Appl. Sci. **2011**, *1*, 1-11; doi:10.3390/as1010001

OPEN ACCESS

applied sciences

ISSN 2076-3417

www.mdpi.com/journal/applsci

Article

Objective Measures of Emotion During Virtual Walks through Urban Environments

Moritz Geiser [1] and Peter Walla [1,2,3,*]

[1] Biological Psychology Unit, Faculty of Psychology, University of Vienna, Liebiggasse 5, A-1010, Vienna, Austria; E-Mail: moritzgeiser@hotmail.de

[2] School of Psychology, Faculty of Science and Information Technology, University of Newcastle, Newcastle, 2308 NSW, Australia

[3] Applied Neuroscience, Neuroconsult, Günthergasse 3/3, A-10190 Vienna, Austria

* Author to whom correspondence should be addressed; E-Mail: peter.walla@newcastle.edu.au; Tel.: +61-2-492-172-60.

Received: 4 May 2011; in revised form: 1 June 2011 / Accepted: 1 June 2011 / Published: 1 July 2011

Abstract: Previous studies were able to demonstrate different verbally stated affective responses to environments. In the present study we used objective measures of emotion. We examined startle reflex modulation as well as changes in heart rate and skin conductance while subjects virtually walked through six different areas of urban Paris using the StreetView tool of Google maps. Unknown to the subjects, these areas were selected based on their median real estate prices. First, we found that price highly correlated with subjective rating of pleasantness. In addition, relative startle amplitude differed significantly between the area with lowest versus highest median real estate price while no differences in heart rate and skin conductance were found across conditions. We conclude that interaction with environmental scenes does elicit emotional responses which can be objectively measured and quantified. Environments activate motivational and emotional brain circuits, which is in line with the notion of an evolutionary developed system of environmental preference. Results are discussed in the frame of environmental psychology and aesthetics.

Keywords: startle reflex modulation; urban environments; emotion and motivation; affective appraisal; environmental preference

---

1. Introduction

Why do we prefer some environments, built and natural, over others? Why do we respond with certain emotions to places, even if we do not have any prior experience with them? Some scholars attributed aesthetic responses to environments solely to learning experiences [1]. Accumulating evidence from environmental psychology and aesthetics though suggests an evolutionary interpretation of preference. The finding that young children prefer depictions of savannah landscapes was interpreted as evidence for a phylogenetically developed system of preference [2]. Appleton's Prospect and Refuge theory [3] is another strand of evidence suggesting that places offering an overview of the landscape as well as a site from which one can see without being seen would be preferred which has been validated empirically to some degree [4-6]. Kaplan *et al*. [7] studied preference for different environmental scenes and finally postulated four predictor variables, namely mystery, complexity, coherence and legibility to account for preference judgments [8,9]. According to their theoretical framework those variables can be understood in terms of information gathering. Scenes high in mystery and complexity both promise a gain in information while coherence and legibility assures its comprehension. They link this information processing approach to an evolutionary perspective of preference by stating that human survival depends on constantly updating ones cognitive maps of the environment which would be served by a natural preference for places that offer new information while enabling its easy comprehension. With respect to the roles of cognition and affect in creating preferences they claim that automatic cognitive processes such as the identification of content and the extraction of potential informational gains would integrate into an affective code resulting in avoidance or approach behavior. This sort of automatic habitat selection seems reasonable to be innate to some degree; after all, it is not unprecedented in humans as many animals show this innate pattern of habitat selection [10].

Russell and collaborators [11-15] investigated affective responses to environments and showed that affective appraisal of environments could reliably be reduced to the two dimensions valence and arousal by factor-analyzing subjects' ratings of landscapes on bipolar adjective pairs. The valence dimension of affect has been conceptualized as a behavioral tendency ranging from approach/appetitive to withdrawal/defense thus fitting neatly with Kaplan and Kaplan *et al*. [7-9] who proposed a role of affect in guiding interaction with the environment. Affect was in these studies defined as "emotion expressed in language" [13]. By definition, verbally reported affective appraisal could occur with no inner emotional feeling [16]. It has also been pointed out that subjects could rate a set of landscape depictions as being differently pleasant while the ongoing emotional state during this task could be steady boredom [16]. Most scholars agree that emotions consist of several components usually termed behavioral, physiological and mental which do not necessarily covary. Behavioral and language dimensions of arousal and valence are presumed to be roughly coupled [17].

Opposed to verbal measures of emotion, psychophysiological approaches to environmental psychology have been an exception thus far. A number of studies used indicators of autonomic arousal to study the effects of environmental stressors or the restorative qualities of places [18-20]. No reported study employed the startle modulation paradigm to study affective evaluation of environments. The present study examines if environmental scenes can alter not only verbally reported emotion, but also its physiological components by measuring the modulation of the eye-blink component of the

startle reflex. Our expectation was that an attractive environment results in a reduction of the startle reflex whereas an unattractive environment enhances it. Furthermore, we recorded ongoing changes in skin conductance level (SCL) and heart rate (HR) to define states of arousal related while being exposed to different environments. Lang and associates [21-23] extensively demonstrated the modulation of the startle reflex to a sudden acoustic probe (white noise delivered through headphones) by ongoing emotional states. Emotional states have mostly been elicited using pictures as lead stimuli [22] although some studies demonstrated startle reflex modulation using more complex stimuli such as music [24], film-clips [25], odors [26] and food [27]. Pleasant states diminish the startle response while it is enhanced in an aversive state. According to Lang and colleagues [22] emotions are organized around the two strategic dimensions valence and arousal. Internal and environmental stimuli induce an affective state along these dimensions which guides subsequent behavior within a particular environment by priming according reflexes. More concretely, this implies that a place that makes us feel uneasy would automatically enhance defensive reflexes such as startle or flight in response to sudden stimuli while a place that makes us feel comfortable and safe would foster an appetitive behavioral repertoire including procreation and nurturance while the exact reason for this emotion might be outside awareness which seems in accordance with subjective experience. The present study makes use of the StreetView tool of Google Maps, an interactive internet mapping service. StreetView is a novel feature of Google Maps which allows for 360 °panoramic views on the street level. Subjects can look around at whatever they are interested in by making use of the 360 °panoramic feature thus allowing for an experience more alike being at the actual place than photographs or VR models could.

Furthermore, we draw on an external criterion–the median real estate price of a given urban area–as an indicator of valence. Average real estate price is thought to be influenced in part by the affective evaluation of a neighborhood by the city's inhabitants. The exact mechanisms determining a neighborhood's real estate price are certainly more complex, involving aesthetic, social, infrastructural and other variables. Nevertheless, these variables might be partially accessible through StreetView, as subjects can not only view physical features like building exteriors but also environmental aspects such as signs of deterioration, the type of people present in the scene *etc*. which might serve as indicators for latent social and infrastructural characteristics. Thus we hypothesize that the more expensive areas do not only cause higher ratings of pleasantness but also an attenuated startle reactivity as indicated by the eye-blink EMG.

2. Method

2.1. Study Participants

The initial sample consisted of 20 volunteers, all university students, 8 men and 12 women aged from 17 to 28 years (mean age = 22.15, SD = 2.39). They were all right handed and had normal or corrected to normal vision. None had any neuropathological history. None of them reported any obvious conscious experiences related to the districts from Paris that were used in our experiment as urban environments. Four subjects' recordings were completely distorted by artifacts. They were excluded from further analysis.

2.2. Lead Stimuli (Urban Environments)

Because real estate prices related to well defined urban districts were freely available on the internet, Paris was chosen as a representative of an urban environment. The city's chamber of notaries publishes median real estate prices per m^2 for all quarties (sub-units within districts) of Paris, based on sells in the previous trimester [28]. We selected the following six quarties: *Charonne* in the 20th district (median real estate price: Euro 4,750 per m^2), *Porte Saint-Denis* (10th district; Euro 5,650), *Croulebarbe* (13th district; Euro 7,040), *La Muette* (16th district; Euro 7,600), *Notre-Dames-des-Champs* (6th district; Euro 9,000) and *St.-Thomas-d'Aquin* (7th district; Euro 12,090). All selected routes contained small streets with 1 or 2 lanes and showed daytime scenes only. They were created through random selection of three points in a given area which were connected with the Google maps route finder tool (Google Inc.) and subsequently modified until the abovementioned properties were as close to being equal in all conditions as possible. Areas with average real estate prices ranging from very low to very high were selected. The median real estate prices used in this study are derived from numbers issued in the second trimester 2009 on the Paris chamber of notaries' homepage. The currently available figures for the first trimester 2010 have changed marginally not affecting their ordinal arrangement. As real estate price is treated as an ordinal variable in this study these minor fluctuations can be ignored.

2.3. Startle Response Measurement

Startle probes were 50 ms bursts of acoustic white noise with 105 db sound pressure level delivered binaurally via professional head phones covering the ears to ensure maximum and clear stimulation. Sound pressure level was measured with a mobile measuring device (produced by Voltcraft). To achieve the respective loudness a commercial headphone pre amplifier was used (Behringer; MicroAMP HA400). Six different audio tracks were created in which five startle probes occurring after the baseline probe at 15 seconds were presented at varying intervals with a minimum inter-stimulus-interval of 40 seconds. All physiological measurements were carried out with a NeXus-10 mobile and wireless recording device (Mind Media BV). Electromyography (EMG) to record eye-blink-related potential changes of the musculus orbicularis oculi of the left eye was conducted by using self-adhesive and pregelled electrodes which were placed about 1 cm below the middle of the lower eyelid and 1 cm below the outer corner of the left eye. We used a dual channel electrode cable with carbon coating and active shielding technology for low noise and an additional ground electrode cable. The ground electrode was placed on the right cheek. EMG sampling rate was 2,048 per second. A band pass filter from 20 Hz to 500 Hz was applied during online recording. Raw EMG data were then recalculated by using the root mean square (RMS) method to transform EMG signals into amplitudes. The resulting amplitudes were then subject to statistical analysis.

2.4. Skin Conductance and Heart Rate

Skin conductance (SC) was recorded at a rate of 32 samples/s with a NeXus-10-SC/GSR sensor (Two finger sensor) connected to the NeXus-10 recording system with a 24 bit resolution which is able

to register changes of less than 0.0001 microsiemens. We attached one sensor to the middle finger and the other sensor to the ring finger of the left hand.

Heart rate was calculated from the raw blood volume pulse signal recorded at a rate of 32 samples/s with a NeXus-10-Blood Volume Pulse sensor. This sensor works with near infrared light, a method known as photoplethysmography. It was also connected to the NeXus-10 recording system and attached to the left index finger.

2.5. Procedure

Study participants were seated on a comfortable chair and viewed a computer monitor which was positioned about 0.5 m in front of them. They were instructed to navigate along six fixed routes through Paris as indicated by a blue line by using a computer mouse. All routes were equated by the experimenters in terms of length, (0.7 km) street size (only streets with one or two lanes), time of day (only scenes in bright daylight) and weather conditions. All routes showed moderately cloudy scenes as well as equated number of scenes in sunlight per condition. This was due to StreetView joining together different photographs of the same geographical place. Subjects were instructed not to deviate from the drawn course and to move along in a continuous manner trying to reach the end point of the 0.7 km route and to move back along the same route if they reached the end. During the trial phase subjects were explained the approximate pace at which to navigate along the route in order to reach the end within five minutes. All subjects managed to walk through most of the tour. Some reached the destination before the end of the five minutes period and subsequently moved back along the same route as instructed. In order to encourage subjects to process the visual scenery actively, they were instructed to imagine: “you just moved to this city for job-related reasons and you were assigned to an accommodation in that area of town!” “Explore your new neighborhood by following the drawn route and try to get as accurate an impression of the area as possible”. “Feel free to examine sites more thoroughly if they spark your interest but try to keep moving along the track continuously so you manage to reach the end of each tour.” During the trial phase subjects were also presented with a single startle probe to demonstrate startle stimulation. Prior to each tour, baseline startle reactivity was measured without lead stimulation. Then, subjects were instructed to begin their virtual walk. The six routes were then followed for 5 minutes each in randomized and counterbalanced order. For each route, apart from the baseline startle probe, five further probes were presented with inter-stimulus intervals ranging from 40 s to 70 s.

Immediately after walking each virtual tour, subjects rated the observed scene on the dimensions pleasure and arousal using a computer-assisted version of the Self-Assessment-Mannequin [21] consisting of a pictorial 9-point scale. In addition, subjects evaluated scenes on a 28 item questionnaire adopted, slightly modified and translated into German from a previous study [29]. After testing subjects were asked, if they had any prior experience with the areas they had just seen. None of the subjects reported having recognized any of them.

2.6. Analysis

2.6.1. Data pre-Processing

Raw EMG signals from the orbicularis oculi were filtered, rectified and computed into amplitudes by the Root-Mean-Square-method by the software package BioTrace+ provided by Mind Media BV. Through visual inspection only single amplitudes clearly occurring between about 100 ms and 200 ms post-startle probe were selected for further analysis. If several peaks occurred, if the EMG signal was distorted by activity with an onset prior to the startle probe or if a response was non-existent altogether, no startle amplitude was calculated. This procedure resulted in a total of 0.007% of missing values. The amount of startle reflex modulation was calculated by dividing the mean of the five startle amplitudes elicited during lead stimulus presentation (virtual walks) by the baseline amplitude of the corresponding condition.

SC and HR were also analyzed by using the BioTrace+ software. For both HR and SC the first 15 seconds of each trial (*i.e.*, before presentation of the baseline startle probe) were analyzed and mean HR or SC was extracted for this period and subsequently treated as the baseline for the respective condition. Then mean HR and SC was calculated for the period 30 seconds–5 minutes, representing the average HR and SC during lead stimulation. Analogue to the startle data, the SC and HR values during lead stimulation were then divided by the baseline, resulting in a percentage of change in autonomic arousal induced by each condition. It is important to mention that 5 startle probes were presented during these periods. Of course, these startle probes had an effect on both HR and SC. However, this effect is considered consistent across our conditions because in all of them 5 startle probes were presented.

2.6.2. Statistical Analysis

Physiological Data

The data from all three physiological measures (startle modification, SC, HR) were subjected to repeated measures ANOVAs with AREA (different urban environments) as within-subject factor. Other than most studies on startle modification, the present study does not use unambiguously positive, neutral and negative valence material as lead stimuli. Instead, the hypothesized affective tone of the different areas varies only gradually. Thus, in addition to the ANOVA, a rank correlation between real estate price and the respective amount of startle modulation averaged across all participants (MEANSTARTLE) was calculated. Rank correlation was used instead of Pearson correlation because real estate price (PRICE) was not considered to be interval scaled.

Behavioral Data

The SAM ratings of valence and arousal were subjected to repeated measures ANOVAs with AREA as the within-subject factor. Higher ratings are indicative of more positive valence and more arousal. Parallel to the startle data, the SAM ratings of valence (averaged across all participants, SAMVALENCE) were rank correlated with real estate price. Finally, verbally reported valence

was rank correlated with MEANSTARTLE. Greenhouse-Geisser corrected p-values are reported where indicated.

3. Results

3.1. Physiological Data

3.1.1. Startle Modulation

The main effect of AREA on startle modulation was not significant, $F(5.75) = 1.33$; n.s. partial $eta^2 = 0.082$. However, simple contrasts performed on the six conditions using the highest price category as baseline reached significance for the comparison highest versus the lowest price category [$F(1.15) = 5.63$; $p < 0.05$] partial $eta^2 = 0.27$. None of the other comparisons approached significance. Correlation between MEANSTARTLE and real estate price (PRICE) revealed a strong linear relationship (-0.771; $p < 0.05$).

3.1.2. Autonomic Arousal

The main effects of AREA on SC [$F(5.85) = 1.082$, n.s]. and HR [$F(5.85) = 1.739$ n.s.] were not significant. Thus, indicators of autonomic arousal were not systematically affected by any area.

3.2. Behavioral Data

Paralleling the physiological results, the main effect of AREA on verbally stated arousal (SAMAROUSAL) was not significant, $F(5.95) = 0.762$; n.s. The main effect for verbally stated valence (SAMVALENCE) though was significant, $F(5.95) = 5.664$; $p < 0.001$ partial $eta^2 = 0.23$. Polynomial contrasts showed a significant linear component when the conditions were arranged in ascending order with respect to their price, $F(1.19) = 35.18$; $p < 0.0001$, partial $eta^2 = 0.649$. Correlation between SAMVALENCE and PRICE were even higher than between MEANSTARTLE and PRICE, 0.941; $p < 0.01$.

Correlation between MEANSTARTLE and SAMVALENCE was moderately high but not significant (0.698; n.s.). All reported p-values of correlations are one-tailed.

4. Discussion

The present study demonstrated verbally reported and physiological emotional responses to virtual walks through six urban environments varying in median real estate price. Regarding objective startle reflex measures the contrast highest *versus* lowest price category representing the conditions with the hypothesized maximum difference in affective valence revealed a strong effect and reached significance. Startle data correlated significantly with real estate price, which was in turn significantly correlated with ratings of valence, suggesting that real estate price was indeed a valid approximation of the affective quality of the presented areas. Simultaneous recordings of heart rate and skin conductance revealed no significant findings with respect to influences of different urban environments on these measures. It can be concluded that evaluation of urban environments does indeed have a strong affective component, detectable through a basic biological and phylogenetically old mechanism. This

appears to be in line with the notion of an evolutionary developed system of preference for environments. An alternative attentional account of the startle modulation observed here cannot be completely ruled out although it seems unlikely as both verbal and physiological measures were not differentially affected by the urban areas, which might be expected had they engaged attention in different ways.

The present study thus provides support for the hypothesis of affect guiding interaction with the environment by priming reflexes and behavior which match current affective states. Two issues remain open for future investigation: Firstly, the concrete variables causing the affective response are not elucidated in this study. Several of the above mentioned theories of environmental preference could potentially explain why some urban scenes resulted in more positive effect than others. Was it a particular combination of mystery, complexity, coherence and legibility displayed by the scenery, a prevalence of prospect and refugee elements, or did our subjects infer social characteristics of the areas from certain visual cues? Possibly more than one theory can explain the observed differences in affective responses, leaving open the question to which degree they contributed respectively.

Figure 1. Mean relative startle amplitudes for all six areas with different median real estate prices per m^2. All means are calculated relative to their corresponding baselines. The lowest startle amplitude in the highest price condition differs significantly from the highest startle amplitude in the lowest price condition. This reflects the most positive emotional and motivational state while walking through the most expensive urban environment. Note that the second most expensive urban environment is associated with a higher startle amplitude than two cheaper urban environments.

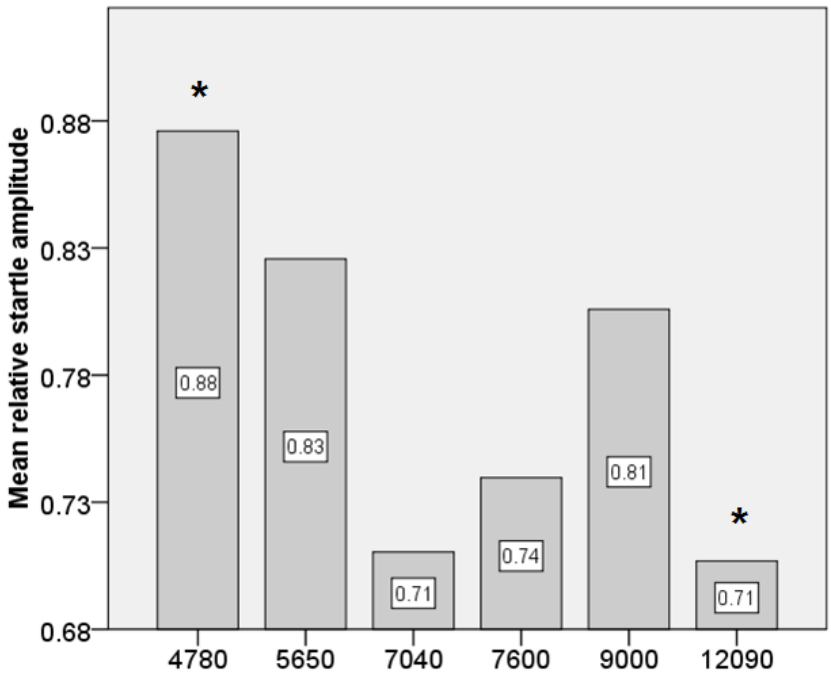
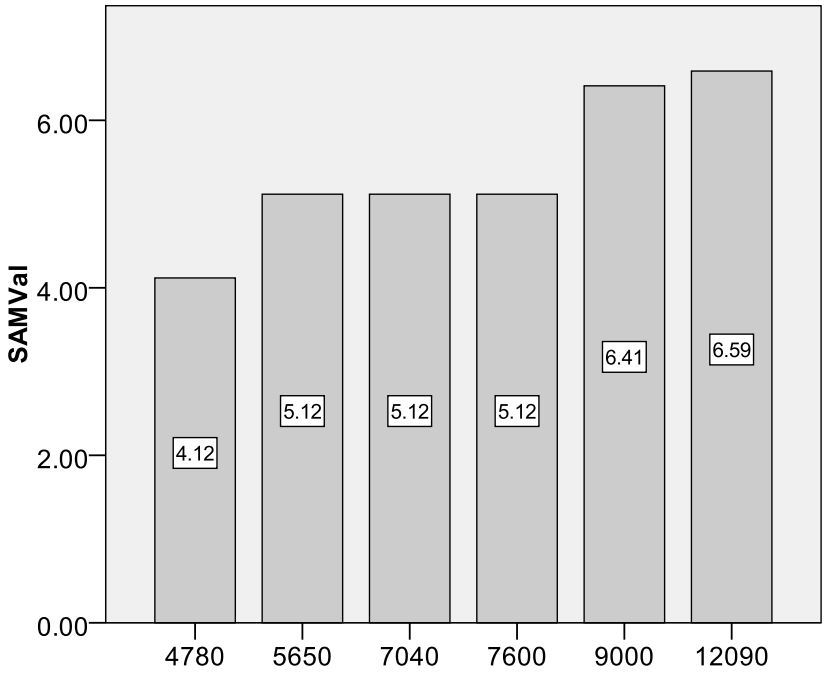


Figure 2. Subjective rating of pleasantness related to the six urban environments. Note, the higher the price the higher the subjective preference.



Secondly, it remains unclear whether the variables influencing verbally stated affective appraisal are the same as those determining changes in physiological state. Albeit verbal and physiological measures were roughly correlated in this study they actually could have been evoked by different sets of stimulus properties which incidentally co-occurred within any area. For instance, variables concerned with the informational content could have been effective in producing verbally reported liking while the perceived danger of being attacked inferred through the analysis of the social makeup could have mainly contributed to the alteration in physiology. In fact, the second highest real estate price area (area five) highlights potential differences between subjective rating and objective startle response (see Figures 1 and 2). While it was rated to be the second most pleasant area, startle modulation indicated that it evoked less positive affect than the much cheaper areas three and four (this pattern is identical for males and females suggesting that it is not caused by outliers or incidental fluctuations in the startle data). One explanation for this irregularity might be that area five is centrally located, while areas three and four lie rather in the periphery. The high real estate price of area four might thus be due to infrastructural variables which could have caused the positive verbal rating while leaving startle reflex modulation unaffected, possibly because thorough cognitive analysis of the scene is a prerequisite for their appreciation.

Interestingly, a recent startle reflex modulation study about degree of anger displayed in facial expressions revealed a similar non-linear relationship between facial expression intensity and startle reflex modulation [30]. Although in their study, self reported degree of anger in facial expressions gradually increased with true increasing anger in facial expressions, eye blink amplitudes actually matched this pattern only for the neutral and the 100% angry facial expression. Our results show a strikingly similar pattern. Final interpretations are difficult, especially with facial expressions, because they mean communicating an emotion rather than actually eliciting one.

As far as we know, the StreetView tool (Google Inc.) has not been deployed in experimental psychological research to date. Compared to photographic or virtual stimulus material it can provide experimental subjects in the laboratory setting with an experience similar to being at an actual place without having to actually take them there. Subjects' responses can then be related to demographic data such as crime statistics, social characteristics of the area's inhabitants or real estate price as done in the present study.

In terms of a better understanding of emotion as such, our study may be seen as highlighting possible discrepancies between basic unconscious emotion and subjective preference.

References

1. Lyons, E. Demographic correlates of landscape preference. *Environ. Behav.* **1983**, *15*, 487-511.
2. Balling, J.D.; Falk, J.H. Development of visual preference for natural environments. *Environ. Behav.* **1982**, *14*, 5-28.
3. Appleton, J. *The Experience of Landscape*; John Wiley: London, UK, 1975.
4. Stamps, A.E. Some findings on prospect and refuge: I. *Percept. Motor Skills* **2008**, *106*, 147-162.
5. Stamps, A.E. Some findings on prospect and refugee theory: II. *Percept. Motor Skills* **2008**, *107*, 141-158.
6. Woodcock, D.M. A Functionalist Approach to Environmental Preference. Ph.D. Dissertation, University of Michigan, Ann Arbor, MI, USA, 1982.
7. Kaplan, S.; Kaplan, R.; Wendt, J.S. Rated preference and complexity for natural and urban visual material. *Percept. Psychophys.* **1972**, *12*, 354-356.
8. Kaplan, R. The analysis of perception via preference—A strategy for studying how the environment is experienced. *Landsc. Plann.* **1985**, *12*, 161-176.
9. Kaplan, S. Aesthetics, affect, and cognition - environmental preference from an evolutionary perspective. *Environ. Behav.* **1987**, *19*, 3-32.
10. Ruso, B.; Renninger, L.; Atzwanger, K. Human habitat preferences: A generative territory for evolutionary aesthetics research. In *Evolutionary Aesthetics*; Voland, E., Grammer, K., Eds.; Springer-Verlag: Berlin, Germany, 2003; pp. 279-294.
11. Russell, J.A. A circumplex model of affect. *J. Perso. Soc. Psychol.* **1980**, *39*, 1161-1178.
12. Russell, J.A.; Mehrabian, A. Approach-avoidance and affiliation as functions of emotion-eliciting quality of an environment. *Environ. Behav.* **1978**, *10*, 355-387.
13. Russell, J.A.; Pratt, G. Description of the affective quality attributed to environments. *J. Perso. Soc. Psychol.* **1980**, *38*, 311-322.
14. Russell, J.A.; Ward, L.M.; Pratt, G. Affective quality attributed to environments—A factor analytic study. *Environ. Behav.* **1981**, *13*, 259-288.
15. Snodgrass, J.; Russell, J.A.; Ward, L.M. Planning, mood, and place-liking. *J. Environ. Psychol.* **1988**, *8*, 209-222.
16. Russell, J.A.; Snodgrass, J. Emotion and the environment. In *Handbook of Environmental Psychology*; Stokols, D., Altman, I., Eds.; Wiley: New York, NY, USA, 1987; pp. 245-281.
17. Lang, P.J.; Bradley, M.M.; Cuthbert, B.N. Emotion, attention, and the startle reflex. *Psychol. Rev.* **1990**, *97*, 377-395.

18. de Kort, Y.A.W.; Meijnders, A.L.; Sponselee, A.A.G.; Ijsselsteijn, W.A. What's wrong with virtual trees? Restoring from stress in a mediated environment. *J. Environ. Psychol.* **2006**, *26*, 309-320.
19. Hartig, T.; Evans, G.W.; Jamner, L.D.; Davis, D.S.; Garling, T. Tracking restoration in natural and urban field settings. *J. Environ. Psychol.* **2003**, *23*, 109-123.
20. Ulrich, R.S. Natural *versus* urban scenes—Some psychophysiological effects. *Environ. Behav.* **1981**, *13*, 523-556.
21. Bradley, M.M.; Lang, P.J. Measuring emotion—The self-assessment mannequin and the semantic differential. *J. Behav. Ther. Exp. Psychiatry* **1994**, *25*, 49-59.
22. Lang, P.J. The emotion probe—Studies of motivation and attention. *Am. Psychol.* **1995**, *50*, 372-385.
23. Vrana, S.R.; Spence, E.L.; Lang, P.J. The startle probe response—A new measure of emotion. *J. Abnorm. Psychol.* **1988**, *97*, 487-491.
24. Roy, M., Mailhot; J.P., Gosselin, N.; Paquette, S.; Peretz, I. Modulation of the startle reflex by pleasant and unpleasant music. *Int. J. Psychophysiol.* **2009**, *71*, 37-42.
25. Kaviani, H., Gray, J.A.; Checkley, S.A.; Kumari, V.; Wilson, G.D. Modulation of the acoustic startle reflex by emotionally-toned film-clips. *Int. J. Psychophysiol.* **1999**, *32*, 47-54.
26. Kaviani, H.; Wilson, G.D.; Checkley, S.A.; Kumari, V.; Gray, J.A. Modulation of the human acoustic startle reflex by pleasant and unpleasant odors. *J. Psychophysiol.* **1998**, *12*, 353-361.
27. Walla, P.; Richter, M.; Färber, S.; Leodolter, U.; Bauer, H. Food evoked changes in humans: Startle response modulation and event-related potentials (ERPs). *J. Psychophysiol.* **2010**, *24*, 25-32.
28. Chambre des Notaires de Paris. Le marché immobilier en Ile de France. Available online: http://www.paris.notaires.fr/prix/info_prix.php (accessed on 5 April 2009).
29. Hanyu, K. Visual properties and affective appraisals in residential areas in daylight. *J. Environ. Psychol.* **2000**, *20*, 273-284.
30. Dunning, J.P.; Auriemmo, A.; Castille, C.; Hajcak, G. In the face of anger: Startle modulation to graded facial expressions. *Psychophysiology* **2010**, *47*, 874-878.