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Money in your palm: Sharp shaped vegetation in the surroundings increase the subjective value of houses

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ABSTRACT

Preference for round over sharp shaped objects, is attributed to the potential damage of sharpness. We tested if leaf sharpness of vegetation surrounding a house, affects the evaluation of the house and its owner. We demonstrated that houses surrounded by sharp leaf vegetation (SLV) were evaluated as more expensive than houses surrounded by round leaf vegetation (RLV). Among the SLV surrounded houses, those surrounded only by palms were rated highest while SLV houses were evaluated as safer. In a final experiment, the perceptions of individual leaves differing in shape, were consistent with the protective function of sharp leaves. Our findings are explained by theorizing that SLV confer protective value on neighboring houses. The perceived higher values and safety of houses surrounded by palms is attributed to the association of palms with suitable and stable living environments. Furthermore, preference for palm habitats may have deep roots of human evolution in African savannas.

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1. Introduction

Imagine traveling along a street, watching the houses and their surrounding vegetation. Would the characteristics of this vegetation affect your estimate of the price of the houses? For example, would vegetation with spiny leaves affect your estimate differently than vegetation with round leaves? Strange as it may seem, this question stems from the richly documented phenomena and derived theories of the effects of shapes of objects on how they are perceived by humans, how are they reacted to and what is known about the link between vegetation and humans' habitat preferences.

One significant factor that has been found to affect people's preferences for living environments is the vegetation in that environment (Kaplan & Kaplan, 1982). Related theories suggest that habitat preferences coevolved with intrinsic qualities of habitats that, in turn, are reflected in the vegetation typical of these habitats (Orians & Heerwagen, 1992). Consequently, it has been suggested that people prefer vegetation that provides functional advantages, such as safety or crucial resources and vegetation that signals other adaptive advantages of the environment. These preferences may function to lead individuals away from inappropriate environments and towards more suitable ones (Kaplan, 1992). Derived from this general theory is the African savanna hypothesis, suggesting that because of the critical role that the savanna had on the evolution of modern humans, savanna-type environments should be preferred over other biomes (Orians, 1986). Indeed, there is evidence that people prefer savanna type vegetation over rain forests, or typical temperate region deciduous and coniferous forests. Much of these preferences are based on the form of the vegetation, that is, figural characteristics of vegetation typical of the preferred biome (Falk & Balling, 2009). Characteristics such as overall size, canopy size and trunk height were shown to affect these preferences (Summit & Sommer, 1999). Even though people prefer savanna-type vegetation within the boundaries of this preference, there is an even higher preference for high quality over low quality savanna habitats. In this case, too, an important factor distinguishing between the two is the figural properties of the vegetation. Specifically, participants from three countries (the USA, Argentina and

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Australia) rated as most attractive trees with a modestly dense canopy and a trunk that bifurcates low to the ground (Orians & Heerwagen, 1992). Given the evolutionary roots and functions of vegetation preferences, these extend to the environment more generally. For example, it has been shown that such aspects as the perceived value of houses or the perceived quality of neighborhoods is associated with the types of vegetation surrounding it (e.g., Anderson & Cordell, 1988; McGranahan, 2008; Pandit, Polyakov, Tapsuwan, & Moran, 2013).

Most studies of vegetation preferences and their impact on perception of the environment focused on overall visual characteristics such as the shape of trees or of their major parts such as canopy or trunk. However, one can theorize that finer figural characteristics of the vegetation such as the shape of leaves also determine preferences of vegetation types or associated environmental characteristic. The goal of the present research is to examine this theory by testing the effect that the shape of leaves has on perceptions of houses and their owners. We first explain what informs this theory and then report the results of seven experiments testing it.

Humans commonly prefer curved visual stimuli over angular stimuli, a preference that may be already observed among toddlers (Jadva, Hines, & Golombok, 2010). Indeed, research on the physiognomic properties of perceptual stimuli points to the tendency to evaluate angular lines more negatively and consider them more threatening compared with curved lines (Aronoff, Barclay, & Stevenson, 1988; Aronoff, Woike, & Hyman, 1992; Bar & Neta, 2006; Uher, 1991). Accordingly, people associate round shapes with peacefulness and angular shapes, such as spikes, with anger and aggression (Lindauer, 1990; Stefanowitsch, 2006). Uher (1991) related sharp edges to antagonism, noting that eyes and zigzag motifs convey a "bite threat" in many cultures. Also, Bar and Neta (2007) showed that exposure to sharp visual stimuli increased activity in the amygdala, the brain's fear center, congruent with a reaction to an aversive stimuli (LeDoux, 2000) and social threat (Phelps et al., 2000) and unlike the effects of round stimuli.

Coss (2003) demonstrated that pedestrians avoid plants that have "rapier-like" leaves. Relatedly, Ford et al. (2014) found that in the African savanna, areas typified by vegetation with thorns are associated with lower risk of predation compared with areas typified by less thorny vegetation. This was reflected by the preference of African ungulate impala (*Aepyceros melampus*) to aggregate in areas with thorny vegetation and the lower rate of encounters with predators and actual kills. In the same African environments, herders build shelters for their livestock made of thorny plants, the Maasai bomas, to defend them from large carnivores such as lions and leopards (Ogada, Woodroffe, Oguge, & Frank, 2003; Western & Dunne, 1979).

Theory and related findings suggests that one clear function of thorns, spines and prickles, as well as sharp and cutting leaf edges on plants is to act as anti-herbivore defenses (Grubb, 1992). It has been recently shown that this function is augmented by an array of pathogenic bacteria and fungi. Injuries caused by sharp plant appendages often results in septic inflammation that may reach life threatening injuries in animals and in humans (Halpern, Raats, & Lev-Yadun, 2007). Moreover, spines, thorns and prickles in animals and in plants are frequently made conspicuous by color, indicating aposematism (warning coloration) (Inbar & Lev-Yadun, 2005; Lev-Yadun, 2001, 2003, 2009). This suggests that approaching such leaves involves danger, explaining why the figural characteristics of leaves determine the way they are perceived.

Here we theorize that the figural characteristics of leaves, specifically leaf shape, affect not only the way leaves are perceived but also judgments of other objects in their environment , for example, houses. It is possible to think of two contradictory hypotheses: a house surrounded by sharp leaf vegetation (SLV) will be evaluated less positively compared with a house surrounded by round leaf vegetation (RLV). This is because the negative characteristics associated with sharp shapes are extended to the objects in their vicinity. Alternatively, a house surrounded by SLV, will be evaluated more positively compared with RLV, because the characteristics associated with sharp shapes confer protection to both the house and its owner.

We here report the results of 6 experiments in which, participants were presented with photographs of houses and various combinations of their surrounding vegetation (SLV or RLV) and were asked to evaluate the houses and their owners. An additional experiment tested the connotations of the two leaf shapes to examine more directly the extent to which the effects of the two types of vegetation tested in our experiments can be attributed to the shape of the leaves as we suggested.

2. Experiment 1

The aim of this experiment was to determine how a house, its safety and its owner (imaginary) are perceived when surrounded by SLV (e.g., palms) compared to RLV (i.e., broad, round shaped leaves).

2.1. Method

2.1.1. Participants

A total of 114 (68 men, 46 women) participants with a mean age of 35 years ($SD = 11.44$) were recruited through Amazon MTurk with the restriction that they are residents of the United States or Canada. MTurk is an online web-based platform operated by Amazon for recruiting and paying participants to perform tasks such as answering on-line questionnaires.

2.1.2. Procedure

Using INQUISIT Millisecond software package (Inquisit 4 Web), each participant was presented with one of four color photographs depicting the front part of a house viewed through its courtyard. Using Adobe Photoshop software, each house was placed in one of two types of front gardens differing in the shape of the plants' leaves: one garden comprised of plants with SLV and the other with RLV. Because differences between the types of plant resulted in different levels of overall luminosity, we used two versions of each photograph, each matched to the level of the original luminosity of one of the photographs (see Fig. 1a and b for an example). Luminosity level was measured by the mean luminosity function of the histogram window in Photoshop. Level of mean luminosity was adjusted by changing the level of brightness of the photographs until the level of mean luminosity matched. This resulted in a 2 (leaf shape: sharp vs. round) x 2 (luminosity level: high vs. low) between−subjects factorial design. Participants were informed that they are about to view a photograph of house in a new neighborhood in a small town in southern Florida and that they are requested to rate aspects of the house, the owner and the environment. Information about the location of the house was provided to minimize the possibility that the surrounding plants will serve as a cue of the geographical location of the house and hence affect the participants' judgments. Rating scales were presented, each on a separate page with the photograph above it.

2.1.3. Dependent measures

(I) The participants were asked to rate the followings, on a scale between 0 − "not at all" to 6 − "to a large extent": (1) the chances that they will be interested in purchasing the house if they could afford it, (2) the friendliness of neighborhood, (3) the safety of the

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