is assumed that when presented with a visual stimulus, people who are members of different cultures or people who speak different languages utilize different cognitive mechanisms (Nisbett, 2003). However, up to date, no study has ever shown how this process occurs. We presume that people from different cultures, who grew up in different visual environments, associate different words with the same object. By analyzing the nature of cross-cultural word associations and word category frequency counts in respondents' answers, we are hoping to understand the connection between culture, verbalized thoughts, and object judgments. Readers should note that this paper neither speculates about the magnitude of cultural impact on object evaluations nor examines the dimensions of aesthetic judgments.

## 2. Literature Review

### *Culture and Visual Perception*

To begin with, most cultural groups have different visual environments which members of each society start interacting with after birth (Segall et al., 1966). Each of these unique visual environments forces different visual inference habits. For instance, Segall and his colleagues have listed typical forms of houses, geographical surroundings, land vistas, furnishings, color homogeneity, artistic training, and patterns in traditional games to be influencers of how one interprets a line drawing. After collecting data about geometric illusions in fifteen different societies, the authors came to the conclusion that perception is learnt and the susceptibility to optical illusions varies depending on culture, since each cultural group has different visual inference habits.

There are several other views about how and why culture shapes visual perception. Perhaps the earliest and most famous proposition is the Whorfian hypothesis: our perception of the world is limited by our vocabulary and shaped by the language we speak (Whorf, 1956). Gilbert et al. (2008) have empirically tested this proposition by asking respondents to identify mid-colors between green and blue. People who speak languages with only one word for green and one word for blue were unable to detect differences in mid-colors, unequivocally demonstrating that this proposition holds true for the majority. Other factors that relate culture and visual perception are depth perception (e.g. drawing more realistic sketches) and perceptual organization (e.g. Western culture favors "concept closure" and task completion).

### *Culture and Evaluation of Perceived World*

Our literature review suggests that culture acts as an independent variable in influencing perception of the natural world. In addition, there is solid evidence that evaluation of sensory information is also mediated by local culture. For instance, Veryzer (1993) has argued that aesthetic evaluation of objects varies cross-culturally. DeMooij (2003) has discussed the failure of global marketing campaigns because of culture-based evaluations (e.g. angular and round shapes convey different meanings, or the color red's association with various meanings depending on the culture). Likewise, Rosen et al. (2004) have posited that each cultural group has a certain preference over web design elements (spatial organization, color coordination, etc.). Similarly, when it comes to attitudes toward human faces, it is almost certain that evaluation of attractiveness varies significantly across the globe (Tovée et al., 2006).

### *Perceptual and Cognitive Differences between Easterners and Westerners*

By referring to Easterners as people who live in East Asia (China, Japan, and Korea) and Westerners as people of European culture (mostly North Americans and Europeans), Richard Nisbett (2003) has carried out a series of experiments and provided a comprehensive view about why people from the East and the West think differently. He has observed a number of differences between Asians and North Americans in his experiments: focus on saliency versus context, taxonomic categorization versus relational categorization, future stability versus future change, emphasis on logic versus emphasis on intuition, ultimate correctness versus need for the middle way, etc. (see Table 1).

Task	Result	
	Westerners	Easterners
Picture recall	Remembered the salient objects	Remembered not only salient objects but also the contextual elements
Categorization of words: cow, chicken, and grass	Put cow and chicken and together because they both are animals (category)	Put cow and grass together because cow eats grass (relation)
Evaluation of statements	Evaluated more positively if a statement is presented with contradictory statement	Evaluated less positively if a statement is presented with a contradictory statement
Detecting differences of lines drawn in squares	Likely to detect correctly the differences in lines	Likely to detect differences in boxes correctly
Estimating global economic trend based on past trends	Estimated more positive trend	Estimated reversal of the trend

**Table 1. Results of Nisbett's experiments (Source: Nisbett, 2003)**

Most of these findings are based on the premise that Easterners have an interdependent self-construal compared with Westerners' independent nature, and there is strong empirical support to this argument. When Wang and Conway (2004) asked Chinese and American adults to list twenty unforgettable memories in their lives, most Americans listed memories that involve individual recollections and emotions, where most Chinese recalled social events. In the same vein, Wu and Keysar (2007) have found that Chinese students could easily take the view of their partners when paired together, which most American students

failed. To further assess neurological correlates of culture-dependent perception, Zhu and Han (2008) have used fMRI to measure brain activity by asking Chinese and American subjects to think about personal traits and the traits of their mothers. As expected, for the American subjects, medial prefrontal cortex (the area of the brain associated with self perception) increased only when thinking about the self. However, this area was activated in Chinese participants both when thinking about the self and mother, which indicates a clear distinction between Easterners' and Westerners' information processing patterns.

Dr. Nisbett (2003) has offered various philosophical, socio-psychological, and sociological explanations about why these differences occur. According to Nisbett, principles of linear logic and non-contradiction in Western Philosophy, and Tao and Confucius doctrines about interconnectedness and constant change in nature influence categorization and perception of truth. He claimed that strong belief in constant change in nature among Asian societies undermines the perception of ultimate shape and state of the artifacts, since their current state is considered to be temporary. By the same token, mostly as a result of Ying Yang philosophy (every truth has an error and every error has a truth in it), Easterners believe that the relationship of the object with its environment is more important than what it is made of. Thus, we assume that this schematic thinking will heavily influence what concepts or words will be associated with certain animals in two different cultures and propose:

**H1:** In American free word associations, "substance" and "object" related word categories will occur more frequently.

**H2:** In American free word associations, "shape" and "state" related word categories will occur more frequently.

**H3:** In Japanese free word associations, the "relationship" related word category will occur more frequently.

Regarding the context focus in Asia and salient object focus in Western societies, Nisbett and his colleagues (2001) have emphasized individual self-construal in Western culture as a driver of most of the differences in thought processes. In other words, human cognition is different in the East and West because of the individualistic and collectivistic aspects of these cultures, which have philosophical and sociological underpinnings (e.g. individual farming in ancient Greek societies versus traditional rice farming in China, which required collaboration; or high versus low social mobility in the East and West). Individualistic and collectivistic aspects of Western and Eastern cultures were also emphasized by Hofstede (1980). He has posited that the individualism/collectivism continuum represents the degree of individualistic versus collectivist tendencies that exist in each society. Individualistic societies put more value on achieving individual potential and personal freedom, where collectivistic societies place a priority on having a better relationship with the other members of their society to keep the harmony. Since we presume that people from collectivistic societies will consciously or subconsciously focus more on relationship or group related concepts, lastly, we hypothesize,

**H4:** In Japanese free word associations, the "group" related word category will occur more frequently.

### 3. Methodology

### *Subjects*

The data of the thirteen Japanese subjects was provided by the Creative Design lab led by Toshiura Taura. Nine subjects from North America, who reported English as their primary language, were contacted by convenience sampling at two different international universities in Japan. Although the majority of the Japanese subjects were males, the gender distribution in North American sample was fairly balanced (four males and five females). Most of the participants in both samples were between age 18 and 35. There was no incentive for participation, and all participants were briefed on the purpose of the study after they completed the survey.

### *Measurement and Procedure*

The word frequency in the open-ended answers was measured by the analysis of free associations about eight different animals. Participants were asked to look at pictures of the animals (penguin, frog, lion, crow, crane, squirrel, snake, and cockroach) and write down any word or phrase that came to their mind for two full minutes. After writing all of their impressions on the questionnaire form, participants were then asked to rank the animals from most liked to least liked, as well as group them into the ones that are “liked” and “disliked”. The whole procedure took about twenty minutes (instructions, animal impressions for 120 seconds each, and the ranking task) and was strictly controlled by the survey administrator to ensure consistency.

### *Analysis*

WordNet 3.0 (Fellbaum, 1998) was used to code each word into its noun form (e.g., red:redness) and assign appropriate senses to polysemous words. After this procedure, each word was classified into one of the 25 WordNet categories, followed by the comparison of word category counts in both samples. Additional z-scores and ChiSquare scores were obtained to test the significance of the findings.

### *WordNet*

WordNet is an electronic lexical database that includes over 90,000 synsets in English (Fellbaum, 1998). It also offers information about syntactical relationships between words and categorizations of nouns based on unique meanings. As Fellbaum (1998) has explained,

WordNet divides the nouns into several hierarchies, each with a different unique beginner. These multiple hierarchies correspond to relatively distinct semantic fields, each with its own vocabulary...Partitioning the nouns has one important practical advantage: it reduces the size of the files that lexicographers must work with and makes it possible to assign the writing and editing of different files to different people. (p. 28)

This very reason was also the major motivation behind our research, as WordNet makes it very easy to compare two cultural groups in order to understand the differences in object assessments. Since higher frequency of a certain category means conscious or subconscious priority given to that certain aspect of the object, our results are likely to explain why people’s object evaluations are controlled by their culture. Readers should note that the “motive” (motivation, incentive, etc.) category had no occurrences in both samples; therefore our analysis had only 24 categories (please check Table 3 for the list of categories).

#### 4. Results

Comparison of the most frequent words has shown that American and Japanese subjects are quite different in terms of what they think when they look at an object (an animal, in this case), except in aesthetic judgments: in both samples, *prettiness* was among the top words. As Table 2 clearly illustrates, the most frequent words for Japanese and North American subjects were dramatically different. The American list was topped by colors (*blackness*, *greenness*) and negative affect words (*poison*, *disgust*, and *scare*), while *flock* (a group related word) appeared in a significantly higher frequency among the Japanese associations. It was interesting to see *disgust*, *fastness*, and *scare* occurring ten times in North American subjects' answers and not being mentioned even once in Japanese associations.

Top 10 Most Frequent Words North American Sample			Top 10 Most Frequent Words Japanese Sample		
Word	N. America # of Occur.	Japan # of Occur.	Word	Japan # of Occur.	N. America # of Occur.
<i>tree</i>	18	6	<i>prettiness</i>	17	16
<i>prettiness</i>	16	17	<i>coldness</i>	13	9
<i>blackness</i>	15	7	<i>leg</i>	12	3
<i>greenness</i>	15	5	<i>flying</i>	11	13
<i>fly</i>	13	11	<i>flock</i>	10	2
<i>bird</i>	11	9	<i>zoo</i>	10	4
<i>poison</i>	11	5	<i>bird</i>	9	11
<i>disgust</i>	10	0	<i>dirtyness</i>	9	4
<i>fastness</i>	10	0	<i>snake</i>	9	0
<i>scare</i>	10	0	<i>swimming</i>	9	5
<i>Total # Words: 1130</i>			<i>Total # Words: 1176</i>		

**Table 2. Word Frequency Counts**

Since in each language, the same thoughts or ideas might be communicated with different words (e.g., the feeling of disgust might have been communicated by a different word in Japanese, which might not necessarily translate as disgust in English), we set up our hypotheses by focusing on the category frequency differences rather than word frequency differences. We assumed that the categories should be more robust against translation errors, and any potential difference in a category frequency should be considered as a cognitive or perceptual difference, not a lexical choice difference. The results have shown that Japanese and North Americans differed significantly in 9 out of 25 categories; namely, body, group, person, plant, quantity, relation, shape, state, and substance. As expected, group and relationship categories were more common in the Japanese sample,

whereas substance, shape, and state stood out in the North American sample. The difference in “object” category, however, was not significant, even though North Americans cited object related words more frequently than Japanese subjects. These findings fully supported H2, H3, and H4 and provided a partial support H1.

Category	Japan # Occur.	N. America # Occur.	Z Value	Significance
<i>attribute</i>	115	136	1.308	P>.05
<i>act</i>	80	67	1.091	P>.05
<i>animal</i>	73	85	0.874	P>.05
<b><i>body</i></b>	<b>67</b>	<b>48</b>	<b>1.781</b>	<b>P&lt;.05</b>
<i>artifact</i>	61	75	1.115	P>.05
<b><i>quantity</i></b>	<b>44</b>	<b>21</b>	<b>2.819</b>	<b>P&lt;.05</b>
<i>cognition</i>	40	28	1.392	P>.05
<b><i>state</i></b>	<b>38</b>	<b>69</b>	<b>2.961</b>	<b>P&lt;.05</b>
<b><i>group</i></b>	<b>36</b>	<b>22</b>	<b>1.772</b>	<b>P&lt;.05</b>
<i>object</i>	36	50	1.406	P>.05
<b><i>person</i></b>	<b>36</b>	<b>20</b>	<b>2.065</b>	<b>P&lt;.05</b>
<b><i>substance</i></b>	<b>33</b>	<b>55</b>	<b>2.273</b>	<b>P&lt;.05</b>
<i>location</i>	23	13	1.541	P>.05
<i>event</i>	22	18	0.497	P>.05
<i>feeling</i>	22	24	0.127	P>.05
<i>process</i>	21	12	1.424	P>.05
<b><i>relation</i></b>	<b>12</b>	<b>3</b>	<b>2.1</b>	<b>P&lt;.05</b>
<i>food</i>	11	11	-0.197	P>.05
<i>communication</i>	8	8	-0.231	P>.05
<i>phenomenon</i>	7	11	0.698	P>.05
<b><i>plant</i></b>	<b>7</b>	<b>19</b>	<b>2.158</b>	<b>P&lt;.05</b>
<i>time</i>	5	3	0.359	P>.05
<i>possession</i>	4	3	0.018	P>.05
<b><i>shape</i></b>	<b>1</b>	<b>7</b>	<b>1.785</b>	<b>P&lt;.05</b>

Total # of words: USA=1130; Japan: 1176

**Table 3. Category Frequency Counts**

## 5. Discussions

In this study, we have found that when presented with a visual stimulus, Easterners and Westerners not only mention different words but also provide associations in different categories, indicating focus variation in cross-cultural object assessments. While relation and group categories were significantly higher in Japanese associations as a reflection of the collectivistic culture, shape, state, and substance stood out in the North American sample, perhaps because of a special focus on object characteristics instead of relationships between objects and the environment. This variation in word associations provides empirical evidence of the direct influence of culture on cognitive procedure – visual focus, to be more specific – and suggests that culture can predict triviality or importance of object characteristics.

As expected, the answers of Eastern subjects contained “group”, “relationship”, “person”, “body”, and “quantity” related words more frequently compared with Western subjects who focused mostly on “substance”, “shape”, and “plant”. These results perfectly match Dr. Nisbett’s propositions that North Americans are less field-dependent and less likely to pay attention to relationships between objects and environment. While the Japanese subjects tended to think about flocks and groups, most of the North American subjects evaluated the animals in terms of their shapes, substance, color, and so on. Additionally, Japanese associations had more “quantity” related words, since quantity is also a group related category and included “person” and “body”. This might have occurred because of common mythical stories about animals that are common in East Asian culture. Lastly, the higher frequency for “plant” in the American sample might be because of the lower population density in North America, compared with mostly city-dwelling Japanese subjects. Japanese are likely to see most of the animals only in the zoo, while American subjects can spot them in their natural habitat.

Although the major purpose of this study was to provide empirical evidence for relationship focus in Asia versus object focus in North America in cognitive processes, we wanted to point out how useful WordNet and free word associations could be for social scientists when it comes to assessing cross-cultural differences. Just like latent factor analysis, WordNet noun categorization can reveal underlying patterns in subject responses, which usually go unnoticed by respondents or researchers. For instance, we believe that most of the Western subjects did not know they focused on colors and shapes of the animals and did not think deeply about how being a member of a flock impacts an animal. This only became obvious after the analysis had been completed. Similarly, subjects from different cultures can be shown the pictures of various objects, political leaders, spiritual characters, or artifacts, and with the help WordNet categorization, their answers might be better analyzed to understand how much attention is paid to internal versus external factors or implicit versus explicit features, and so on.

## 6. Limitations

As free word association can be used to tackle cross-cultural research problems, it has certain setbacks. First of all, it is a new method with limited applications. Additionally, this method requires the translation of every single word into English, and WordNet categorizes words according to pre-identified 25 groups that are perhaps influenced by North American culture. Although our results were in line with previous cross-cultural studies, we

recommend using this method with caution and call for the replication of our findings with cross-cultural comparisons of attitudes and impressions in different product categories.

Readers might also be confused with the term *cognition* and reference to animal stimuli as *objects* throughout the paper. Although animals are live organisms that are somewhat different than inanimate objects, there was no indication in the literature that the visual information processing procedure should be different for animate and inanimate objects. After all, the findings also confirmed that American subjects focused more on color and shape, compared with the Japanese subjects whose focus was on the relationship.

Besides the limitations with the method, two major issues that should be addressed in this study are the small sample size (there were only thirteen Japanese subjects and nine North American subjects) and the use of one single category (animal pictures only). The findings can only be generalized if the sample size is increased and the categories are expanded (e.g. sports, plants, etc.). Perhaps the best way to increase the sample size is using culture-mixed subjects, such as Americans who were born and raised in Japan and Japanese who were born and raised in the USA. Without these modifications, this study should be considered as exploratory.

Lastly, this study identified the cause of the perceptual differences between the two groups as culture, even though there might be some other explanations, such as language, climate, and so on. Since the major purpose of the study was to address the existence of the differences rather than pinpointing exact causes of perceptual differences, we based our findings on past research. One should also keep in mind that there might be dozens, if not hundreds, of other reasons why the subjects in our groups evaluated the stimuli differently, including individual differences (age, gender, income, mood, religion), geographic differences (climate, environment), communicative behavior (the groups might perceive the objects in the same way but just verbalize differently), etc.

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