PHYSIOLOGICAL REACTIONS TO UNCANNY STIMULI: SUBSTANTIANTION OF SELF-ASSESSMENT AND INDIVIDUAL PERCEPTION IN USER ENJOYMENT AND COMFORT

by

TATIANA BALLION
B.S. University of Central Florida, 1998
M.A., University of Central Florida, 2004

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Major Professor: Valerie Sims

ABSTRACT

There is abundant anecdotal evidence substantiating Mori's initial observation of the "uncanny valley", a point at which human response to non-human entities drops sharply with respect to comfort (Mori, 1970), and the construct itself has a long-standing history in both Robotics and Psychology. Currently, many fields such as design, training, entertainment, and education make use of heuristic approaches to accommodate the anticipated needs of the user/consumer/audience in certain important aspects. This is due to the lack of empirical substantiation or, in some cases, the impossibility of rigorous quantification; one such area is with respect to the user's experience of uncanniness, a feeling of "eeriness" or "wrongness" when interacting with artefacts or environments. Uncanniness, however, continues to be defined and measured in a largely subjective way, and often after the fact; an experience or product's uncanny features are pointed out after the item has been markedly avoided or complained about by the general public. These studies are among the first seeking to determine a constellation of personality traits and physiological responses that incline the user to have a more frequent or profound "uncanny" reaction when presented with stimuli meeting the criteria for a level of "eeriness". In study 1, 395 adults were asked to categorize 200 images as uncanny, neutral, pleasant, or other. In Study 2, physiological and eye-tracking data was collected from twenty two adults as they viewed uncanny, neutral and pleasant images culled from study 1. This research identifies components of the uncanny valley related to subjective assessment, personality factors (using the HEXACO and Anthropomorphic Tendencies Scale), and biophysical measures, and found that traits unique to Emotionality on the HEXACO inventory, compounded with a form of anthropomorphism demonstrates a level of relationship to the subjective experience of uncanny stimuli. There is evidence that HEXACO type and forms of anthropomorphic perception mediates the biophysical

expression and the subjective perception of the stimuli. In keeping with psychological hypotheses, stimuli to which the participants had greatest response centered on death, the threat of death, or mismatched/absent facial features.

This is dedicated to my mother.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS/ABBREVIATIONS

ATS	Anthropomorphic Tendencies Scale
BPS	Beats per second
CGI	Computer Generated Imagery
CONELRAD	Control of Electromagnetic Radiation
EAN	Emergency Action Network
EBS	Emergency Broadcast System
ECG	Electrocardiogram
EEG	Electroencephalogram
fMRI	Functional Magnetic Resonance Imaging
Hz	Hertz
iGBA	Induced Gamma-Band Activity
mHz	Megahertz
PANAS	Positive and Negative Affect Schedule
SRA	Shared Representation of Action
sVx	Shared Voxels of Action, Observation, and Execution

CHAPTER ONE: INTRODUCTION

In 1970, roboticist Masahiro Mori framed human affect in terms of a linear progression towards familiarity with one important aspect: at a certain point, user affect sharply dropped into revulsion; Mori described this drop as the Uncanny Valley. In this valley, user experience has suddenly changed from acceptance, tolerance, even affection (e.g., the charming cuteness of Star Wars' R2D2) to feelings of uncanniness, such as disgust, horror, and loathing. Mori gave examples of what types of entities also call up these sorts of emotions, giving examples of zombies, corpses, and the like. From the uncanny valley, this progression of affect again rises, generating increasingly positive affect in the user, until the entity is perceived positively as human-like, or close enough to human to evoke responses similar to responses to another human's expressions of emotion and intention.

Before suggesting that the event of a stimulus falling into the "uncanny valley" is a unique, new, or independent occurrence stemming from technological developments that allow us to better simulate humanlike appearance, we must first consider that an uncanny reaction is instead an evoked response in a human-artefact interaction that is a subset of the existing emotional response sets in decision-making, social interaction, and expectancy-setting. Similarly, it is logically unsound to risk reifying the concept of an uncanny reaction into any model, theoretical or applicative, which expects to provide a modicum of predictive validity while the question of the independence of the construct remains unchallenged.

The end result of affective revulsion – the perception of "uncanniness" – cannot be extracted from the larger context in which it occurs; while there are neural substrates that can be identified

contributing with respect to theory of mind and/or inference of intentionality, these physical events operate as a result of the mental events which preceded the speculation of internal states – the mapping to a human template or human-based social schemata which set expectations that formed the basis for the predictions which may be violated. Even these mental events have a socially-driven constituent that also offers explanatory and predictive value – the anthropomorphic framing used to interpret actions, as well as the function served by the narrative environment in which the human observer frames the observed. All of these mechanisms interact with the literal and conceptual idea of embodiment, in terms of expectation(s), as well as in the sense of valid/invalid feedback from the perspective of the human perceiver; in this sense, Masahiro Mori's anecdotal observation of an Uncanny Valley is a special case of a larger phenomenon.

Template Use

Here the concept of *template* and the concept of *schema* are used as largely interchangeable terms, although the accepted understanding that schemata do possess properties not shared by templates is acknowledged (e.g., dynamic structure); the idea of personal schemata with respect to interaction in the environment (successful or unsuccessful) was established in the 60's by Aaron Beck (1991) where faulty or maladaptive schema could be re-evaluated in order to provide better functioning in personal and interpersonal relationships. Beck's focus has been on the translation, through Cognitive Therapy, of 'faulty' or negativistic schemata into healthy alternatives that allow for a more resilient base of functioning. It is implied through this transformation that there exist normal, healthy schema of interaction with the environment that are utilized in the normal course of functioning. These schemata are drawn upon as determined

by the individual to be appropriate; faced with a choice of schemata to apply, the individual will seek to instantiate the schema which appears to be most resembling of the existing situation, and therefore the schema with the highest likelihood of affording success through the correct setting of expectations and results.

At its simplest level, an individual's template or schema – interchangeable terms for the purposes of this discussion, and largely interchangeable save for nuances of meaning with reference to the property of process outside of this discussion – is an organized mental representation of the external world – a "network of meaning" (Beals, 1998) – which is essentially an internal representation of a scenario laid virtually complete, and is usually thought of as being based upon prior experiences (Vernon, 1955). The schema contains flexible, adaptive information about the world, held as a prototype of an event or event chain which can be used as a guide in new but similar (as identified subjectively) situations; in this sense, there is a relationship to metaphor in that, fundamentally, a schema serves as a symbol of a set of expectancies or flow of events (Lakoff & Johnson, 1980; Holland & Quinn, 1987). The schema has a start state and end result, with various templates affording greater adaptability than others; in the Piagetian perspective, once a schema cannot be modified to allow for new information yet still be the same 'type', a new schema must be generated to allow for this new event. In this way, the child learns that every fur-bearing, four-legged beast is not a member of the class called "dog", and generates new schemata to provide expectancies and predictability to interactions with cats, farm animals, and so on. It is clear, from the examples of Piaget and Bartlett that some of the fundamental schemata established would be those of humanness that comes with the sense of self and individuation process.

The idea of such a mental representation came at the same time as the spirit of investigation began to contain references to mentation and mental life as something which could be subjected to empirical analysis in contrast to previous reliance upon subjective introspection or elimination of the consideration of mental events. In the case of schema theory, this approach came out of formal observation and speculation with Frederic Bartlett (and Mikhail Bakhtin) (Beals, 1998) although used in a neurological setting as early as 1911 (Stein, 1992). While Bartlett (1932) saw schemata as being of different interdependent types (essentially, the feel or atmosphere and event) with respect to the systematic change in the recall of text passages over time, Piaget (1929) presented the ability to develop and modify schemata as one of the results of the child operating within their environment in the sensorimotor stage; Piaget described the schema as both a construct and a process in that the schema itself contains information, yet itself is dynamic; it is for this reason that reference to a template is viewed as a *type* of schema. However, both Bartlett and Piaget described schemata as providing value-based judgements and bearing the effects of the culture in which the individual is raised.

Beside Social Psychology, the concept of schema-driven operation has been used most notably in terms of return-to-the-norm management of clinical cases, particularly in the realm of Cognitive Therapy from the perspective of the populace; however, the concept of schema generation, selection, and management has been shown to drive an individual's perceptions, both of other people as well as situations (Stein, 1992), and the role of expectancy-setting (and the resulting schemata) are by no means restricted to any one field and, notably, it has been demonstrated that comprehension and memory for schemata-consistent material is superior to schemata-

inconsistent material, and that, as in the Bransford and Johnson's 1972 experiments where some passages of text are perceived as incomprehensible until a schema is provided.

Today, there are established, accepted constructs to the concept of schema evocation throughout the social and neurological sciences, ranging from classification of vocalizations and song (Lewis, Talkington, Walker, Spirou, Jajosky, Frum, & Brefczynski-Lewis, 2009) to the utilization of templates in an external sense as a form of mnemonic or rapid decision tree for already-understood situations, where a template for accepted axioms can be constructed with the end result of equating the skill of the novice user (of a computer system) with the skill of an expert (e.g., Hou, Musen, & Noy, 2005), thereby encouraging the connection of schemata development as a method by which the world may make more sense, faster. In this way, through mimicry of human learning in the form of template matching, technology models cognition successfully. Coming back to the human component of the interaction as the generator of schemata, it has been shown that individual templates play a role in the proficiency of the individual in developing accurate and utilable shared mental models in group settings (Huber and Lewis, 2011; Veldhyuzen and Stassen, 1977). In this way, "dynamically similar" dual-function terms (Asch, 1946; 1958), when applied to non-humans, may truly serve as a point of anchoring with respect to schema when anthropomorphic projection is taken into consideration. From this perspective, it can easily be seen that there may be applications of Implicit Personality Theory at work in human-robot interaction that resemble naïve personality theory and may be subject to a type of continuum (or vectors) of potency, evaluation, activity (in the spirit of Osgood's Semantic Differential Model; Osgood, May and Miron, 1975), and/or other constituents.

It is accepted that different classes of non-human entities evoke human-based schemata; this can be seen in phenomena as diverse as anthropomorphism and pareidolia (where the perceived pattern is human-like; for example, as a face being seen on window scale or burnt toast), and the interpretation of certain non-human objects such as robots as possessing human-like characteristics. In a study conducted by Broadbent, Lee, Stafford, Kuo, and McDonald (2011), it was shown that deviation from expected templates for a "healthcare robot" when the robot was expected by participants to be human-like resulted in both physiological changes (higher blood pressure) as well as ratings of the subsequent interaction as being more negative using the Positive and Negative Affect Schedule (PANAS) in comparison to participants who had anticipated that the healthcare robot would be less human in appearance. Participants were asked to anticipate the design of a "healthcare robot" that would be in to see them shortly; participants drew robots ranging from clearly non-human (e.g., boxy wheeled structure) to clearly human-like. Participants were then introduced to the "healthcare robot", which had both aspects – a boxy shape with a "face" that was humanoid. While Broadbent et.al. interpreted that those who elected to utilize a "human-like" schema may have perceived the box-like "healthcare robot" as more threatening, or sought – and found – confirmation in the "human-like" aspect from a "face" displayed on the robot, and therefore found it as more threatening. Another explanation lies in the possibility that the marked deviation from expectations resulted in feeling ill-at-ease and reporting an unpleasant experience because the selected schema contains class attributes which were violated by the actual appearance of the healthcare robot. With these attributes violated, the participants would then interpret the healthcare robot as being less predictable than an object or entity which was schema-conformant.

So, it is shown that humans will access human-based schemata even in the absence of cues that may indicate the advantageous selection of non-human templates, and there is left open the possibility that a selected schema, once violated, may itself be the cause of feelings of mistrust, fear, or the desire to avoid.

Human-to-Artefact Correlations

It has been established (Tettamani, Buccino, Saccuman, Gallese, Danna, Scifo, Fazio, Rizzolati, Cappa, Stefano, & Perani, 2005), that the mapping of human-like action to non-human artefacts is accomplished through the actions of the mirror neurons. Mirror neurons are located in the ventral premotor and inferior parietal cortex, these neurons respond to the motion of others (action perception) deemed like the Self, or to which Self-like motion can be attributed, as well as action execution; this has been called the Shared Representation of Action (SRA) (de Vignemont & Haggard, 2008) or Shared Voxels of Action observation and execution (sVx) (Gazzola & Keysers, 2009) commonly, among others. While initially observed in primate brains, imaging has allowed an analogous system to be demonstrated in humans in a similar area of the brain (Brodman's area 44, or Broca's Area). While in primates, this area has been shown to be more specific in what it selects for mirrored activation, in humans it has been shown that there is a broader range of selected actions and behaviours as well as less general discrimination with respect to opportunities to select candidates for mirroring (Tettamani, et.al., 2005), not limiting itself to simply and literally mirroring Self-like actions with the purpose of understanding the action being viewed (Blakemore & Decety, 2001), humans additionally evince activation when viewing non-human movement, or even listening to verbal descriptions of embodied action (Tettamani, et.al., 2005).

It has been established that the incorporation of mirror neuron activity implies a "sharedness" of movement (Grezes & Decety, 2001) which may have significant evolutionary value, both in terms of directing and interpreting one's own actions, as well as in anticipating the actions or behaviour of another individual or a group (Meltzoff, 1999; Meltzoff & Moore, 1997; Blakemore & Decety, 2001). When brought into the framework of schemata, this "sharedness" has an additional implication in terms of the schema end-state: the implication of function. This changes the form of the action assessed from simple action to action-plus-hypothesis about the intended consequence. The predictive value of the template is enhanced with each subsequent (correct) application, and evidence (as well as common cognitive biases) suggests that misapplication carries less valence than accurate application (or confirmation of the predicted outcome).

Further, although little has been done in the way of relating the role of anthropomorphism and expectations/schemata specifically to the function of the mirror neurons in a direct sense, and this remains a desirable avenue for even further investigation, with respect to the movement of non-human movement objects such as robots, it has been established that mirror neurons play a role in the action perception of robots (Gazzola, Rizzolatti, Wicker, & Keysers, 2007; Oberman, McCleery, Ramachandran, & Pineda, 2007). With the understanding that mirror neuron activity is founded on the principle of there being a sharedness between the actor and observer, this mirror neuron attribution of human-like action is then, at its heart, a form of anthropomorphic attribution, and clearly establishes that a human-like template selection may lie at the heart of subjective interpretations of behaviour as "defecting" from the expected (human-like) schema,

and in this way – and for this specific reason – being "unnatural" or "unhealthy", where it is the schema-based mapping of human movement setting the expectation for future behaviors, actions, or projected goal-states. Further, with regard to goal-state speculation, there has been no investigation as to the effects of template-matching between humans and non-humans either with regard to movement, or appearance.

Appearance alone is a notable instance of the potential for error in template selection driving a misidentification of intended goal-state, purpose, or function. From an evolutionary perspective, it can be reasoned that various features serve to assist or enhance goal-state achievement: pupils react to light; gaze fixation is a response to movement; hands grasp; legs perambulate; teeth serve the function of biting and mastication, and so forth. Based on this, it is easy to see how, for example, a lion with human teeth would be a schema violation driven by assumed template-based goal-state (carnivorous eating) and/or function (rending flesh with teeth common to carnivores). This violation requires that the observer discontinue use of the selected schema, and from that point may do any of a number of things – change the schema itself to allow for new information, change schemata completely, experience feelings of fright, dismay, excitement, anger, or any of a number of other reactions which are likely to be highly personalized and unique to the individual based upon past events, personality traits such as openness to experience, physical states (e.g., preparedness to fight), and so forth.

In Popular Culture and Environments

Instances of the uncanny in popular culture abound, and the point at which accepted – expected – occurrences deviate resulting in a feeling ranging from confusion or unreality to terror is by no

means limited to human-robot interaction.

Mori's initial hypothesis dealt solely with robotic subjects; however, once introduced, many other non-robotic examples immediately become apparent, throughout many different types of media (MacDorman and Ishiguro, 2006); even Mori's hypothesis identified denizens of the uncanny valley as being the same ilk as zombies, corpses, and prosthetic limbs, common tropes in horror movies, films, stories, and images based upon the *body horror* genre, and archetypes of the sort of "bogey man" of childhood fears and horror stories. It could be said, in fact, that the bulk of the body horror genre is reliant upon the fear and uneasiness generated when the integrity and/or function of the humanoid schema is violated, as well as the sympathetic involvement of the viewer and societal expectations for body integrity that are template-driven, and, in turn, schema generators in their own right.

Uncanny physicality (in either appearance or movement) and environmental placement (even in the form of background music) also has been used intentionally in entertainment to provoke feelings of unease, disorder, foreboding, or chaos, or to set into motion malevolent events (i.e., the motif of harmful sensation). With regard to scene music, the film *Vanilla Sky* very effectively utilises the uncanniness of a numbers station broadcast overlaid by scene music so as to be almost imperceptible at a key moment to convey disorder. Numbers station broadcasts in themselves are quite often perceived by the uninitiated listener as being uncanny, often described as scary, eerie, or "just wrong". By way of explanation, these numbers station broadcasts are clandestine broadcasts not unlike the Bransford and Johnson (1972) experiments in some respects; broadcast over shortwave radio, numbers station broadcasts are divorced from

immediate meaning to the listener, being intended to be understood by only the sender and the person(s) intended as the recipient. The numbers station messages are strings of numbers (most frequently; hence the name), letters, and occasionally whole-word use indicating that transmission has ended (e.g., *"konetz", "ende"*, etc.). The stations are often introduced by unrelated introductory music, such as *The Lincolnshire Poacher*. However, in contrast to the Bransford and Johnson experiments, it is not only immediate meaning that is removed from these transmissions; in the spirit of Bartlett's schemata divisions, there is quite often an atmospheric unnaturalness to the music and voice(s) themselves, beyond that normally encountered over shortwave radio. Many of the voices are clearly not read live; amateur enthusiasts (e.g., The Conet Project) have determined that the pronunciation of numbers is uniform throughout the broadcast – in other words, much like telephone recordings (such as those recorded by the voice actress Jane Barbe for the Bell Telephone System), the same enunciation of the numbers are used throughout the broadcast. This alone removes normal human inflection from the broadcast; it has also been found that many of the vocalizations are synthetic or highly manipulated, even to the point of being sped up or slowed down, adding the aspect of unnatural cadence or tonality with respect to the schema evoked by the expectation of hearing a human voice. Under normal listening conditions, these broadcasts are often perceived as uncanny; when added to a soundtrack, such as in *Vanilla Sky*, these numbers station broadcasts contribute this feeling of unnaturalness, eeriness…uncanniness.

Similarly, the film *Salvage* (released also under the title *Gruesome* in some countries) makes use of the unnatural movement of characters peripheral to the main scene to add to a mounting feeling of uneasiness; in one example, the main character (Claire) turns from talking with

another character. As the camera focuses on Claire's face, the background is left ablur, but the face of the character Claire had been speaking with then morphs grotesquely, displaying an enlarged mouth and eyes. Unobserved directly, this action adds to the unnaturalness of the building scene; even if this peripheral detail is directly observed by the audience, the result is an escalation in horrific anticipation, as it has been clearly conveyed that Claire's environment is uncanny – unhealthy, or "wrong".

Even the uneasiness or outright horror many feel with respect to mannequins and/or dolls (formally *pediophobia*, a form of *automatonophobia*) and the fear of animatronic (or audio-animatronic) and waxen figures – including facial reconstructions, specifically forensic facial reconstructions – have roots in the uncanny valley in that it is a fear of non-human objects with humanoid characteristics (also including *pupaphobia*, the fear of puppets). This establishes, through physical appearance, expectations for human-like interaction and then quickly violates those expectations. Conversely, examples of exaggerated human facial features (e.g., as seen with clowns – *coulrophobia*), impart information with respect to function and emotion which to many are off-putting. In a similar way, fear of masks (*maskaphobia*) may lie in aspects of the uncanny valley from a categorical perspective in that the mask is static, often has improper implied musculature with respect to the (again, implied) skeletal structure, and have an unrealistic skin texture or even pallor which is indicative of illness or death. However, just as fear of amputees (*apotemnophobia*) has, on the other side of its coin, a fetish culture (*acrotomophilia*), maskaphobia has its own fetish culture, especially visible in the fetish of "masking", "female masking" (and in some specific instances, costume play or *cosplay*): the wearing of rubber (or similar material) masks and accoutrements to give the impression of (for

example) a male being a female (in the case of female masking). What is to many off-putting – the lack of expression, or appropriate expression; the unlifelike feel of the mask (and in some cases, the whole outfit); the mismatch between speech and mouth carriage (much less tonality) becomes an object of fixation rather than repulsion. Anecdotally, from a Freudian perspective, this fixation has become the "happy event" that the un-human has come to, or approaches, life.

With respect to forensic facial reconstruction, there is a problem faced in much the same way that CGI artists attempt to establish a 'life-like' exemplar of a deceased (or non-existent, as is often the case in CGI entertainment) person. To quote Wechsler (2002):

> The face is the one area where muscles don't necessarily attach to bone: Often, muscles fold one atop the other, one into the other. Moreover, these 44 facial muscles are capable of producing some 5,000 different expressions. So for animators, a realistic human face - in motion and, what's more, emoting - damn, that was proving tough. And some, especially in the wake of Final Fantasy, the all-digital, $140 million box office bust, were beginning to ask themselves whether this particular wall was even theoretically scalable.

In the case of forensic facial reconstruction, there are many methods by which results may be achieved, and each of these methods has its own benefits and drawbacks (Wilkinson, 2004). However, some methods yield a reconstruction in which resemblance is scanty at best, or can

only be seen after identification of a body and recovery of in-life photographs. For the reconstruction itself, individual reaction may be one of uncanniness in the sense that the reconstruction does not resemble a valid human form (from a templature perspective), or is off-putting for other reasons such as unrealistic asymmetry (or, conversely, unrealistic symmetry), a blank or "dead" stare, implied musculature which is slackened as if in sickness or death, and so forth. As an unfortunate result (and one meriting further study), it is reasonable to suspect (and an excellent point for further investigation) that individuals may spend *less* time reviewing the images of reconstructed faces, thereby impeding rapid identification, even if their reaction is not one of aversion, their focus would be on identifying why the reconstruction looks "wrong", or some other fascination with the uncanny aspects instead of the desired reconstruction-to-known-human template matching that is the intended purpose.

Examples of the elaboration of the contents of the uncanny valley are seen not only on a macro level in such obvious (and recent) examples such as the CGI characters in *The Polar Express* and *Beowulf* (Gallagher, 2007), but on a micro level in terms of self-report of disturbing characters, images, and descriptions from individuals who find certain stimuli disturbing or eerie – even disgusting. Anecdotal evidence is abundant of fictional, or even imaginary, characters seeming disturbing or malevolent, particularly during childhood. There are many amateur media examples which compete, in terms of viewer reaction, with larger-scale endeavours such as *The Polar Express* and *Beowulf*, where the latter unintentionally taps into the uncanny valley, and the former intentionally exploits aspects of the uncanny. Whether it is in physical appearance, storyline, environment, or through sound, in many cases these amateur media employ schema violation so as to lead to a hyper-real tableau, and through this, acceptance on the part of some

(and irritation or revulsion on the part of others). Examples range from the animated serial comic *Salad Fingers* (Firth, 2005) to selections available on You Tube, such as *Still Life* (Knautz, 2006); *val val val* (Wheele, 2009); *The Dining Room or There Is Nothing* (Earle, 2006); *I Feel Fantastic* (Creepyblog, 2009); *Metalosis Maligna* (Kaayk, 2007); a (pseudo) recording of a television show alleging to be *Candle Cove* (see below) (Killerkoliseo, 2011; Straub, 2011), as well as many others. Further, the defection from established expectancies with respects to the societal norms of format, sound, and communication have led many people to experience interruptions such as Control of Electromagnetic Radiation (CONELRAD), Emergency Broadcast System (EBS), and Emergency Action Notification (EAN) images, tones, and (often synthesised) verbal instructions to be unsettling for reasons unrelated to any actual imminent emergency (e.g., Yahoo, 2009a,b). Similarly, individuals have presented anecdotal evidence of being made uneasy by radio or telephone announcements which utilise diphone or concantenative synthesis to generate speech (and also in work-environment aspects; see Hallgren and Lyberg, 1998), as well as individual-level reports of speech synthesis utilised in numbers station transmissions as being "eerie" or "frightening" despite their nonsensical nature (as contrasted with EBS/EAN messages; it would appear that message content has little to do with subjective perception as being "wrong" or "frightening"), and small communities (e.g., Conet Project, 2001) have sprung up to catalogue and speculate about the nature of these (to many unnerving) broadcasts. Examples of numbers stations abound, and many have been replicated or 'enhanced' with visual images, e.g., Achtung! The Swedish Rhapsody Numbers Station, and the fabricated Persephone Numbers Station (CapnSONIC, 2007a,b).

There can be uncanniness in objects, environments, and events other than human-robot

interaction, and to a large part, the human decision to experience comfort or place trust in any situation can be related directly to the degree to which the environment or object exhibits conformity to expected behaviours as predicted by the stimuli that is evoked. In many instances, the "uncanny" reaction is exploited in order to induce a feeling of horror or revulsion; the Internet phenomenon of *creepypasta* provides numerous examples of template evocation and violation.

Creepypasta derives its name from a type of portmanteau – they are stories that are unsettling ("creepy") and are often retold again and again (from "copy/paste" to "copypasta" to "creepypasta") in many internet subcultures. The majority of popular creepypasta is housed at various sites such as creepypasta.com, which also provides links to other repositories of creepypasta. The basic format of creepypasta is of a paranormal nature equivalent to "ghost stories"; some are similar to chain letters that offer some sort of good fortune, avoidance of bad fortune, or similar claims if the reader will forward the information within a certain period of time, or to a certain number of people. Many creepypasta contain frequent use of the uncanny, with initially normal scenes deviating from the schema they have suggested (to the reader), often with the threat of malevolent results, in this way another instance of the relationship between the uncanny and the motif of harmful sensation. Some examples (given in full as an appendix) are of "Suicidemouse.avi", the progenitor of the lost/forgotten episode genre of creepypasta, where a normally beloved and harmless character (Mickey Mouse) morphs into an uncanny caricature of a "normal" Mickey Mouse, exposing the viewer to sensations which result in madness and suicide (Creepypasta Wikia, n.d.). Following this example is the fictional "Dead Bart" episode of The Simpsons (unaired because it does not exist; the creepypasta is a text-based description),

in which cartoon characters take on life-like (in the story, described as 'hyper-real', directing attention to the unease potentially carried into a hyperreal environment) physical characteristics, appear to suffer actual death, engage in out-of-template activities for both the series and the entertainment cartoon format in general, and appear to predict the future (Creepypasta Wikia, n.d.). Another creepypasta details the television show "Candle Cove", in which fictitious users in an online forum reconstruct the mysterious show Candle Cove that they watched on television as children; the descriptions of the marionette characters, the child "Janice", and the themes of the show become increasingly malevolent-sounding as it departs from the expected template of a children's television show until, in the final post, it is implied that this show was a shared hallucination (or a malevolent transmission not perceived by adults, thereby maximizing the threat of danger from the inability of adults to intervene) amongst children in a broadcast area, with the underlying implication that the exposure to this show has in some way changed or injured the posting population (again, the motif of harmful sensation that often accompanies schema violations), or that the individuals posting somehow escaped a worse fate by turning off the television at disturbing points, such as "The Screaming Episode" (Creepypasta Wikia, n.d.).

CHAPTER TWO: LITERATURE REVIEW

The Uncanny Valley is the common term for the sharp drop in feelings of pleasure and comfort occurring in the transitioning from minimal affect to familiarity, then pleasure forward to recognition of an entity as a fellow human. It could be expected that this transitioning would be represented as a steady increase in positive affect; in other words, as humans interact with entities ranging from industrial robots to humanoid robots, as the robot becomes more "human", the emotions experienced would become increasingly positive. This is far from the case, however; humans have an increase in positive feelings of familiarity, but only up to a point – suddenly, our positive feelings come to an abrupt halt, and are replaced by negative feelings. At the point of this sudden drop in positive emotional response causing a disquieting feeling as experienced by a human in the dip of this "valley", human emotional response may range from mild uneasiness to an intense visceral revulsion; this sharp drop in positive affect has been described by Masahiro Mori in terms of the emotional response of humans as plotted against the anthropomorphization of a robot (Mori, 1970), and is shown in Figure 1.

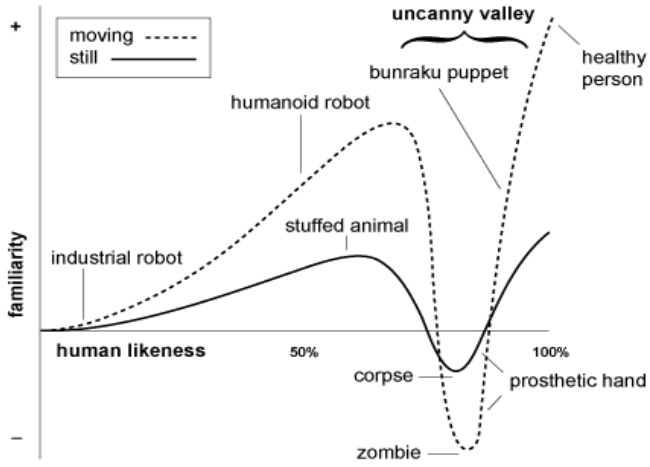


Figure 1: Mori's Uncanny Valley, courtesy K. F. MacDorman and Takashi Minato

http://www.androidscience.com/theuncannyvalley/

Background

As it is used today, the term "Uncanny Valley" refers to the sharp, steep drop in level of experienced comfort along a continuum when a human encounters or interacts with another entity. Although Masahiro Mori (1970) somewhat formalised the concept and facilitated the Cartesian depiction (See Fig. 1) with respect to robotics as an interplay between comfort and anthropomorphisation, the concept of the uncanny did not originate with Mori; in 1906, Ernst Jentsch wrote an essay entitled 'On The Psychology of the Uncanny', in which Jentsch described the uncanny in terms of being the domain and inclination of primitive peoples, as well as the uneducated, including women and children (Jentsch, 1906); in this way, Jentsch established the beginnings of the chain between animism and anthropomorphism, and the resultant path through to uncanniness, surrealism, and dehumanisation. Jentsch establishes his conceptualisation as occurring when, for example, a primitive person is unable to determine if something which appears to be animated is actually alive – for example, in the case of an automaton which, for Jentsch's era, was the state of the art equivalent to Mori's robots. One of Jentsch's examples is the short story *Der Sandmann* [The Sandman], written by E. T. A. Hoffmann (1816), and featuring a clockwork automaton, Olympia [appearing also as 'Olimpia' in some texts], set in a surrealistic horror story as the love interest of the doomed protagonist. By Jentsch's yardstick, the clockwork automaton, the corpse, and the individual in the midst of a tonic-clonic seizure exhibit aspects which are un-home-like – unfamiliar – *uncanny*. And it is these stimuli which will resonate most strongly with those of immature or inadequate powers of rational thought.

Upon reading Jentsch's essay, Sigmund Freud uprooted Jentsch's conceptualisation and replanted it within the framework of Psychoanalytic theory with his book, *The Uncanny*, in 1919.

He took odds with Jentsch on the interpretation of Hoffmann's story, explaining that Olympia, the clockwork automaton, was hardly the only – or even most – uncanny aspect of Hoffmann's story, instead focussing upon the theft of one's eyes by the Sandman (or Sand-Man, as Freud writes) within Psychoanalytic theory, giving Hoffmann's tale an even sharper twist of macabre castration, and calling Hoffmann the 'unrivalled master of the uncanny in literature' (Freud, 1919). Freud felt that Olympia was more of a wish-fulfillment of childhood – that one's dolls might, happily, come to life – whereas, as predicted by Freudian theory, the loss of one's eyes has its roots in the childhood fear of castration or parental retribution. From Freud's perspective then, again differing with Jentsch, the concept of the uncanny is brought into adult life through childhood fears and unresolved conflict which exist in opposition to societal norms and which, when brought to light through aesthetic works, result in a feeling of *Unheimliche*, or uncanniness (Freud, 1919).

In the historical address of the uncanny, with treatment by Jentsch and Freud, the issue of the uncanny was largely laid to rest until Mori, with the exception of Jacques Lacan, who framed uncanniness as anxiety (Lacan, 1962-63), and denied Freud's division between anxiety and fear, where, according to Freud, fear is based upon a specific object and anxiety is not; to Lacan, anxiety arises when an object cannot be classified as other objects are classified (Lacan, 1962-63). This treatment more closely approaches the concept of uncanniness as a failure of a particular mapping strategy (or of any viable mapping strategy) as well as providing supportive evidence for a categorical classification strategy, although Lacan's address is directed at Freudian theory, not upon investigation of the uncanny.

Regardless of the basis upon which study of the uncanny is rested, it is undeniable that there is an event/feature, or cluster of events/features, which may occur and affect the perspective of the observer in the same way in which a Rubin vase allows figure-ground reversal; with the shift in perspective, the familiar becomes unfamiliar, affection and empathy become revulsion, and tolerance becomes prejudice. The entity becomes alien because it has come so close to approximating human behaviour. There is evidence that some amount of the issue may arise from incomplete, impossible, or improper mapping from an anthropomorphic perspective. From the establishment of this point, it is possible to continue to concerns of application and allow for differing paradigms to have differing interpretation from a theoretical standpoint.

It should be noted that Mori's initial proposition (1970) was based upon independent observation, not empirical investigation. However, despite the paucity of empirical analysis, the conceptualisation of the Uncanny Valley has held up for over forty years in the realm of human-computer interaction, human-robot interaction, design, and entertainment because of its predictive and explanatory value. As can be seen from Mori's hypothesis, we humanize an entity with respect to its human-like appearance and/or behaviour, but only up to a point; at the point of the valley, the entity is simply not human enough to elicit positive emotions, yet is "human" enough to elicit negative associations because the emphasis has shifted from attempting to find similarity to the perception of the *differences* as the most prominent feature. Relating and re-framing the anthropomorphic process with a this-to-that mapping of function or intent similar to approaches in Decision Field Theory and Human Semantic Knowledge (e.g., Busemeyer and Townsend, 1993; Hampton, 2008) and similar in approach to MacDorman and Ishiguro (2006), it may be considered that, prior to the valley, a successful this-to-that mapping has occurred; for

example, the observer (or user) has identified the function(s) of the entity's parts in relation to their own parts – in essence, the internal debate or "conversation" with respect to component and function has been satisfactorily resolved – the observer has labeled parts as arms, legs, mouth, eye(s), and has inferred function and capability from this labeling process.

Approaching from the left of the Valley (see Fig. 1), this mapping is inadequate to identify the entity as human – it is clearly *not* human – but the entity has human-like parts, functions, and/or behaviours that allow an entity-to-human relationship to be made which, it is expected, will allow for successful prediction of behaviour, function, and the result of any anticipated interaction, and the entity can be viewed with tolerance, empathy, and even affection, much as one may relate to a child, pet, or similar non-adult-human ingénue-like creature.

To the right of the Valley, as with the example of the Bunraku puppet, there are entities that exhibit at times startlingly human-like emotions up to actual fellow humans. Here, again, these entities can be allowed tolerance, empathy, and affection due to the human-to-other mapping outweighing the value of any contradictory input, and the assumed success of the prediction of behaviour, function, and the result of anticipated interaction.

Within the Valley, however, incompatible mapping occurs; it is possible that the individual, unknowingly, does not perceive that they are capable of adequately predicting future events, function, or possibly even accurately determining the "parts" of the entity. The denizens of the Uncanny Valley may, because of design, reflect functions that are incompatible with the stated purpose, or possess implied functions that are not immediately comprehensible to the observer.

An example of such a disconnect in this-to-that mapping could be seen in the observation of an entity with an exaggerated mouth-space; while this may have occurred out of necessity (e.g., needing to fit equipment into the mouth area of a robot, resulting in a skewed proportionality to other facial features) or of accident (e.g., an artist/designer who "specialises" in mouths not realising that their detail in the mouth-space is far greater than attention paid to competing features, such as eyes and nose), when viewed by an observer, this entity is processed with an emphasis on the mouth. Based upon the observer's expectations, past experience, semantic connections, and so on, this entity may well be met with a reaction of alarm – the observer may have unconsciously decided that the purpose of the exaggerated mouth is to bite, and/or the observer cannot muster an immediate response to the anticipated exaggerated behaviour(s) which may come from this exaggerated mouth. Similarly, the "eyes" of an entity are often responsible for landing it firmly into the Uncanny Valley; much Internet discussion was generated over Computer-Generated Imagery (CGI) movies such as *The Polar Express* and *Beowulf,* as well as the appearance of a long-deceased but CGI-resurrected Orville Redenbacher (having died in 1995) in a 2007 popcorn commercial (Loder, 2004; Gallagher, 2007; Norton, 2007), among other instances. Observers often commented on the eyes of the artificial actors or "synthespians" (Beaver, 2008), calling them "creepy", "evil", "robot-like", or "dead"; although formal empirical study has not followed, these events received significant informal attention, and has been brought up as evidence in the endeavour's failure (e.g., the low box office earnings of *The Polar Express*). With respect to a this-to-that mapping, it is possible that inadequate rendering of the eye area results in the perceived inability to determine what, if anything, is being seen – or assessed. Without the ability to determine where the eyes are looking, and the emotional state of the synthespian while viewing, during the decision period, the observer is, it appears, inclined to

reject the entity and view it with alarm or revulsion. As the state of the art of robotics and synthespians increases, it may well be that other less obvious, or non-visually based, factors come to play a role in entering or escaping the Uncanny Valley, such as vocal qualities. Considering that most information is generated through visual channels, it seems only reasonable that once that channel is perfected, or absent, secondary or tertiary stimuli will then increase in importance with respect to processing and judgement.

The proposition that a mapping function between perception of entity and manifestation of perception along the continuum of humanness exists is not unique to the phenomenon of the uncanny valley; in fact, a "this-to-that" relationship lies at the heart of anthropomorphic interpretation. MacDorman and Ishiguro (2006) took this approach, and their methods had striking similarities to approaches taken in both Human Semantic Knowledge and Decision Field Theory (Hampton, 2008; Busemyer and Townsend, 1993). In this approach, prior to the valley's drop, the observer has successfully "mapped" the entity onto a human template, identifying the place and function of eyes, nose, mouth, limbs, and so forth. Any internal confusion on the part of the observer has been reduced or eliminated as the component parts of the entity have been processed, catalogued, and interpreted. On either side of the uncanny valley, the observer encounters human-like facets which allow for tolerance, affection, and even empathy, and the mapping that occurs is perceived to be successful enough to allow for the prediction of future events utilizing human-based schemata. However, within the uncanny valley, it is speculated that the mapping is interpreted by the observer as being inadequate for the prediction of future events, or the function implied by the entity's features is incompatible with the abilities/wants/expectation-template the observer brings to the exchange.

As in the aforementioned example of an exaggerated mouth, often such design is the result of the inattention or skill of the designer – for example, an inadequate designer may place too little emphasis on the accuracy of the eyes, or an especially masterful designer of one area may place too great an emphasis on that area, throwing what is construed (by the observer) as the facial features out of balance with respect to each other in a comparative sense. Similarly, necessity or design may dictate the exaggeration of areas that are interpreted as components of a "face" or anthropomorphised "body" be exaggerated or over-emphasised with respect to the other features – for example, a storage panel which fits in as the "mouth" area being proportionally larger implying the function of communication and/or biting (or any other mouth-function) taking precedence or a higher probability over other functions such as sight. These prioritisations are determined based upon the template generated for the anthropomorphic relationship relating the viewed object to the human prototype.

Following this line of thought, during the time that there is an object-to-human relational connection, it could also be reasoned, and has been to a great extent demonstrated, that individuals attempting to make the cognitive map are speculating what is occurring in the mind of the 'other', the entity being viewed (Watzlawick, 1970; Rilling, Nystrom, and Cohen, 2004); Young and Saxe, 2009; Zaki, Bolger, and Ochsner, 2009, among many other examples). Literature in the field of Social Cognition already has demonstrated that there are gradations of speculation which occur, as well as the attribution of human characteristics (including Will) to non-human entities (e.g., Kwan and Fiske, 2008) and the attribution of human-like intention in the sense of fitting into a larger anthropomorphized narrative schema (Heider and Simmel, 1944; Springer, Meier, and Berry, 1996). In this situation, as the anthropomorphized entity is being

functionally mapped to human form and function, it is not unreasonable to suggest that what is operating at this point is an attempt at speculation on the entity's mental state and/or intentions. In tasks that could be used to draw conclusions as to the intent of another, Rilling et al. (2004) found by way of fMRI that a particular set of brain areas are utilised during Theory of Mind-like speculation(s); it was suggested that similar areas were activated during human-computer interaction, although human-human interaction was clearly greater, while Liu, Sabbagh, Gehring, and Wellman (2004) investigated theory of mind speculation by using ERP, finding that there is a specific area, speculated to be in the left orbitofrontal cortex, which functions in the case of judgements about belief, while judgements about reality demonstrate a different ERP pattern of activation. However, the Rilling et al. and Liu et. al. studies did not address the question of gradations of human-computer (or even human-entity) interaction, only aspects of theory of mind attribution itself; for this reason, it is an interesting question as to whether more, equal, or fewer brain areas suggesting theory of mind speculation might be engaged during interaction with indeterminate partners, or with partners evoking an uncanny response.

Since Mori's observation in 1970, a large body of non-empirical works and observations has followed, while there has been limited empirical work with respect to establishing a formal existence, limitations, and even definition(s) (Pollick, in press). With the acceptance of the usage of schemata to set expectations from which the uncanny then defects, it is understandable to question the actual origin of the uncanny reaction and where this reaction fits within the framework of evolution and development. It would be expected, from this standpoint, that humans are not the only form of life to exhibit a preference to avoid that which appears malevolent, sick, or otherwise 'wrong'. To this end, Steckenfinger and Ghazanfar (2009)

modelled a parallel to human uncanny reaction in primates; through the presentation of actual monkey faces, realistic monkey avatar faces, and unrealistic monkey avatar faces [Figure 2], monkeys demonstrated a clear preference to avoid looking at the realistic monkey avatar faces in both static and moving formats.

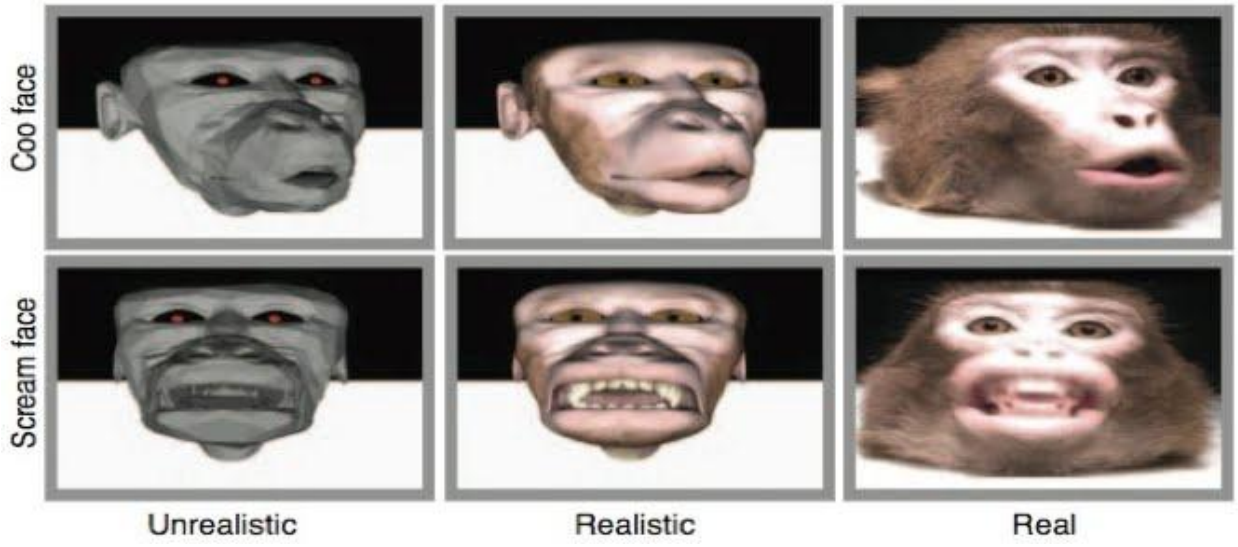


Figure 2: Primate stimuli

Following the demonstration of an uncanny correlate in primates (Steckenfinger & Ghazanfar, 2009), it has further been demonstrated that the adult manifestation of an uncanny reaction is existent in infants (Lewkowicz & Ghazanfar, 2011), where it was hypothesised that as infants interact with human faces with increasing frequency and variability, norms for facial attractiveness and facial characteristics which evoke pleasure/displeasure are formed and refined. Lewkowicz and Ghazanfar's 2011 study determined through the presentation to infants of realistic human faces, realistic avatar faces, and unrealistic avatar faces, that an uncanny reaction manifests itself at approximately twelve months of age, and further suggest that the development

of an uncanny reaction is not only a developmental stage, but a result of exposure and interaction with 'valid' human faces, which lends great support for the role of the development of Piagetian schemata, and specifically for the development of a schema (or schemata) for "humanness".

The example provided by the Lewkowicz and Ghazanfar (2011) study not only functions in support of a recapitulation hypothesis, but further shows that the uncanny reaction, far from being an emotional outcropping new to technological advances, is in all likelihood an important component of developmental progress. Further correlates to human action are found in Saygin, Chaminade, Ishiguro, Driver, and Frith (2011), where fMRI imaging demonstrated that, crossing appearance with movement (human/non-human appearance matched with human/non-human movement) when asked to view taped movement of a human, robot, and an android, it was appearance which drove the activation of the mirror neuron system, thereby calling up expectations for the android (human appearance, non-human movement) which were not fulfilled as those same appearance-based expectations were for the human (human appearance, human movement).

Considering the role of schemata (Stein, 1992) and the implication of function or purpose which it is hypothesized characterizes an uncanny interaction, it is not a far stretch to suggest that there is an anthropomorphically-based 'theory of mind' occurring, directed at the target entity. It has been investigated whether the discernment of human-like (versus non-humanlike) is a categorical perception (Cheetham, Suter, and Jancke, 2011), where Mori's original hypothesised valley lies in the category break between human and non-human; this is a proposition similar in practice to the concept of schema-selection that the two perspectives are wholly compatible and equally

proper in terms of explanatory value from a conceptual level. In practice, Cheetham, Suter, and Jancke found that human-like appearance is, in fact, subjectively-based in a 'neighbourhood' about human appearance. For this reason, Cheetham et al. justifiably propose further investigation about the categorical boundaries from either side of the human-avatar continuum. It is also notable that while Cheetham et al. found little effect from shape and texture in facial processing, subjective report indicated that participants claim to attend to texture in classification of facial characteristics (Cheetham et al., 2011).

The verbiage used in descriptions of the uncanny is often unique to that individual; Ho, MacDorman, and Promono (2008) discussed adjectives utilised in their analysis of twenty-seven emotions used to describe eighteen videos of moving forms (seventeen robotic and one human). Ho et al. found that descriptors such as *strange* were less likely to be used than terms such as *eerie*, *disgusted*, etc.; this clearly establishes that for the average individual, descriptors such as *strange* may imply a decision made on a cognitive level (see Ho et al. for further comparators), while descriptors of visceral events (e.g., labelling of the feeling or event experienced rather than the categorical decision of "strange" further supports the recommendation of Cheetham et al. (2011) that the uncanny valley is unlikely to be a clearly-demarcated event occurring on a Cartesian coordinate system as often portrayed, instead being a multifactor assessment on a continuum which has multiple possibilities for individual differences based upon personal experiences or community fable. Further, Ho et al. provide support for the facet of "pathogen avoidance" (Mori, 1970; Rozin and Fallon, 1987; MacDorman and Ishiguro, 2006; Ho et al., 2008) which originates with Mori's hypothesis, and implies a fundamental judgement of healthy actions and behaviours that are anticipated, and, when violated, cause default to the impression

of ill health, disease, unpredictable behaviour(s), and death, triggering revulsion and avoidance. While denotative differences in the descriptors used differ from the "pathogen avoidance" associated with "disgust", it has been suggested (MacDorman and Ishiguro, 2006) that there is a connotative relationship that results in the same end: avoidance of the potentially infectious or harmful stimuli. Rozin and Fallon (1987) relate *disgust* to a food-related (orally-ingested) type of rejection having bearing upon one's health, where an item termed *disgusting* has the ability to contaminate, even in a manner related to sympathetic magic (if not by direct contact or shared origin). To this end, MacDorman and Ishiguro (2006) discussed the potential of the application of terror management reactions to uncanny stimuli from the rationale that what appeared to be a sickly human form, or a disassembled (or "injured") human form evokes the same reaction as would exposure to disaster or battle resulting in death, in short, treating the android components as a *memento mori* with the presumed ability to spread poor fate, be it in the form of pathogen or sympathetic magic.

Summary

In sharp contrast to the old adage, 'familiarity breeds contempt', it appears reasonable to anticipate that familiarity in the form of expectancy-setting in fact breeds *comfort*, and it is the deviation from that set of expectancies that may result in marked discomfort and distress. When applied to human-human, human-agent, or human-anthropomorphized artefact interactions, these feelings of comfort may be enhanced by conforming to an expected exchange templature which may be suggested externally, in the form of affordances, as well as allowing adequate time to test an extant templature to discover that methods employed to accommodate the exchange are unsuccessful, and the current interaction paradigm is poorly-fit to the self-recommended

template. Further, there is strong indication that the designation of "uncanniness" is best explained by a categorical assignment than a placement across a continuum. Lastly, the role of social priming of schema, and expectations in general, cannot be under-emphasized.

Up to the present time, much emphasis has been placed on the role of the uncanny valley in mass media and human-robot interaction; little attention has been directed towards the inner workings of an uncanny reaction. While most noticeable within the field of human-robot interaction, uncanny reactions stand to occur at any point where a human-like schema may be implied, and particularly where some type of anthropomorphic implication is perceived. To this end, even an environment may be considered "uncanny", much less visual, olfactory, and auditory stimuli that deviate from expectations. For this reason, the fundamental components of an uncanny experience from a perceptual, descriptive, or biophysical standpoint from the point of view of the user should be explored thoroughly before advancing to compounded constructs involving shape and movement, form and sound, and so forth; the essence of the uncanny experience could then be predicted through basic user testing such as survey sampling for similar adjectival descriptors, personality testing across the intended user group, or observation of physiological measures in a pre-release testing environment. With these goals in mind, the individual components of what contributes to an uncanny experience, from personality and biophysical factors to information filtered through the user (e.g., self-report, analysis of descriptors, elicitation of schemata in use, and so forth) should be considered before advancing on to attempt prediction on stimuli that contain a blend of components. These studies serve to address personality and biophysical predictors of the subjective experience of uncanniness.

CHAPTER THREE: EXPERIMENT 1 - RESEARCH DESIGN AND METHODOLOGY

Hypothesis

Fundamentally, it is anticipated that instrumental evaluation will demonstrate that there is a difference between those who more readily describe or react to uncanny stimuli, and those individuals who are less likely to do so. It also is expected that participant evaluations combined with measurable physical reactions will demonstrate that the uncanniness of an image, be it static or moving, elicits physical reactions comparable to a shock or startle response attributable through theory to the violation of template(s)/expectancies. It also is anticipated that participant evaluation will reference this violation, as well as refer to an anthropomorphisation of these expectancies; in other words, expecting a human-like set of responses or interaction, when this expectation is abruptly not met or deviated from markedly with appearance/action incompatible with a healthy human template, the observer will have a physically observable reaction, mentally classify the image/event as "uncanny", and utilize human form-based descriptors in a post-exposure abreaction.

Justification

It is unreasonable to suggest that technological advances have brought about a new outcropping of emotional response in the form of an "uncanny" reaction. First, one must investigate the possibility of the evoked response in a human-artefact interaction being a pre-existing reaction, or a subset of the existing set of emotional responses in decision-making, social interaction, and expectancy-setting. In this way, the mistake of chasing after individual reactions such as the

reaction to eyes, mouth, face-set, movement, and so forth, may be avoided; there is not yet cause to assume that there is a "sum of parts" that is in operation while the potential remains that there is a driving set of expectations, both personal and societal, brought to an interaction that would serve as a better predictor in that this set of expectancies *leads* to the anticipation(s) to which the "sum of parts" will be compared. Similarly, it is logically unsound to risk reifying the concept of an uncanny reaction into any model, theoretical or applicative, which expects to provide a modicum of predictive validity while the question of the independence of the construct remains unchallenged. By securing the concept of an "uncanny" reaction as being a part of a larger system of evaluation, a more accurate model of prediction may be derived with respect to human-artefact interaction.

In this way, it is clear that the end result of affective revulsion – the perception of "uncanniness" – cannot be extracted from the larger context in which it occurs. While there are neural substrates which can be identified contributing with respect to theory of mind and/or inference of intentionality (Gallagher and Frith, 2003; Saxe and Kanwisher, 2003), these physical events operate as a result of the mental events which preceded the speculation of internal states, and it is suggested that one crucial mental event is the mapping to a human template or human-based social schemata that serves to set expectations forming the basis for the predictions which may be violated. So it is demonstrated that a physical event (or events) occurs, however even these mental events have a socially-driven constituent which also offers explanatory and predictive value – the anthropomorphic framing used by the observer to interpret human-like actions (or to categorize actions as human-like), as well as the function served by the narrative environment in which the human observer frames the observed. All of these mechanisms interact with the literal

and conceptual idea of embodiment, in terms of expectation(s), as well as in the sense of valid/invalid feedback from the perspective of the human perceiver; in this sense, Masahiro Mori's (1970) anecdotal observation of an Uncanny Valley is a special case of a larger phenomenon.

Experiment 1

In the primary experiment, subjective ratings from participants will be used to determine four normed sets of images that fall into one of these four categories: Uncanny, Neutral, Pleasant, and Control.

Participants

Three hundred ninety-five younger adults (undergraduates recruited from psychology courses at the University of Central Florida using the SONA system) participated in this study. After screening the raw survey data for data entry errors, invalid responses, and outliers, the sample retained for analyses consisted of three hundred ten younger adults (M_{age} = 20.88, SD = 4.81; 60.6% female). Data from eighty-five participants were eliminated prior to analyses because they had failed to complete the survey in its entirety or had provided invalid responses for the sole purpose of receiving extra credit (i.e., participants "Christmas treed" the survey, as demonstrated by conflicting answers, answers inconsistent with known facts [e.g., having played video games for 99 years], or answers that were all the same or followed a visible pattern, such as "1, 2, 3, 4", repeating). All participants completed a brief demographic questionnaire (Appendix H), some of which was free-response, and some of which were Likert ratings (e.g., of video game enjoyment), the 100-item HEXACO Personality Inventory (Ashton and Lee, 2009),

and the 145-item Anthropomorphic Tendencies Scale (ATS) (Chin, Sims, Ellis, Yordon, Clark, Ballion, Dolezal, Shumaker, and Finkelstein, 2005). Additionally, all participants were pre-screened to ensure that they had normal or corrected-to-normal vision.

Materials

Stimuli

Two hundred images (fifty per condition – Uncanny, neutral, pleasant, and control) were gathered from various academic, Internet, and entertainment sources (publications, links, productions, etc.), as well as International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005) (See Appendix A). All images were edited to ensure that they were approximately the same size and had similar proportions. Uncanny images were selected from images posted to Internet forums (primarily image boards, e.g., 4chan's "Paranormal" board) and are comprised of computer-generated depictions of humans or humanoid forms, robots, puppets, facial reconstructions, still pictures of movie monsters, and humans with morphed faces that were suggested by users as meeting the criteria for adjective and descriptor matching (e.g., "uncanny"' "creepy"; "eerie"; "disturbing"; "unhealthy"; "malevolent"; "nightmare fuel"; "this disturbs me and I cannot explain why", etc...). Neutral and Pleasant images consisted of IAPS un-retouched photos that had been classified by the IAPS protocol to have been normed to fit the desired description. IAPS images were not used rated on dimensions, but accepted as a categorical classification (e.g., pleasant, neutral, where the valence, arousal, and dominance are taken as an overall classification) for comparison to uncanny images which were also not rated on dimensions.

Self-Report Scales

The scales used were the HEXACO (Ashton and Lee, 2007; See Appendix B), and the Anthropomorphic Tendencies Scale (ATS) (Chin, et al., 2005; See Appendix E). The purpose in selecting the HEXACO over a "Big Five" personality measure is that the HEXACO measures across six personality dimensions (Honesty-Humility (H), Emotionality (E), Extraversion (X), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O); Ashton and Lee, 2007) which contain subscales (contributing criteria) that allow for specific trait breakdown when needed. Further, the HEXACO has the advantage of having been developed across nine languages, and therefore tends to be more culture-free (or culture-fair) than American- or Western civilization-biased personality trait inventories. Especially notable is the HEXACO's inclusion of the category of "Honesty/Humility", which is notably absent from standard "Big Five" inventories, suggesting that the trait is either not measured, not measured well, or collapsed across other traits, resulting in confounding of constructs. It is for these reasons that the HEXACO appeared to be the preferred personality inventory for this study.

The Anthropomorphic Tendencies Scale (Chin, et al., 2005) measures the degree to which an individual engages in what is considered to be anthropomorphic behavior – the attribution of human-like qualities to non-human entities. The scale was developed to address multiple forms of anthropomorphism, most notably Extreme Anthropomorphism, Anthropomorphism of Pets, Anthropomorphism towards Gods or Deities, and Negative Anthropomorphism. While there are other factors involved in anthropomorphisation, the ATS has proven to reliably predict individual tendencies towards a spectrum of conditions, both physical and non-physical. The decision to acquire a rating on anthropomorphism in this line of enquiry was made because of the

clear relationship as described throughout this work and others between the interrelationship of schema, theory of mind, categorical decision points, and anthropomorphism.

Procedure

The current experiment obtained subjective ratings from participants in order to determine four normed sets of images that fall into one of these four categories: Uncanny, Neutral, Pleasant, and Control. Participants were asked to categorize each image. Specifically, they were asked to choose which category they felt the image was most representative of (uncanny, neutral, pleasant, or control). All participants were tested individually in a single session that lasted no more than 120 minutes. All participants logged into the UCF Psychology Research Participation System –Sona System – from a location of their choosing and were provided with a link (https://www.surveymonkey.com/s/8CNJMC9) to the norming survey hosted at Survey Monkey (www.surveymonkey.com). After obtaining informed consent (See Appendix G) and prior to beginning the experimental protocol, participants completed a demographics questionnaire (See Appendix H). Participants then read detailed instructions for rating the images that they would be viewing during the experimental session (See Appendix I).

Following the instructions, participants viewed a total of 200 images (one at a time) and provided ratings of each image as conforming to one of the four categories (Uncanny, Neutral, Pleasant, or None of the Above). The presentation order of the images was randomized across participants. The category descriptions that participants used to make their ratings were as follows:

Uncanny: This stimulus appears alarming or unnerving because of its features (or lack of). There is something that appears fundamentally "wrong" or "unhealthy" about this stimulus. If I were to meet this stimulus in a face-to-face situation, I would feel revulsion or fear quickly.

Neutral: This stimulus does not evoke any response, positive or negative. If I were to meet this stimulus in a face-to-face situation, I would have virtually no reaction.

Pleasant: This stimulus appears enjoyable or peace-inducing because of its features (or lack thereof). There is something that appears fundamentally "right" or "positive" about this stimulus. If I were to meet this stimulus in a face-to-face situation, I would feel pleasure or enjoyment quickly.

None of the above (Control): Not conforming to any other description.

During the experimental protocol, the first image appeared on the monitor and remained until the participant selected one of the four categories from a list by clicking on the appropriate radio button on the bottom of the screen. Immediately following this rating of an image, participants were given the chance to describe their thoughts and/or feelings about that image in a free-response text box. At that time, the second image appeared on the monitor and they were again asked to select one of the four categories from the list. Immediately following this second rating,

participants were given the chance to describe their thoughts and/or feelings about that image in a free-response text box; and so on until all 200 images have been viewed, rated, and described. Images were randomized between participants.

Once the experimental protocol was completed, participants were then asked to complete the HEXACO, and 145-item ATS. Upon completion of both surveys, participants were both debriefed and thanked for their time and participation.

CHAPTER FOUR: EXPERIMENT 1 – RESULTS

Measures

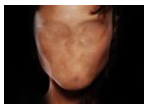
The HEXACO was scored in accordance with the scoring sheet (See Appendix D); answers were reverse-scored where instructed (indicated by 'R' following the question number on the scoring key), and the seven scales (HEXACO-six plus Altruism) were used to generate an operational definition of Personality for use in this analysis.

The Anthropomorphic Tendencies Scale was scored by determining the factor loading score for each item (See Appendix F) and multiplying each response by that score. In this way, for each of the participants, anthropomorphism was operationally defined in terms of the four labeled scales of the ATS.

Experiment 1: Results - Norming

The twenty uncanny images were culled from the battery of images presented in Experiment 1; because of the high *n* and clearly-defined user ratings, it was decided to take only the highest-rated uncanny stimuli, scoring at 80% or higher (Shown in Table 1). These images were almost uniformly deviations from humanoid form, and included only one instance of a robotic class – an actroid – despite the initial battery of Experiment 1 containing multiple robot/actroid/android forms in anticipation of conformance to Mori's hypothesis. This event establishes for the population sample that the observations since Mori and in anecdotal circumstances establish that the experience of "uncanniness" is not limited solely, or even mostly, to robots.

Table 1: Frequency of Uncanny Images

Image	N	Uncanny		Neutral		Pleasant		None of the Above	
		f	*p*	*f*	*p*	*f*	*p*	*f**	*p***
	310	299	96.5	7	2.3	-	-	4	1.3
	310	299	96.5	8	2.6	1	0.3	2	0.6
	310	297	95.8	8	2.6	2	0.6	3	1
	310	296	95.5	6	1.9	2	0.6	6	1.9
	310	296	95.5	9	2.9	2	0.6	3	1
	310	292	94.2	14	4.5	2	0.6	2	0.6
	310	292	94.2	12	3.9	2	0.6	4	1.3
	310	291	93.9	13	4.2	2	0.6	4	1.3
	310	290	93.5	14	4.5	2	0.6	4	1.3
	310	288	92.9	17	5.5	-	-	5	1.6
	310	285	91.9	21	6.8	-	-	4	1.3
	310	284	91.6	14	4.5	5	1.6	7	2.3
	310	281	90.6	20	6.5	4	1.3	5	1.6

	310	281	90.6	20	6.5	4	1.3	5	1.6
	310	281	90.6	18	5.8	4	1.3	7	2.3
	310	280	90.3	16	5.2	7	2.3	7	2.3
	310	272	87.7	21	6.8	10	3.2	7	2.3
	310	260	83.9	33	10.6	11	3.5	6	1.9
	310	254	81.9	42	13.5	2	0.6	12	3.9
	310	249	80.3	46	14.8	5	1.6	10	3.2

Note. * *f* = number of participants that provided rating; ** *p* = percentage of participants that provided rating.

Neutral images were initially collected from the pre-screened IAPS program. Neutral candidate images for the upcoming study were then taken from the battery of images presented in Experiment 1; once again, because of the high *n* and clearly-defined user ratings, it was decided to take only the highest-rated neutral stimuli, scoring at 90% or higher (See Table 2). In this way, these neutral images were determined to be the most unequivocally neutral, having first been normed against IAPS and further selected in a comparison in Experiment 1. There was no deviation from the expected IAPS rating; in other words, the "Neutral" pictures were clearly and consistently rated "neutral" in the Experiment 1 environment.

Table 2: Frequency of Neutral Images

Image	N	Uncanny		Neutral		Pleasant		None of the Above	
		f	*p*	*f**	*p***	*f*	*p*	*f*	*P*
	310	13	4.2	257	82.9	16	5.2	24	7.7
	310	8	2.6	253	81.6	17	5.5	32	10.3
	310	20	6.5	251	81	14	4.5	25	8.1
	310	4	1.3	249	80.3	32	10.3	25	8.1
	310	12	3.9	247	79.7	28	9	23	7.4
	310	5	1.6	242	78.1	38	12.3	25	8.1
	310	8	2.6	242	78.1	37	11.9	23	7.4
	310	21	6.8	237	76.5	29	9.4	23	7.4
	310	21	6.8	230	74.2	35	11.3	24	7.7
	310	30	9.7	230	74.2	32	10.3	18	5.8

Note. * *f* = number of participants that provided rating; ** *p* = percentage of participants that provided rating.

Pleasant images were initially collected from the pre-screened IAPS program for images rated

and normed as “Pleasant”. Pleasant candidate images for Experiment 2 were then taken from the battery of images presented in Experiment 1; once again, because of the high *n* and clearly-defined user ratings, it was decided to take only the highest-rated neutral stimuli, scoring at 90% or higher (See Table 3). In this way, these pleasant images were determined to be the most unequivocally pleasant, having first been normed against IAPS and further selected in a comparison in Experiment 1. There was no deviation from the expected IAPS rating; in other words, the “Pleasant” pictures were clearly and consistently rated “pleasant” in the Experiment 1 environment.

Table 3: Frequency of Pleasant Images

Image	N	Uncanny	\	Neutral		Pleasant		None of the Above	
		f	*p*	*f*	*p*	*f**	*p***	*f*	*P*
	310	-	-	12	3.9	296	95.5	2	0.6
	310	9	2.9	15	4.8	281	90.6	5	1.6
	310	5	1.6	24	7.7	280	90.3	1	0.3
	310	4	1.3	25	8.1	278	98.7	3	1
	310	4	1.3	27	8.7	277	89.7	2	0.6
	310	1	0.3	30	9.7	276	89	3	1
	310	2	0.6	31	10	275	88.7	2	0.6

	310	4	1.3	31	10	274	88.4	1	0.3
	310	12	3.9	26	8.4	269	86.8	3	1
	310	9	2.9	28	9	267	86.1	6	1.9

Note. * *f* = number of participants that provided rating; ** *p* = percentage of participants that provided rating.

Experiment 1: Results - Exploring Variance Explained by IVs

Three standard multiple regression analyses series were performed to determine if personality traits (Honesty-Humility (H), Emotionality (E), Extraversion (X), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O)), anthropomorphic tendencies (Extreme Anthropomorphism, Anthropomorphism of Pets, Anthropomorphism towards Gods or Deities, and Negative Anthropomorphism), and exposure to video games (Enjoyment, Expertise, Hours/Week, Years Playing, and Age First Played) significantly predicted participants' ratings of uncanny, neutral, and pleasant images. The first of these regression analyses examined both the amount of variance in participant ratings of uncanny images that these three (personality, anthropomorphic tendencies, and exposure to video games) sets of predictor variables were able to explain as a group, and the unique predictive power of each of the independent variables. Preliminary analyses conducted to ensure no violation of normality, linearity, multicollinearity, and homoscedasticity identified three extreme multivariate outliers using a $p < .001$ criterion for Mahalanobis' Distance (critical chi-square = 39.25) and these outliers were eliminated from the final multiple regression analysis.

Table 23 (See Appendix J) displays the correlations between the variables, and Table 4 displays the unstandardized regression coefficient (*B*) and intercept, the standardized regression coefficients (β), the semipartial correlations (sr^2), R^2, adjusted R^2, and *F*. *R* for regression was significantly different from zero, F (16, 306) = 2.28, $p < .004$, with R^2 at .112. The adjusted R^2 value of .063 indicates that 6.3% of the variability in the overall model of participant ratings of uncanny images is predicted by personality, anthropomorphic tendencies, and exposure to video games. For the four regression coefficients that differed significantly from zero, 95% confidence limits were calculated. The confidence limits for Emotionality were -4.368 to 4.382; those for Extreme Anthropomorphism (Factor 1) were .048 to .379; those for Enjoyment of Video Games were .430 to 4.100; and those for Age First Played were -1.067 to -.059.

For both the second regression analyses (examining the amount of variance in ratings of neutral images that the sets predictor variables were able to explain as a group and as individual IVs) and third regression analyses (examining both the amount of variance in ratings of pleasant images that the sets of predictor variables were able to explain as a group and as individual IVs), preliminary analyses conducted to ensure no violation of normality, linearity, multicollinearity, and homoscedasticity identified one extreme multivariate outlier using a $p < .001$ criterion for Mahalanobi's Distance (critical chi-square = 39.25) that was eliminated from each of the final multiple regression analyses.

Table 4: Summary of Multiple Regression Analyses for Variables Predicting Participants' Ratings of Uncanny Images (N = 306)

Variable	*B*	*SE B*	β	sr^2 (unique)
Honesty-Humility	0.007	2.23	0	
Emotionality	7.106*	2.519	0.199	0.024
Extraversion	-1.807	2.042	-0.054	
Agreeableness	-0.638	2.349	-0.017	
Conscientiousness	0.091	2.165	0.003	
Openness to Experience	0.585	1.919	0.018	
Altruism	-0.361	2.088	-0.013	
Extreme Anthropomorphism	0.213*	0.084	0.165	0.019
Anthropomorphism of Pets	-0.143	0.112	-0.076	
Anthropomorphism towards Gods or Deities	-0.010	0.195	-0.003	
Negative Anthropomorphism	0.402	0.276	0.086	
VG Enjoyment	2.265*	0.932	0.214	0.018
VG Expertise	*0.332*	*0.956*	*0.033*	
VG Hrs/Wk	-0.317	0.209	-0.109	
VG Years Playing	-0.367	0.206	-0.121	
VG First Played	-0.563*	0.256	-0.128	0.015
R^2		0.112[a]		
Adjusted R^2		0.063		
R		0.334		
F		2.276*		

Note. * $p < .05$.
[a] Unique variability = .076; shared variability = .036.

Table 24 and Table 25 (Appendix K) displays the unstandardized regression coefficient (*B*) and intercept, the standardized regression coefficients (β), the semipartial correlations (sr^2), R^2,

adjusted R^2, and F for the second and third standard regression analyses, respectively. R for regression for the second analysis was not significantly different from zero; the seven personality variables, the four anthropomorphic variables, and the five exposure to video games variables produced an adjusted R^2 of .031 (F (16, 309) = 1.62, $p < .062$). R for regression for the third analysis was significantly different from zero; the seven personality variables, the four anthropomorphic variables, and the five exposure to video games variables produced an adjusted R^2 of .150 (F (16, 306) = 4.37, $p < .000$). This third regression contained five significant predictors of participants' ratings of pleasant images – Honesty-Humility, Emotionality, Agreeableness, Openness to Experience, Age First Played VG – that uniquely predicted 8.7% of the variance. The strongest predictor was Emotionality (β = .234), followed by Openness to Experience (β = .128), Honesty-Humility (β = -.134), Age First Played VG (β = .114), and Agreeableness (β = .117).

Experiment 1 Discussion

From this study it is shown that while there may be underlying physical events in the spirit of visceral reaction to uncanny stimuli, that such measures are likely highly individualised and would be predictable on an individual level as a group of traits and experiences. Further, these reactions are secondary to the consideration of internal mental states and expectancies, social conditioning, enduring personality traits, and states of expectancies at the point of presentation.

Experiment 1 served to cull images rated as highly uncanny from a larger candidate pool, and demonstrated that these ratings exhibited a small effect for personality characteristics such as tendency towards a form of anthropomorphism that is beyond what might be considered

'normal' or 'average' anthropomorphism. Further, there is a clear tie-in with the Emotionality facet of the HEXACO (from hexaco.org):

> Persons with very high scores on the Emotionality scale experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others.

From this, the combination of Extreme Anthropomorphism with Emotionality leads towards a personality portrait tending to a base in fear and anxiety, and a tendency to identify and attach empathetically with others; the Extreme Anthropomorphism leads to a more open conceptualization from this individual's perspective as to what this "other" may be. The support they receive may come from a non-human 'other', as well as the identification of threat origin and stress. In this way, exposure to video games may serve as a factor which is a mediator into another realm of 'other', as it affords exposure to fictional personalities, acceptance of CGI-formatted human-like characters, and an additional avenue of stressor in the form of in-game assignments, goals, and dangers. This leads to the interrelationship of simulation and hyperreality (in the sense of Baudrillard and Eco) which is outside of the scope of this work, but should be addressed to a small extent in light of the triad comprising susceptibility to uncanny reactivity: it is a viable avenue for enquiry as to the role of simulated life within the perspective

of threat preparation, as well as enjoyment. It stands to reason that for the high-Emotionality, Extreme Anthropomorphic individual (high-E, EA), threats and allies are not limited to our commonly-shared reality state, instead subject to a broader personal definition which may make those with lower scores lack understanding of the enhanced richness of the worldview of the high-E, EA individual, for whom this situation of level of emotional involvement is a normal state of existence.

It is strongly indicated that a future line of enquiry be directed at the role of simulation, vicarious experience, and heightened suggestibility in hyperreal environments with respect to subjective emotional response from attachment to fear; the potential for other composite personality typologies; the influence of societal roles and norms in schemata development for these types; and the implications of such composite characterizations for design, in a wide-ranging sense, from industrial design to product design.

CHAPTER FIVE: EXPERIMENT 2 - RESEARCH DESIGN AND METHODOLOGY

Hypothesis

It is anticipated that evaluation utilising biophysical measures will demonstrate that there is a difference between those who more readily describe or react to uncanny stimuli, and those individuals who are less likely to do so. It is expected that participant evaluations combined with measurable physical reactions will demonstrate that the uncanniness of an image, be it static or moving, elicits physical reactions attributable through theory to the violation of schemata/template(s)/expectancies. It also is anticipated that participant evaluation will reference this violation, as well as refer to an anthropomorphisation of these expectancies; in other words, expecting a human-like set of responses or interaction, when this expectation is abruptly not met or deviated from markedly with appearance/action incompatible with a healthy human template, the observer will have a physically observable reaction, mentally classify the image/event as "uncanny", and utilize human form-based descriptors in a post-exposure abreaction.

Justification

The contribution of biophysical state(s) as a result of exposure to, and processing of, uncanny stimuli has received virtually no attention, although it there is a high probability of physiological changes as the precursor or effect of exposure to uncanny stimuli. From the perspective of the user, it is assumed that negative emotional states that are attributed to uncanny stimuli would be perceived as a result of the stimuli, as opposed to the internal condition of schema change. From the perspective of the experimenter, however, monitoring physiological states such as EEG, ECG, and respiration should demonstrate the internal processing of event(s) that require schema

change or re-evaluation.

Experiment 2

In the second experiment, subjective ratings and physiological data was collected in an effort to define a constellation of behavioral and physiological responses that can be said to uniquely define the human response to the uncanny valley.

Participants

Forty-eight adults (recruited from University of Central Florida using the SONA system) participated in this study. After screening the raw survey data for data entry errors, invalid responses, and outliers, the sample retained for analyses consisted of twenty-two adults (M_{age} = 32.32, SD = 10.67; 63.6% female). Data from twenty-six participants were eliminated prior to analyses because they had failed to complete the survey in its entirety or had provided invalid responses for the sole purpose of receiving extra credit. The final sample size of twenty-two was determined to be adequate by a power analysis and computed by G*Power (Faul, Erdfelder, Lang, and Buchner, 2007; 2009). All participants completed a brief demographic questionnaire, the 100-item HEXACO Personality Inventory (Ashton & Lee, 2009), and the 145-item Anthropomorphic Tendencies Scale (ATS) (Chin, Sims, Ellis, Yordon, Clark, Ballion, Dolezal, Shumaker, Finkelstein, 2005). Additionally, all participants were pre-screened to ensure that they had normal or corrected-to-normal vision and, and did not have any heart-related or health-related conditions that could result in physiological readings that were outside of normal ranges for adults of their age.

Materials

Stimuli

Stimuli consisted of a set of forty static images (twenty uncanny, ten neutral, and ten pleasant) that fit into one of four categories: uncanny, neutral, pleasant, and none of the above as determined by the ratings of participants in Experiment 1.

In order to provide a uniform experience and minimise participant movement, it was determined that the stimuli would be randomly assembled and then presented as a PowerPoint show that was pre-timed so that better control could be maintained over stimuli presentation. Target stimuli were presented for one second, followed by a neutral screen or "mask" (meant in the stimuli sense) for four seconds to allow a return to approximate baseline before the presentation of the next target stimuli. The unnormed stimuli presented were the twenty uncanny culled photographs from Experiment 1; IAPS photos having been rated as Neutral or Pleasant were used as supplemental stimuli (ten each, coming from the top-rated IAPS pictures in each category in Experiment 1) to both break up the presentation of uncanny stimuli as well as afford comparative biophysical reactions to "known" stimuli in comparison with uncanny stimuli (Appendix L). The PowerPoint slideshow was self-advancing, requiring no movement or effort on the part of the participant.

Equipment and Software

The Biopac MP-35 system, which contains an electrocardiogram (ECG), electroencephalogram (EEG), and respiration monitoring capability was selected because the Biopac system allows for high-pass filtering for artifact removal in addition to providing the ability to vary sample rates,

pause, mark stimuli or event presentation, and provide real-time monitoring ability through the Biopac interface. Because it was desirable to have minimal movement from the participants during viewing, marking stimuli change for later matching was a necessary feature. The limitation to the Biopac's functionality was primarily in the EEG collection, which is a two-electrode (plus ground) configuration for the occipital lobe, where an EEG which allowed for sampling more specific events particular to other areas of the brain would have been preferred. The Biopac's EEG allows for a degree of measure of visual workload as sampling occurred.

The Arrington monocular PC-60 with Viewpoint software was used because it provided monocular tracking, which was less intrusive and allowed for faster adaptation than binocular head-mounted systems; additionally, the PC-60 has an easy calibration interface, and confirmation of calibration can be quickly ascertained and re-conducted, if necessary. Further, the Viewpoint software allows a scene camera to show what the user is seeing, as well as allowing for gazepoint overlay; this was felt to be important because it allowed for eye movements to not only be matched to the second, but to allow for monitoring of participant re-positioning, which proved to be an important asset.

Procedure

The current experiment obtained subjective ratings from participants in an effort to define a constellation of behavioral and physiological responses that can be said to uniquely define the human response to the uncanny valley. All participants were tested individually in three sessions that lasted no more than 120 minutes. In Session 1, all participants logged into the UCF Psychology Research Participation System – Sona System – from a location of their choosing and were provided with a link (https://www.surveymonkey.com/s/6H2BTJW) to the Pre-Session Questionnaire hosted at Survey Monkey (www.surveymonkey.com). After obtaining informed consent, participants completed a demographics questionnaire, the HEXACO, and the ATS. Once participants had completed the Pre-Session Questionnaire in its entirety, they were allowed to sign-up and schedule a time to take part in the laboratory-based Session 2.

In Session 2, participants came into the lab located in the Psychology building on UCF's Main Campus, where they agreed to the application of Biopac MP-35 sensors (3 EEG leads [two live, one ground], 3 ECG [two live, one ground], and a respiratory effort transducer) and the wearing of the Arrington monocular PC-60 head mounted eye tracker. Once fitted with the sensors and eye tracker, participants were read detailed instructions regarding remaining still while the images that they would be viewing were shown to allow for accurate recording of biophysical measures. Instructions identical to the instructions previously given were also displayed on the computer monitor prior to the presentation of the first image. Participants were then asked if they had any questions, and were told that the experimenter would not be able to answer questions once they began viewing the experimental images, but would again be able to answer questions after the viewing had ended.

After collecting a baseline reading for each participant, participants viewed a total of 40 images (one at a time). During the experimental protocol, one image appeared on the monitor and remained for 1.5 second, followed by a mask image (see Appendix) for 4 seconds.

Following the completion of the laboratory-based experimental protocol of Session 2, participants were both debriefed and thanked for their time and participation. After debriefing, and prior to their departure from the lab, participants were directed to a Post-Session Questionnaire online (hosted at surveymonkey.com) where they were asked to provide additional ratings and free response for each of the 20 images viewed in Session 2.

In Session 3, all participants accessed the Post-Session Questionnaire hosted at Survey Monkey (www.surveymonkey.com) – from a location of their choosing via the link they were provided (https://www.surveymonkey.com/s/6Z3C86J) at the end of Session 2. During Session 3, participants were first asked to rate the extent to which each of the twenty images was found to be eerie, wrong, shocking, alarming, disgusting, unhealthy, and unnerving. Immediately following their ratings, participants were given the chance to describe each image in their own words in a free-response text box. The purpose of the free response was to gain insight into idiosyncratic responses with respect to expectations, templature, scenario processing, and so forth that would be unique to an individual, gender, age group, culture, or other grouping.

Following the completion of the experimental protocol, participants were once again thanked for time and their participation.

CHAPTER SIX: EXPERIMENT 2 - RESULTS

Measures

The HEXACO was scored in accordance with the scoring sheet (Appendix D); answers were reverse-scored where instructed (indicated by 'R' following the question number on the scoring key), and the seven scales (HEXACO-six plus Altruism) were used to generate an operational definition of Personality for use in this analysis. In addition, for Experiment 2, the Anthropomorphic Tendencies Scale (ATS) was again used to generate an operational definition of the anthropomorphizing personality for empirical use. Also used were: EEG – taken as an occipital activity measure only as a limitation of the Biopac equipment; this is a measure of visual processing workload and cannot be expanded to infer status in other areas; ECG – collected as a measure of workload in a change against baseline for each stimuli. In this setting, workload may imply physical effort exerted during mental accommodation; Respiration – taken as a measure of workload and relaxation states; Gaze Point – collected as a measure of attentional focus.

Experiment 2: Biopac Results

Stepwise Regression: Exploring Variance in Physiological Responses Explained by IVs

A series of multiple regression correlation analyses with stepwise entry of variables were conducted to test if personality, anthropomorphic tendencies, and video game exposure predicted participant's physiological responses (brain activity, heart rate, and respiration) to uncanny, neutral, and pleasant images. For each regression conducted, the physiological measure was regressed onto personality traits (Honesty-Humility (H), Emotionality (E), Extraversion (X), Agreeableness (A), Conscientiousness (C), and Openness to Experience (O)); anthropomorphic

tendencies (Extreme Anthropomorphism, Anthropomorphism of Pets, Anthropomorphism towards Gods or Deities, and Negative Anthropomorphism), and video game exposure (Enjoyment, Expertise, Hours/Week, Years Playing, and Age First Played). All data were analyzed using IBM SPSS Statistics v. 19 (SPSS, 2010), with an alpha level set to .05, unless otherwise indicated.

The first regression exploring the relationship between brain activity in the occipital lobe (EEG) and uncanny images indicated that of the 16 predictors, only 2 were able to predict brain activity. The first model, which only included Anthropomorphism of Pets as a predictor, accounted for a significant R^2 of 18.1% of the variance in brain activity , F (1, 20) =4.42, p < . 048. After entry of Anthropomorphism towards Gods or Deities into the model, the total variance explained by the model as a whole was 43.6%, F (2, 19) =7.34, p < .004.

The second and third regressions exploring the relationship between brain activity in the occipital lobe (EEG) and neutral and pleasant images, respectively, indicated that of the 16 predictors, none were able to predict brain activity.

All three regressions exploring the relationship between electrical activity of the heart (ECG) and uncanny, neutral and pleasant images indicated that of the 16 predictors, none were able to predict heart rate.

The first regression exploring the relationship between respiration and uncanny images indicated that of the 16 predictors, only 1 was able to predict respiration. This model, which only included

Openness to Experience, accounted for a significant R^2 of 27.5% of the variance in respiration, F (1, 20) =7.603, $p < .012$. The second regression exploring the relationship between respiration and neutral images indicated only Openness to Experience was able to predict respiration; this model accounted for a significant R^2 of 20.5% of the variance in brain respiration, F (1, 20) =5.147, $p < .035$. The third regression exploring the relationship between respiration and neutral images indicated only Openness to Experience was able to predict respiration; this model accounted for a significant R^2 of 19.6% of the variance in brain respiration, F (1, 20) =4.86, $p < .039$.

Exploratory One-Way ANOVAS: Comparing Physiological Responses Based on Image Type

A series of sixty-three one-way between groups ANOVAs were conducted to explore the impact of level of extreme anthropomorphism, level of anthropomorphism of pets, level of anthropomorphism of gods and/or deities, level of emotionality, level of openness, level of enjoyment in playing video games, and the age at which participants first played video games on physiological responses (EEG, ECG, and Respiration) to uncanny, neutral and positive images. The means and standard deviations are presented in Table 5. Abbreviated results for all one-way between groups ANOVAs can be found in Appendix M, only those analyses that had a significant F-test are presented below.

Table 5: Descriptive Statistics for Physiological Reactions to Uncanny, Neutral and Pleasant Images

Physiological Reaction	N	Mean	Standard Deviation
EEG (Uncanny)	22	0.1142	1.66
EEG (Neutral)	22	-0.1837	2.368
EEG (Pleasant)	22	0.1185	1.674
ECG (Uncanny)	22	0.004	0.0016
ECG (Neutral)	22	0.003	0.0019
ECG (Pleasant)	22	0.003	0.739
Respiration (Uncanny)	22	-0.8662	0.7390
Respiration (Neutral)	22	-0.8037	0.7609
Respiration (Pleasant)	22	-0.9977	0.8883

A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was a statistically significant difference at the $p < .05$ level in EEG responses for the three groups: F (2, 19) = 4.093, p = .033, η^2 = .301. Post-hoc comparisons using the Tukey HSD test indicated that the mean EEG response for individuals who scored high on the tendency to anthropomorphize pets (M = 1.42, SD = 2.08) was significantly different from individuals who scored moderately on the tendency to anthropomorphize pets (M = -1.02, SD = 1.33). Individuals who scored low on the tendency to anthropomorphize pets (M = 0.26, SD = 1.21) did not differ significantly from either high or moderate scoring individuals.

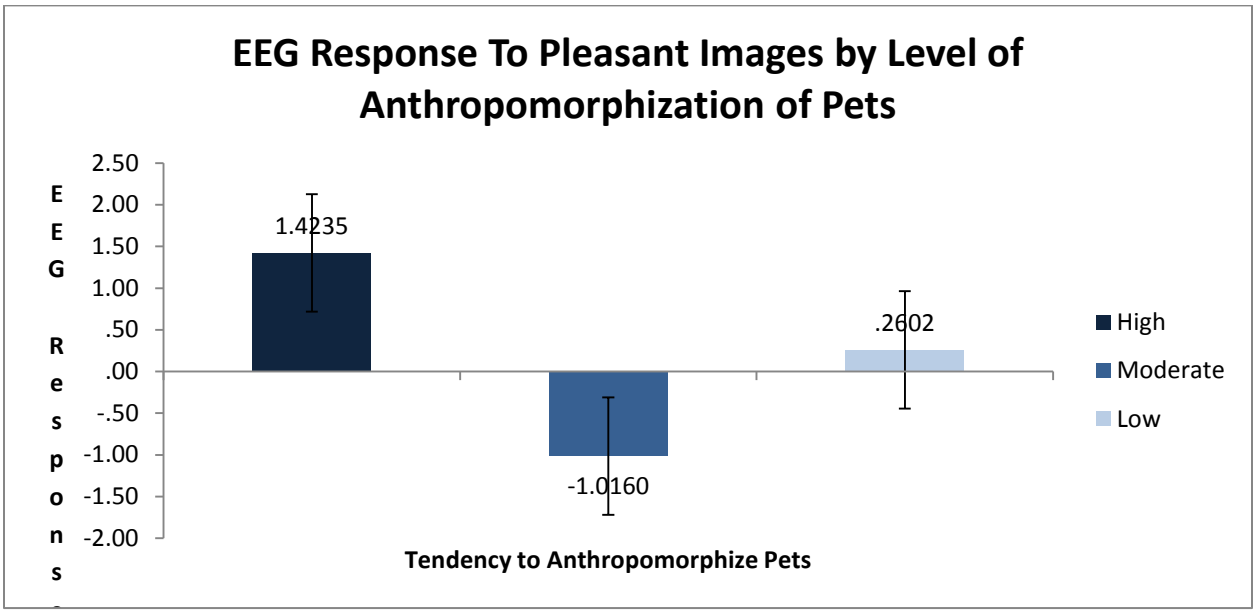


Figure 3: One-Way ANOVA of EEG by Level of Anthropomorphization of Pets

A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was a statistically significant difference at the $p < .05$ level in EEG responses for the three groups: F (2, 19) = 4.95, p = .019, η^2 = .343. Post-hoc comparisons using the Tukey HSD test indicated that the mean EEG response for individuals who scored high on the tendency to anthropomorphize pets (M = 1.83, SD = 1.54) was significantly different from individuals who scored moderately on the tendency to anthropomorphize pets (M = -0.63, SD = 1.60) and individuals who scored low on the tendency to anthropomorphize pets (M = -0.23, SD = 1.21). Additionally, individuals who scored low on the tendency to anthropomorphize pets did not differ significantly from moderate scoring individuals.

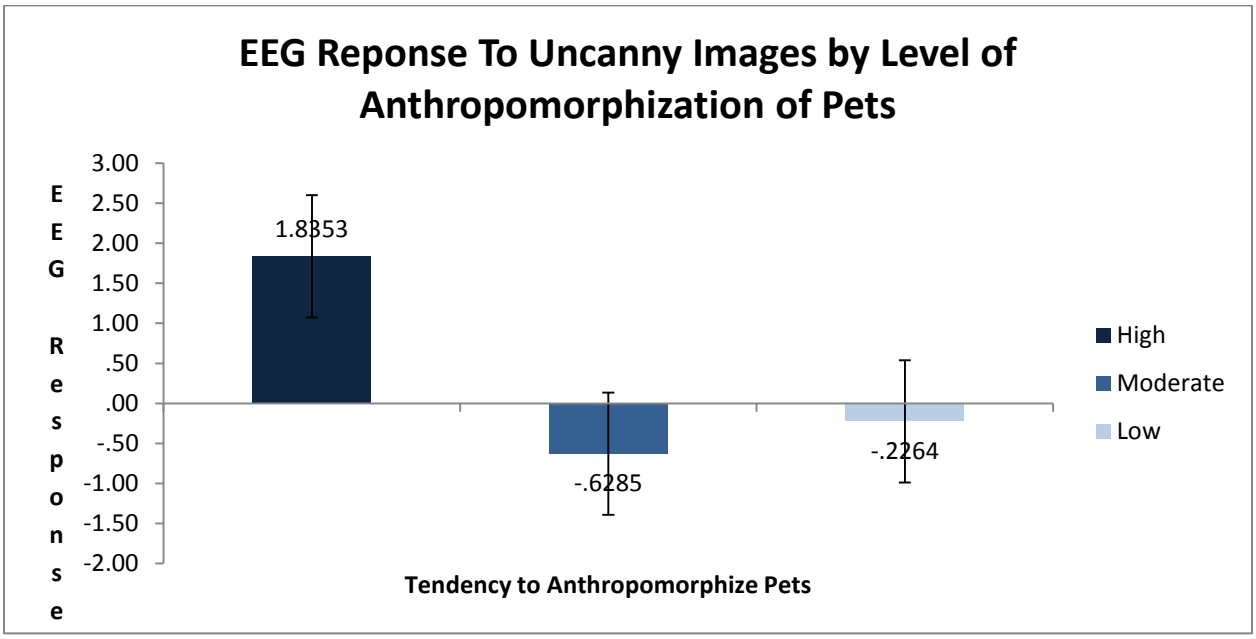


Figure 4: One-Way ANOVA of EEG Responses by Level of Anthropomorphization of Pets

A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on respiration when viewing neutral images. There was a statistically significant difference at the $p < .05$ level in respiration responses for the three groups: F (2, 19) = 3.93, p = .037, η^2 = .293. Post-hoc comparisons using the Tukey HSD test were not performed due to the fact that one of the groups contained fewer than two individuals. Three independent-samples t-tests were conducted to compare respiration responses for individuals who scored high, moderate, or low on the emotionality scale of the HEXACO. There was a significant difference in respiration response for high emotionality individuals (M = -1.19, SD = 0.72) and moderate emotionality individuals, M = -0.44, SD = 0.62; t (19) = -2.56, p = 0.02 (two-tailed). There was no significant difference in respiration response for high emotionality individuals and low emotionality individuals, M = -0.06, SD = 0.00; t (10) = -1.52, p = 0.16 (two-tailed). There was no significant difference in respiration response for moderate emotionality individuals and low emotionality individuals; t (9) = -.59, p = 0.56 (two-tailed).

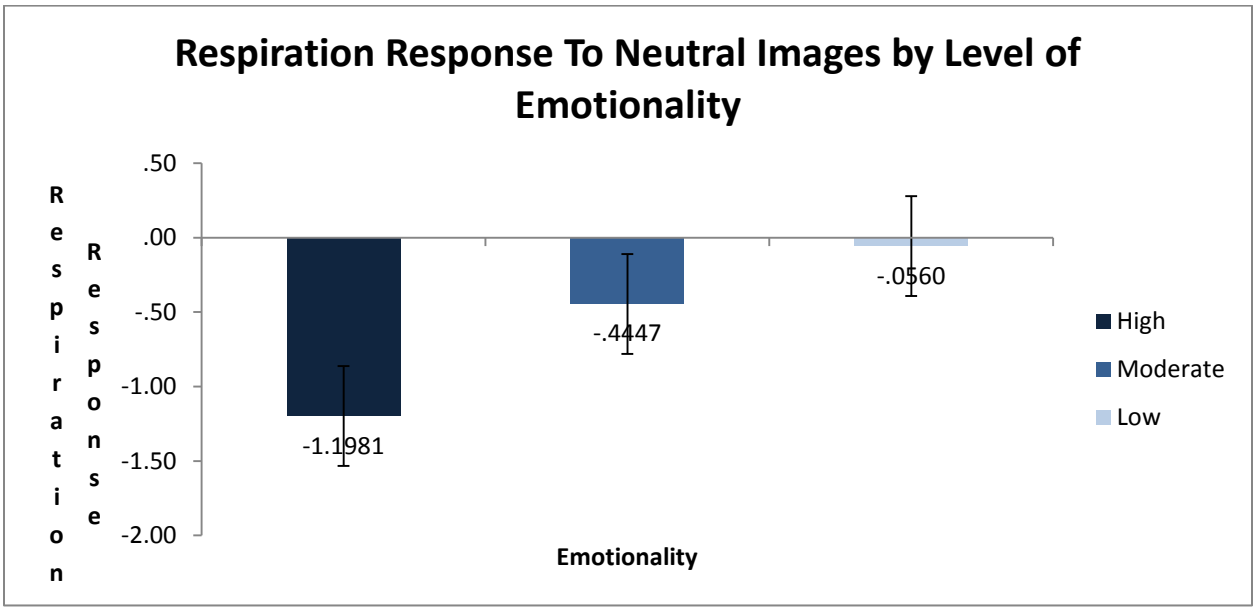


Figure 5: One-Way ANOVA of Respiration Response by Level of Emotionality

A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on respiration when viewing pleasant images. There was a statistically significant difference at the $p < .05$ level in respiration responses for the three groups: F (2, 19) = 3.53, p = .050, η^2 = .271. Post-hoc comparisons using the Tukey HSD test were not performed due to the fact that one of the groups contained fewer than two individuals. Three independent-samples t-tests were conducted to compare respiration responses for individuals who scored high, moderate, or low on the emotionality scale of the HEXACO. There was a significant difference in respiration response for high emotionality individuals (M = -1.24, SD = 0.71) and moderate emotionality individuals, M = -0.52, SD = 0.61; t (19) = -2.46, p = 0.02 (two-tailed). There was no significant difference in respiration response for high emotionality individuals and low emotionality individuals, M = -0.21, SD = 0.00; t (10) = -1.38, p = 0.19

(two-tailed). There was no significant difference in respiration response for moderate emotionality individuals and low emotionality individuals; t (9) = -0.48, p = 0.64 (two-tailed).

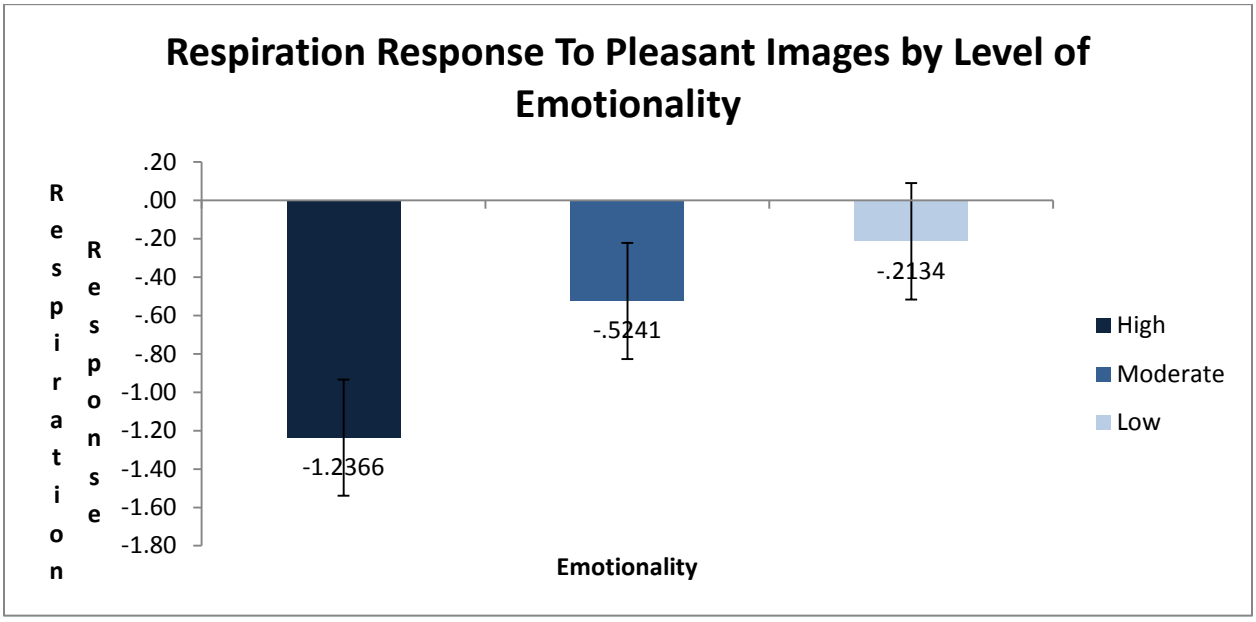


Figure 6: One-Way ANOVA of Respiration Response by Level of Emotionality

A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on respiration when viewing uncanny images. There was a statistically significant difference at the $p < .05$ level in respiration responses for the three groups: F (2, 19) = 4.46, p = .026, η^2 = .319. Post-hoc comparisons using the Tukey HSD test indicated that the mean respiration response for individuals who scored first began playing video games in adulthood (M = -2.47, SD = 0.35) was significantly different from individuals who first began playing in their teens (M = -0.66, SD = 0.88) and from those individuals who first began playing as young children (M = -0.98, SD = 0.72). Individuals who first began playing in their teens did not differ significantly from those that began playing video games as young children.

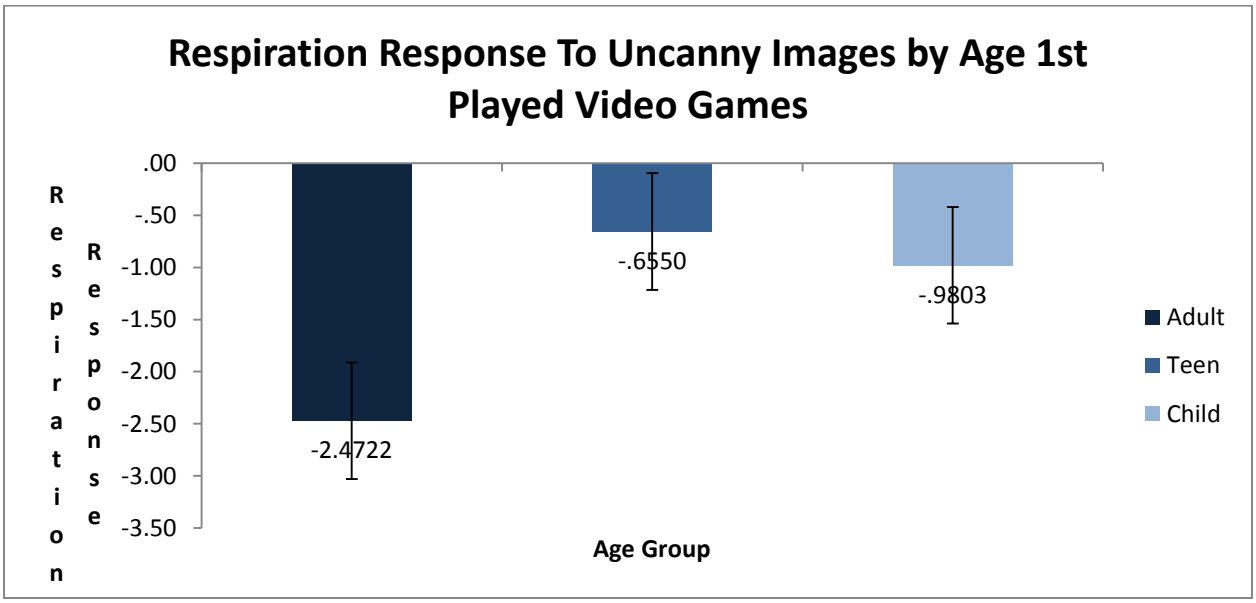


Figure 7: -Way ANOVA of Respiration Response by Age 1st Played Video Games

Exploratory Mixed Between-Within ANOVAS: Comparing Differences in Physiological Responses to Images by Individual Traits

A series of twenty-one mixed between-within ANOVAs were conducted to explore the impact of level of extreme anthropomorphism, level of anthropomorphism of pets, level of anthropomorphism of gods and/or deities, level of emotionality, level of openness, level of enjoyment in playing video games, and the age at which participants first played video games on physiological responses (EEG, ECG, and Respiration) to uncanny, neutral and positive images. Abbreviated results for all mixed-model ANOVAs can be found in Appendix N; only those analyses that had a significant F-test are presented below.

A 3 (level of openness: high, moderate, and low) by 3 (ECG responses to three types of images: neutral, pleasant, and uncanny) mixed-model ANOVA, where level of openness was between-

subjects and ECG responses to type of image was within-subjects, was conducted to assess the impact of an individual's openness on ECG reactivity to images. There was a significant main effect for ECG responses, Wilks' Lambda = 0.58, F (2, 18) = 6.48, p = 0.008, η^2 = 0.419. However, these results were qualified by a significant interaction between level of openness and ECG responses, Wilks' Lambda = 0.53, F (4, 36) = 3.35, p = 0.02, η^2 = 0.271. Post-hoc comparisons were performed using the Bonferroni adjusted α level for multiple comparisons (i.e., .05 divided by 3 analyses) of 0.017. The mean ECG response for individuals viewing pleasant images (M = 0.0037, SD = 0.0019) was significantly different from individuals viewing uncanny images, M = 0.0041, SD = 0.0022, p = 0.005. The mean ECG response for individuals viewing neutral images (M = 0.0037, SD = 0.0016) was not significantly different from individuals viewing pleasant images (p = 0.375). The mean ECG response for individuals viewing neutral images was not significantly different from individuals viewing uncanny images (p = 0.343). These findings, further clarified by plots examining the relationship between level of openness and ECG responses (see Figure 8), suggest that individuals who scored low on the openness scale of the HEXACO exhibited greater differences in ECG reactivity to the three types of images ($M_{neutral}$ = 0.0028, $M_{pleasant}$ = 0.000 , $M_{uncanny}$ = 0.0045), than those who scored high ($M_{neutral}$ = 0.0041, $M_{pleasant}$ = 0.0040 , $M_{uncanny}$ = 0.0043), or moderate ($M_{neutral}$ = 0.0032, $M_{pleasant}$ = 0.0038 , $M_{uncanny}$ = 0.0036) on the same trait.

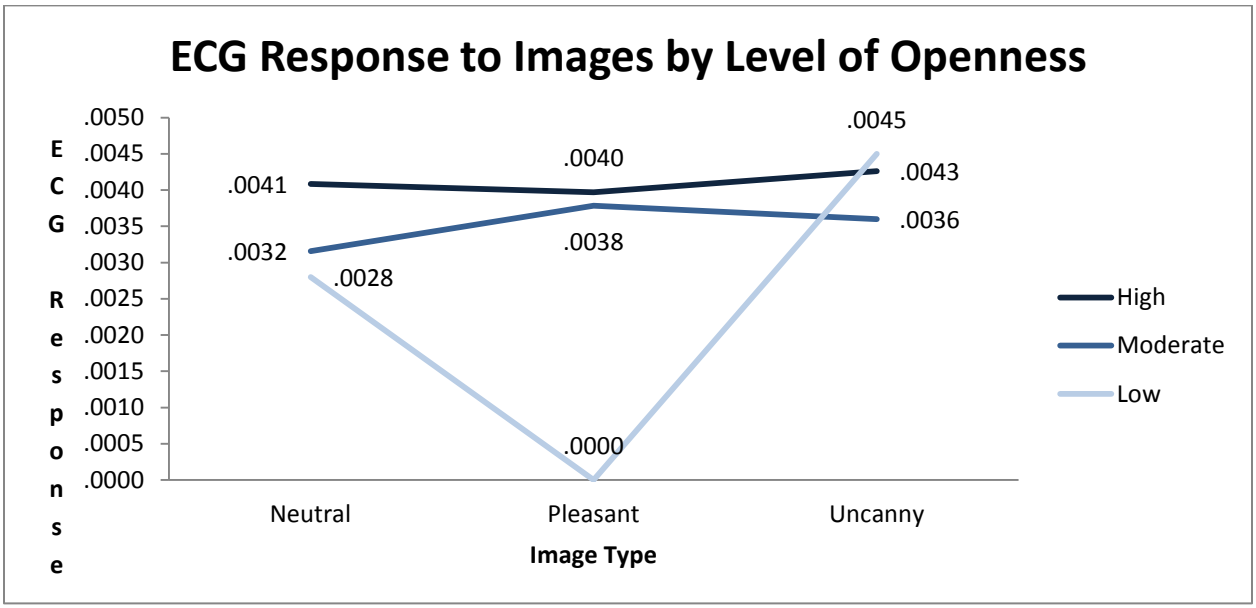


Figure 8: Mixed-Model ANOVA of ECG Response by Level of Openness

A 3 (level of extreme anthropomorphism: high, moderate, and low) by 3 (respiration responses to three types of images: neutral, pleasant, and uncanny) mixed-model ANOVA, where level of extreme anthropomorphism was between-subjects and respiration responses to type of image was within-subjects, was conducted to assess the impact of an individual's extreme anthropomorphic tendencies on respiration reactivity to images. There was a significant main effect for respiration responses, Wilks' Lambda = 0.49, F (2, 18) = 9.17, p = 0.002, η^2 = 0.505. However, these results were qualified by a significant interaction between level of extreme anthropomorphism and respiration responses, Wilks' Lambda = 0.59, F (4, 36) = 2.69, p = 0.05, η^2 = 0.23. Post-hoc comparisons were performed using the Bonferroni adjusted α level for multiple comparisons of 0.017. The mean respiration response for individuals viewing neutral images (M = -0.8037, SD = 0.7609) was significantly different from individuals viewing uncanny images (M = -.0997, SD = 0.8884, p = 0.001). The mean respiration response for individuals viewing pleasant images (M = -

0.8662, *SD* = 0.7390) was nearly significantly different from individuals viewing uncanny images (*p* = 0.018). The mean respiration response for individuals viewing neutral images was not significantly different from individuals viewing pleasant images (*p* = 0.724). These findings, further clarified by plots examining the relationship between level of extreme anthropomorphism and respiration responses (see Figure 9), suggest that individuals who scored low on the extreme anthropomorphism measure of the Anthropomorphism Tendencies Scale exhibited greater differences in respiration reactivity to the three types of images ($M_{neutral}$ = -0.9799, $M_{pleasant}$ = -1.1002, $M_{uncanny}$ = -1.8785), than those who scored high ($M_{neutral}$ = -0.7942, $M_{pleasant}$ = -0.8573 , $M_{uncanny}$ = -0.9080), or moderate ($M_{neutral}$ = -0.7402, $M_{pleasant}$ = -0.7608 , $M_{uncanny}$ = -0.9187) on the same measure.

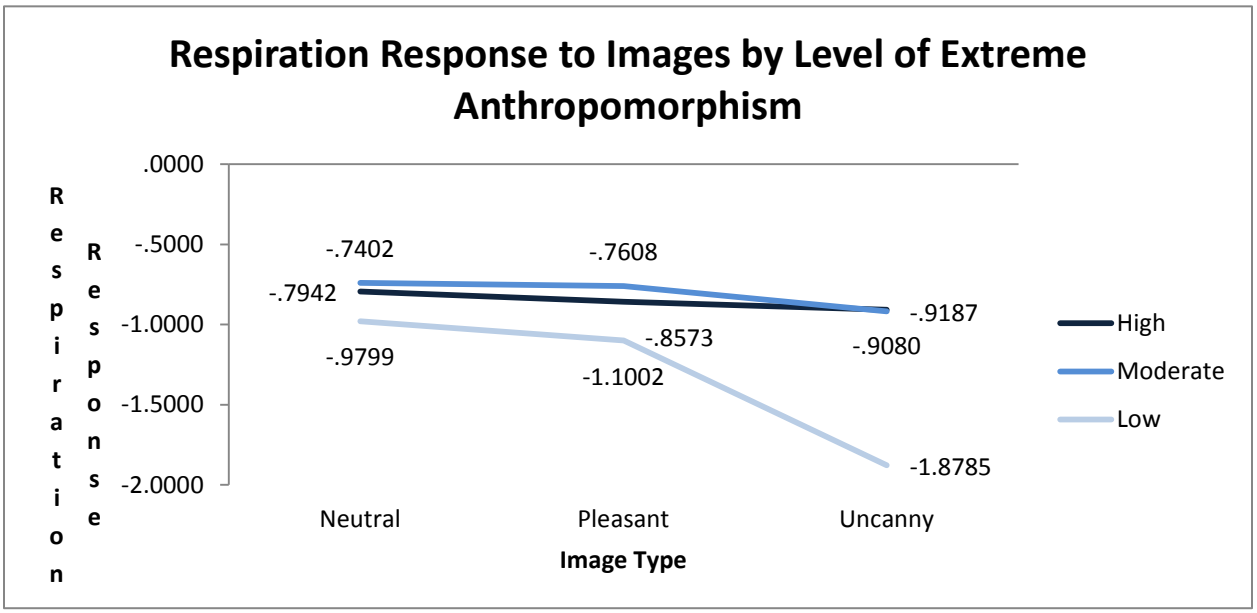


Figure 9: Mixed-Model ANOVA of Respiration Response by Level of Extreme Anthropomorphism

A 3 (level of anthropomorphism of God/Deities: high, moderate, and low) by 3 (respiration responses to three types of images: neutral, pleasant, and uncanny) mixed-model ANOVA, where

level of anthropomorphism God/Deities was between-subjects and respiration responses to type of image was within-subjects, was conducted to assess the impact of an individual's anthropomorphic tendencies of God/Deities on respiration reactivity to images. There was a significant main effect for respiration responses, Wilks' Lambda = 0.42, F (2, 18) = 12.65, p = 0.000, η^2 = 0.584. However, these results were qualified by a significant interaction between level of extreme anthropomorphism and respiration responses, Wilks' Lambda = 0.43, F (4, 36) = 4.78, p = 0.003, η^2 = 0.347. Post-hoc comparisons were performed using the Bonferroni adjusted α level for multiple comparisons of 0.017. The mean respiration response for individuals viewing neutral images (M = -0.8037, SD = 0.7609) was significantly different from individuals viewing uncanny images (M = -.0997, SD = 0.8884, p = 0.000). The mean respiration response for individuals viewing pleasant images (M = -0.8662, SD = 0.7390) was significantly different from individuals viewing uncanny images (p = 0.003). The mean respiration response for individuals viewing neutral images was not significantly different from individuals viewing pleasant images (p = 1.000). These findings, further clarified by plots examining the relationship between level of anthropomorphism of God/Deities and respiration responses (see Figure 10), suggest that individuals who scored low on the anthropomorphism of God/Deity measure of the Anthropomorphism Tendencies Scale exhibited greater differences in respiration reactivity to the uncanny images ($M_{neutral}$ = -0.8563, $M_{pleasant}$ = -0.9201, $M_{uncanny}$ = -1.8558), than those who scored high ($M_{neutral}$ = -0.8178, $M_{pleasant}$ = -0.9040 , $M_{uncanny}$ = -0.9693), or moderate ($M_{neutral}$ = -0.7404, $M_{pleasant}$ = -0.7314 , $M_{uncanny}$ = -0.7395) on the same measure.

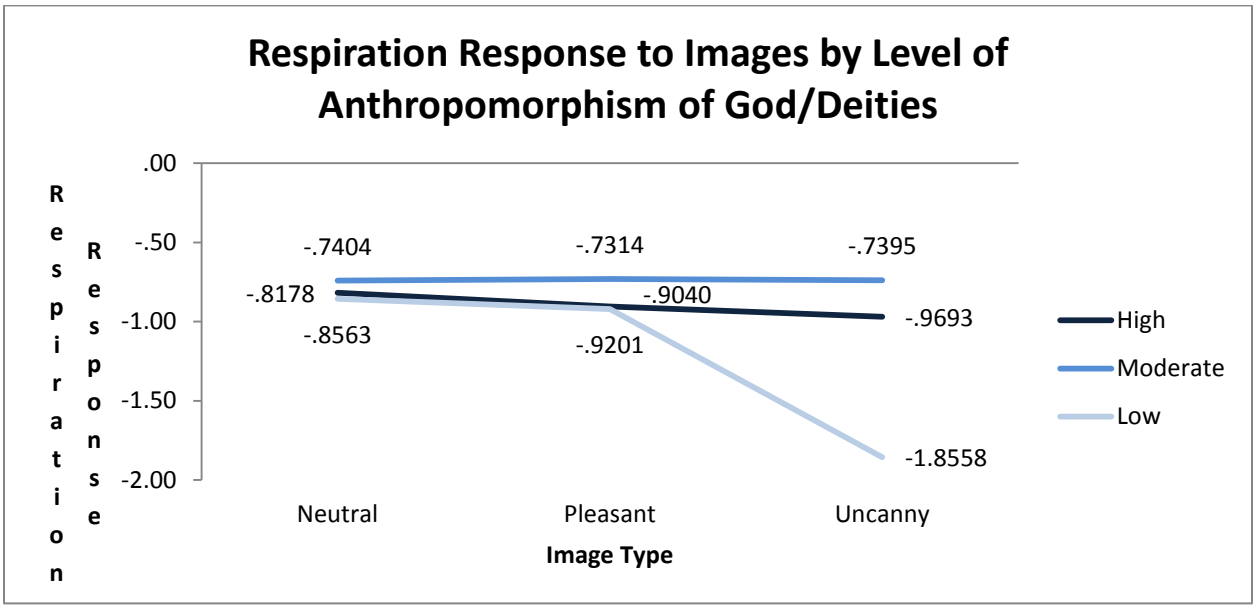


Figure 10: Mixed-Model ANOVA of Respiration Response by Level of Anthropomorphism of God/Deities

Z-Score Analysis: Examining Physiological Responses to Images

Each participant's mean score across all stimuli was obtained for each of the biophysical measures. Z-scores were then calculated for the participant's reaction to each of the individual stimuli presented. Z-scores in the neighborhood of two standard deviations from the mean were identified as unusual reactions for the participant. The significant z-scores are presented in Tables 6 - 13.

Uncanny images were appearing at stimulus numbers 3, 4, 7, 10, 12, 14, 15, 16, 18, 21, 23, 24, 27, 28, 31, 34, 35, 37, 38, and 39 having been randomly positioned in the presentation order. Image three was the first uncanny picture presented, depicting a supine humanoid figure that is a piece of artwork on display, but attained ratings of being uncanny in Experiment 1 of over 90%. During this stimulus, one participant showed a decrease in respiration ($z = -2.65$), while another participant displayed a large change in ECG ($z = 2.32$), and three others showed large decreases

in EEG frequency (z = -2.18, -1.96, -3.20), and two others showed decreases in EEG Delta (z = -2.18, -2.40). Stimulus image three provides a good example of the lack of uniformity across individuals with respect to biophysical measures, and it is recommended that a larger *n* and higher-capability EEG at minimum be used to better ascertain the nature of the reactions observed.

Participants had some reactions to pictures that were not uncanny; for example, in the random ordering, the first stimulus presented was that of a stimulus that had been previously established at Neutral. Observing that multiple participants had a biophysical reaction, it was determined that this was in all likelihood a "novelty effect" at the appearance of the first stimuli, or, conversely, participants may have been apprehensive regarding the experimentation process.

Image two was a neutral image of a man and child playing. One participant displayed a large ECG change (z = 2.08) and another participant had a significantly lower rate of respiration (z = -2.08); One participant had unusually low respiration for both images two (z = -2.08) and three (z = -2.65), perhaps indicating a state of relaxation. One participant had unusually low respiration for image 4 (z = -3.21), while two others had unusually high respiration (z = 2.24, 2.27). Taken in total, respiration in comparison to images displayed, the participant's baseline, the other biophysical measures, and the total participant pool tend towards unremarkable occurrences on all counts. For this reason, respiration would not be pursued as an avenue of enquiry in the future, at least not at the expense of other, possibly more viable, measures. In this instance, respiration appears to have not provided much in the way of insight into emotional state or mental workload.

Table 6: Unusually High z-scores for Respiration

#	Image	z-score	#	Image	z-score
1		5.09 *	19		2.07
4		2.24, 2.27 *	22		1.97
5		2.41	23		2.07 *
8		2.13	24		2.3
10		2.22	27		2.75
11		1.97	33		1.97, 2.25
16		2.11	34		6.07, 1.97
17		1.97	35		1.97, 2.30, 2.46

Note. * Also has a low score.

Table 7: Unusually Low z-scores for Respiration

#	Image	z-score	#	Image	z-score
1		-2.25, -2.31, -2.33 *	23		-2.07 *
2		-2.08	29		-2.8
3		-2.65	30		-2.39
4		-3.21 *	31		-3.14
6		-2.24	32		-2.3
7		-2.62, -2.79, -2.09	40		-2.15, -1.98, -2.05
12		-2.85, -2.28			

Note. * Also has a high score.

Table 8: Unusually High z-scores for the Change in ECG

#	Image	z-score	#	Image	z-score
1		2.01	19		3.06
2		2.08	21		2.02, 2.18 *
3		2.32	22		2.11
4		2.15	25		2.11
7		2.61, 2.48	28		2.60, 2.53
8		2.70, 2.11	32		3.32, 2.08
9		2.11	33		2.15
11		2.49	34		2.9
13		3.14	37		3.02
14		2.37, 2.35	38		2.11, 2.02, 3.12
15		2.58, 2.49	39		2.8
17		2.11	40		2.48, 2.79, 2.18

Note. * Also has a low score.

Table 9: Unusually Low z-scores for the Change in ECG

#	Image	z-score	#	Image	z-score
12		-2.34	29		-2.49 same participant for all four
16		-2.34	30		-2.49
21		-2.34 *	31		-2.49
26		-2.51	32		-2.49

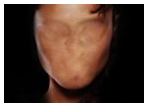
Note. * Also has a high score.

Table 10: Unusually High z-scores for EEG Frequency

#	Image	z-score	#	Image	z-score
1		2.28, 2.42, 2.32 *	18		2.28, 2.41 *
4		2.16, 2.61, 2.90	19		3.08
7		2.14	32		2.46
16		2.06	37		3.05

Note. * Also has a low score.

Table 11: Unusually Low z-scores for EEG Frequency

#	Image	z-score	#	Image	z-score
1		-2.45 *	21		-2.08, -1.96
3		-2.18, -1.96, -3.20	22		-2.91, -2.10, -3.76
5		-2.36, -2.18, -2.08, -2.43, -2.64	26		-2.36, -2.45
6		-4.02, -4.38, -2.10, -4.32, -2.43	27		-2.36, -4.51, -2.10
7		-1.96 *	29		-2.18
8		-3.66	31		-2.55
9		-2.45, -1.96, -2.43	32		-2.36, -2.55, -2.10, -2.64, -3.48
10		-2.08	34		-2.55
12		-3.66, -3.76	35		-2.55, -2.18 *
13		-2.45, -1.96, -3.20	37		-2.36, -2.55, -2.10, -2.43, -2.64
14		-2.91	39		-1.96, -3.09, -2.10, -3.48
17		-2.18	40		-2.08 *

18		-2.08 *

Note. * Also has a high score.

Table 12: Unusually High z-scores for EEG Delta

#	Image	z-score	#	Image	z-score
4		2.21 *	22		2.00, 2.30
5		2.29	24		2.06, 2.51
8		2.09	26		2.37, 2.33
10		2.04	27		2.21 *
11		2.27 *	30		1.96, 2.06
18		2.24	34		2.87 *
19		2.04	35		3.34, 2.71

Note. * Also has a low score.

Table 13: Unusually Low z-scores for EEG Delta

#	Image	z-score	#	Image	z-score
1		-2.06, -2.55	20		-2.03
3		-2.18, -2.40	21		-2.93 *
4		-1.96 *	27		-2.00, -2.46 *
11		-2.16 *	34		-2.60 *
13		-1.95	37		-2.32

Note. * Also has a high score.

With respect to the interplay between HEXACO type, ATS score, and biophysical response, a regression analysis was run with the personality factors of the HEXACO and ATS as predictors of the number of uncanny pictures that would be related to a biophysical reaction in an individual. The model provided a good fit ($R = .962$) and was significant ($F = 11.33$, $p < .05$). The significant predictors were HON_HUM ($p = .007$), EMOT ($p = .017$), EXTRO ($p = .013$), CONSC ($p < .05$), and ATS_F4 (Negative Anthropomorphism) ($p = .029$). Thus, individuals higher in Honesty/Humility had a tendency to have physiological reactions to more uncanny stimuli than individuals low on this trait, and again the role of Emotionality shows an influence. Extroversion, Conscientiousness, and Negative Anthropomorphism taken together complete the personality components. Further investigation would need to be undertaken to better explain the contributions required, but the traits unique to Emotionality compounded with a form of

anthropomorphism appear to again demonstrate a level of relationship to the experience of uncanny stimuli. It is possible that the HEXACO trait of Honesty (see HEXACO descriptors, Appendix C) may in some way mediate the biophysical expression or the subjective visceral perception of the stimuli, but this possibility would require specific investigation and remains simply speculation at this stage. The stimuli to which the participants had greatest response (seven uncanny images) all centered around death, the threat of death, or mismatched/absent facial features (e.g., comparatively larger eyes/missing eyes).

Eyetracking

The eye data collected suffered from multiple issues; foremost was a loss of data during collection due to the Arrington's .acq file being too large to continue recording while running two participants. A decision was made due to the low participant turnout to continue collecting Biopac data when the eye tracker advised it was low on memory, so as not to lose any further participants. There was a second participant immediately after the partially-recorded participant, so that participant was also run with partially incomplete eye data.

After additional memory was obtained and the files were taken off the host computer, this left a total of twenty potentially valid participants with eye data collected. Of these remaining twenty, one had to be eliminated completely due to continual movement throughout the stimuli presentation, resulting in a complete loss of calibration. Further matching between HeadScene camera and x-y shifts revealed that multiple participants had changed their head position from the point of calibration, some of them several times. After attempts to manually perform a

translation in coordinates to accommodate head movement proved unreliable, it was determined that low turnout, equipment issues, and attrition had already impacted statistical power enough that eye data results would not be able to be analyzed in any statistically valid manner. In future efforts for data collection, it might be advisable to use a chin rest or provide a "trial run" of stimuli presentation to acclimate the participant to remaining still, as it appeared that while all participants were capable of following the direction to remain still after post-calibration and during stimulus presentation (approximately eight minutes), some participants were unaware that what they thought to be minimal movement had the result of skewing their eye calibration. During the running of the stimuli, the Biopac marking (for stimulus change) was being constantly attended to, which resulted in minor head movements being missed.

Data collected from the eye tracker was limited to participants whose calibration remained steady throughout the session whose data was not compromised in any way requiring interpretation or translation. This group consisted of eight participants; these participants, although below a significant number, did exhibit a few noteworthy patterns to their fixations (see Tables 14 – 16 for means, standard deviations, and range of fixation per image). Also of interest overall is that participants fixated longest for pleasant stimuli (M = 4.793), particularly food, followed by time spent on neutral stimuli (M = 4.049). The least amount of time was spent in fixations upon uncanny stimuli (M = 3.638).

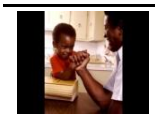
Table 14: Neutral Image Fixations

Image	Slide Position	All Fixations	First Fixation	Final Fixation

	1	Mean (SD)	2.826 (2.38)	2.629 (1.99)	3.363 (2.68)
		Range	.635 - 6.481	.783 - 5.731	.049 - 7.230
	8	Mean (SD)	9.508 (17.87)	9.189 (17.63)	9.916 (18.08)
		Range	.363 - 52.427	.016 - 51.661	.050 - 53.194
	13	Mean (SD)	1.985 (1.74)	1.693 (1.45)	2.449 (2.08)
		Range	.232 - 4.773	.066 -4.014	.033 - 5.531
	17	Mean (SD)	2.968 (3.68)	2.984 (3.45)	3.204 (4.03)
		Range	.046 - 11.545	.016 - 10.795	.066 - 12.294
	19	Mean (SD)	1.295 (1.11)	1.283 (1.34)	1.691 (1.36)
		Range	.199 - 3.715	.033 - 3.648	.100 - 4.464
	20	Mean (SD)	3.987 (4.00)	3.658 (3.81)	4.352 (4.34)
		Range	.395 - 10.254	.016 - 9.513	.016 - 11.01
	26	Mean (SD)	4.502 (7.38)	3.937 (7.27)	4.881 (7.61)
		Range	.201 - 22.482	.316 - 21.741	.066 - 23.22
	30	Mean (SD)	2.851 (3.41)	2.434 (3.17)	3.453 (3.55)
		Range	.438 - 10.521	.233 - 9.762	.100 - 11.278
	33	Mean (SD)	3.452 (3.63)	3.604 (3.13)	3.789 (3.94)
		Range	.406 - 9.604	.316 - 8.846	.533 - 10.362
	40	Mean (SD)	2.909 (3.26)	2.648 (3.12)	2.484 (3.78)
		Range	.124 - 10.278	.016 - 9.529	.066 - 11.028

Note. *.

Table 15: Pleasant Image Fixations

Image	Slide Position		All Fixations	First Fixation	Final Fixation
	2	Mean (SD)	3.778 (4.44)	3.096 (4.39)	4.567 (4.42)
		Range	.607 - 13.053	.016 - 12.296	1.316 - 13.812
					

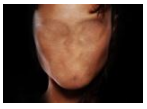
	5	Mean (SD)	5.966 (10.87)	5.714 (10.68)	6.351 (11.06)
		Range	.707 - 32.727	.133 - 31.969	.467 - 33.485
	6	Mean (SD)	6.849 (13.14)	6.616 (12.93)	5.949 (13.84)
		Range	.875 - 39.291	.116 - 38.533	.033 - 40.049
	9	Mean (SD)	10.366 (19.79)	11.138 (19.69)	10.268 (20.13)
		Range	.471 - 58.991	.483 - 58.241	.833 - 59.741
	11	Mean (SD)	3.744 (3.29)	3.904 (3.20)	3.607 (3.78)
		Range	.634 - 11.095	.733 - 10.362	.017 - 11.828
	22	Mean (SD)	4.361 (7.76)	4.284 (7.49)	4.702 (7.96)
		Range	.442 - 23.348	.016 - 22.640	.366 - 24.056
	25	Mean (SD)	3.708 (5.07)	3.553 (4.81)	3.946 (5.39)
		Range	.660 - 15.868	.416 - 15.127	.017 - 16.609
	29	Mean (SD)	3.928 (3.66)	3.511 (3.63)	3.723 (4.14)
		Range	.686 - 15.868	.017 - 11.412	.083 - 12.927
	32	Mean (SD)	2.264 (1.03)	1.643 (0.85)	2.913 (1.19)
		Range	.439 - 3.673	.233 - 2.915	.833 - 4.431
	36	Mean (SD)	2.370 (2.22)	2.384 (1.86)	2.751 (2.50)
		Range	.324 - 7.238	.466 - 6.480	.050 - 7.996

Note. *.

Table 16: Uncanny Image Fixations

Image	Slide Position	All Fixations	First Fixation	Final Fixation

	3	Mean (SD)	5.369 (7.67)	4.745 (7.57)	5.999 (7.76)
		Range	.575 - 19.625	.016 - 18.875	.549 - 20.375
	4	Mean (SD)	7.253 (9.78)	6.553 (9.74)	7.828 (9.92)
		Range	.899 - 26.164	.133 - 25.406	.266 - 26.922
	7	Mean (SD)	8.218 (15.29)	7.669 (15.18)	8.632 (15.49)
		Range	.652 - 45.872	.883 - 45.114	.166 - 46.629
	10	Mean (SD)	2.110 (1.67)	1.676 (1.66)	2.153 (1.85)
		Range	.249 - 4.015	.017 - 3.548	.083 - 4.765
	12	Mean (SD)	5.029 (6.06)	4.510 (5.90)	5.510 (6.29)
		Range	.638 - 17.676	.516 - 16.909	.050 - 18.442
	14	Mean (SD)	2.981 (3.62)	2.882 (3.30)	3.165 (4.01)
		Range	.378 - 11.33	.199 - 10.578	.183 - 12.095
	15	Mean (SD)	3.238 (3.32)	2.784 (3.06)	3.838 (3.46)
		Range	.314 - 9.979	.333 - 9.229	.633 - 10.728
	16	Mean (SD)	1.689 (1.47)	1.574 (1.29)	1.833 (1.83)
		Range	.385 - 4.486	.065 - 3.731)	.316 - 5.231
	18	Mean (SD)	2.254 (1.66)	1.812 (1.56)	2.403 (2.12)
		Range	.513 - 5.231	.699 - 4.465	.166 - 5.997
	21	Mean (SD)	5.234 (6.73)	4.758 (6.57)	5.641 (7.01)
		Range	.799 - 16.842	.049 - 16.093	.166 - 17.592
	23	Mean (SD)	5.417 (9.98)	4.760 (9.93)	6.109 (10.01)
		Range	.512 - 29.970	.266 - 29.221	.799 - 30.720
	24	Mean (SD)	6.836 (12.29)	6.459 (12.12)	7.191 (12.52)
		Range	.717 - 36.526	.017 - 35.768	.316 - 37.284

	27	Mean (SD)	3.287 (3.02)	2.825 (2.79)	3.835 (3.26)
		Range	.534 - 9.912	.166 - 9.163	.017 - 10.662
	28	Mean (SD)	2.215 (1.97)	1.651 (1.81)	2.717 (2.22)
		Range	.514 - 5.122	.066 - 4.364	.416 - 5.880
	31	Mean (SD)	2.481 (2.00)	2.272 (1.81)	2.838 (2.35)
		Range	.201 - 5.222	.366 - 4.464	.299 - 5.981
	34	Mean (SD)	4.309 (4.92)	4.521 (4.73)	4.802 (5.12)
		Range	.538 - 15.293	.166 - 14.543	.116 - 16.043
	35	Mean (SD)	3.091 (2.61)	2.638 (2.45)	3.451 (3.00)
		Range	.670 - 8.913	.016 - 8.163	.066 - 9.662
	37	Mean (SD)	2.505 (1.69)	2.272 (1.49)	3.144 (1.87)
		Range	.159 - 4.565	.016 - 3.815	.216 - 5.314
	38	Mean (SD)	3.291 (3.42)	3.00 (3.11)	3.752 (3.71)
		Range	.133 - 11.111	.732 - 10.361	.050 - 11.861
	39	Mean (SD)	4.168 (5.59)	3.937 (5.40)	4.545 (5.85)
		Range	.630 - 17.675	.433 - 16.925	.050 - 18.424

Note. *.

Comparisons of Study 1 Rankings to Study 2 Physiological Responses

As shown in Tables 17- 19, the physiological responses obtained in study two are compared with the rankings of the images from study one; these tables indicate that there is likely interplay between the images preceding the stimulus presentation in study two, and is the foundation for the suggestion that the situation in which the stimulus is presented – the overall ambient event,

and/or preceding stimuli – play a role in the evaluation of a stimulus or event as “uncanny”.

Table 17: Comparison of Study 1 Rankings and Study 2 Physiological Responses to Neutral Images

Image	Slide Position	Neutral		Study 2 EEG		Study 2 ECG		Study 2 Respiration	
		%	*rank*	*M*	*SD*	*M*	*SD*	*M*	*SD*
	40	82.9	1	-0.074	3.05	0.006	0.006	-1.198	1.55
	1	81.6	2	-0.454	1.82	0.004	0.004	-1.096	1.42
	33	81	3	0.334	4.22	0.005	0.004	-0.322	0.73
	26	80.3	4	0.044	4.65	0.002	0.002	-0.583	0.79
	19	79.7	5	-0.533	3.79	0.003	0.003	-1.058	1.65
	30	78.1	6	0.137	3.94	0.004	0.004	-1.265	1.51
	17	78.1	6	-0.635	2.29	0.002	0.002	-0.585	0.82
	8	76.5	7	0.648	1.89	0.003	0.003	-0.952	1.09
	13	74.2	8	-0.733	3.09	0.003	0.003	-0.416	0.46
	20	74.2	8	0.570	2.44	0.004	0.003	-0.584	0.78

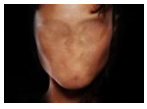
Note. *.

Table 18: Comparison of Study 1 Rankings and Study 2 Physiological Responses to Pleasant Images

Image	Slide Position	Study 1 Ratings		Study 2 EEG		Study 2 ECG		Study 2 Respiration	
		%	*rank*	*M*	*SD*	*M*	*SD*	*M*	*SD*
	11	95.5	1	1.361	3.54	0.003	0.002	-0.387	0.55
	29	90.6	2	-0.495	3.77	0.004	0.004	-0.762	0.9
	25	90.3	3	0.141	2.63	0.004	0.005	-1.352	1.42
	2	98.7	4	-0.164	2.38	0.003	0.003	-1.079	1.06
	5	89.7	4	0.039	2.98	0.003	0.002	-0.739	1.05
	6	89	5	0.543	2.72	0.004	0.003	-0.867	1.05
	36	88.7	6	-0.743	2.67	0.004	0.003	-1.167	1.56
	9	88.4	7	0.034	1.63	0.004	0.003	-0.489	0.61
	22	86.8	8	0.896	4.14	0.003	0.003	-0.494	0.82
	32	86.1	9	-0.428	3.08	0.004	0.004	-1.326	1.55

Note. *.

Table 19: Comparison of Study 1 Rankings and Study 2 Physiological Responses to Uncanny Images

Image	Slide Position	Uncanny		Study 2 EEG		Study 2 ECG		Study 2 Respiration	
		%	*rank*	*M*	*SD*	*M*	*SD*	*M*	*SD*
	38	96.5	1	0.542	3.66	0.004	0.004	-0.836	0.9
	23	96.5	1	0.352	2.65	0.003	0.003	-1.157	1.54
	24	95.8	2	0.868	3.15	0.004	0.003	-1.411	1.72
	4	95.5	3	-0.753	2.15	0.003	0.004	-1.298	1.37
	18	95.5	3	0.140	2.21	0.003	0.002	-1.026	1.21
	7	94.2	4	0.199	2.85	0.005	0.005	-0.971	0.95
	31	94.2	4	1.882	3.64	0.004	0.004	-1.321	1.65
	37	93.9	5	-1.328	1.15	0.005	0.007	-1.102	1.38
	16	93.5	6	0.183	2.61	0.004	0.003	-1.066	1.48
	39	92.9	7	-0.791	3.34	0.004	0.004	-0.619	0.9
	3	91.9	8	-0.012	2.68	0.004	0.003	-1.170	1.29
	34	91.6	9	-0.287	3.73	0.005	0.006	-0.322	1.53
	12	90.6	10	-0.415	3.04	0.004	0.003	-1.487	1.66

	28	90.6	10	-0.388	3.64	0.004	0.004	-0.953	1.12
	35	90.6	10	0.791	4.17	0.003	0.002	-0.295	0.63
	21	90.3	11	-0.731	3.97	0.004	0.005	-0.493	0.61
	14	87.7	12	0.025	2.75	0.004	0.003	-1.444	1.67
	10	83.9	13	0.170	2.56	0.004	0.004	-1.066	1.37
	27	81.9	14	1.630	4.2	0.005	0.003	-1.234	1.64
	15	80.3	15	-0.450	1.84	0.003	0.002	-0.683	0.68

Markov Analysis

A Markov analysis was conducted to determine the steady state predictive behavior for individuals who provided a greater than average reaction to the stimulus changing. The physiological changes (EEG, ECG, respiration) observed during the viewing of all forty images were converted to absolute values to remove directionality, and the mean for each category of image (Pleasant, Neutral, Uncanny) was calculated. Nine new variables were created representing each possible initial-final pairing (NN, NP, NU, PN, PP, PU, UN, UP, UU) for all

physiological measures collected. The means of each initial-final pairing were then calculated, resulting in nine new means representing each possible pairing – NN, NP, NU, PN, PP, PU, UN, UP, UU – and the physiological responses falling above the means of each category pairing were identified. The mean change in response to the image switching from one state (Neutral, Pleasant, or Uncanny) to a second state (Neutral, Pleasant, or Uncanny) is given in Table 20.

Table 20: Markov Analysis: Means for Changes in Physiological Response with Each Transition

Matrix		Physiological Response		
		EEG	ECG	RESP
		M	*M*	*M*
Initial Image Type	Neutral	2.11903	0.00394	1.00946
	Pleasant	2.27761	0.00395	1.05939
	Uncanny	2.18322	0.00384	0.94176

**Note.*

The transitional probabilities (see Table 21) were calculated by dividing the frequencies with which participants who had reactions greater than the mean reaction within each state-transitional category (e.g., a pleasant stimulus changing to a neutral stimulus) by the total number of participants who had a reaction greater than the mean for each stimulus starting state (e.g., total number of deviations greater than the mean when transitioning from a pleasant stimulus to any category of stimulus).

Table 21: Markov Analysis: Transitional Probability Matrices

Transition Matrix	Initial Image Type		
	Neutral	Pleasant	Uncanny
	*P**	*P*	*P*

Final Image Type	EEG	Neutral	0.14706	0.14706	0.70588
		Pleasant	0.34118	0.10588	0.55294
		Uncanny	0.29240	0.30994	0.39766
	ECG	Neutral	0.10417	0.23958	0.65625
		Pleasant	0.26042	0.12500	0.61458
		Uncanny	0.24748	0.34343	0.40909
	RESP	Neutral	0.08197	0.24590	0.67213
		Pleasant	0.20732	0.10976	0.68293
		Uncanny	0.28571	0.34162	0.37267

**Note. P* = probability

Table 22: Markov Analysis: Steady State Matrix

Matrix		Final Image Type		
		Neutral	Pleasant	Uncanny
		*P**	*P*	*P*
Physiological Response	EEG	0.26470	0.22160	0.51370
	ECG	0.21940	0.26320	0.51740
	RESP	0.22040	0.26020	0.51940

**Note. P* = probability

This observation is supported by the personality facets derived from the HEXACO -- Emotionality and Openness to Experience -- as well as potential explanation afforded by the occurrence of anthropomorphic peakings (e.g., the less-common Extreme Anthropomorphism categorisation). The parallels in physiological lability are also accounted for with respect to vagal tonality, which has already been discussed as a potential component of the HEXACO categories of Emotionality and Openness to Experience.

In sum, the Markov analysis is consistent with the expectation that there is personality/emotionality differences in individuals who demonstrate more marked reaction to uncanny stimuli. It is further expected that this difference will be observable in personal recounting/recollection and/or adjectival/descriptor analysis, which is another recommended avenue of enquiry. From the steady-state matrix (see Table 22), we see that more than half of individuals who do have above-average physiological reactions to the stimulus changing will have a reaction when changing to an uncanny stimulus over repetition or time. This observation is supported by the personality facets derived from the HEXACO -- Emotionality and Openness to Experience -- as well as potential explanation afforded by the occurrence of anthropomorphic peakings (e.g., the less-common Extreme Anthropomorphism categorisation). The parallels in physiological lability are also accounted for with respect to vagal tonality, which has already been discussed as a potential component of the HEXACO categories of Emotionality and Openness to Experience. In sum, in demonstrating that there is a component of participants who consistently exhibit a reaction to uncanny stimuli, the Markov analysis supports another aspect of the expectation that there are personality/emotionality differences in individuals who demonstrate more marked reaction to uncanny stimuli. It is further expected that this difference will be observable in personal recounting/recollection and/or adjectival/descriptor analysis, which is another recommended avenue of enquiry.

Experiment 2 Discussion

One-Way ANOVAs

With respect to respiration, level of anthropomorphism of pets mattered for uncanny pictures, while emotionality mattered for pleasant and neutral images. This may be related to individual

variances in vagal tone and Respiratory Sinus Arrhythmia (RSA) (Porges, 1992; Thayer, Friedman, and Borkovec, 1996) and indicate that the vagal control over the heartbeat, itself an indicator of behavioural inhibition (where greater variability may show as a higher score in the HEXACO traits of Openness to Experience and Emotionality), and demonstrates the need for further research in this area with screening designed to differentiate between those who are less (and/or more) behaviourally guarded so as to determine if the effect is strictly a physical one, or if the effect extends into cognitive reasoning about uncanny stimuli.

EEG responses for pleasant and uncanny images varied as a level of anthropomorphisation of pets. People who scored high on the anthropomorphisation of pets responded significantly differently from participants who scored moderate and low (between whom there was no difference). There is a strong likelihood that the apparently higher visual processing occurs as a result of simply having a broader range of classifications open to anthropomorphisation. In other words, individuals who are inclined to attribute human-like characteristics to their pets are discriminating between human categories, pet categories, and possibly other categories when attempting to assign meaning, intent, and purpose to novel images that trigger a human template response.

Level of Emotionality again held an influence for respiration responses with neutral and pleasant images, specifically for participants scoring high and moderate for Emotionality, further extending the potential for influence of vagal tonality (and in that, emotional boundedness or self-governance as an investigatory option), however there was no significant difference for low Emotionality scorers, which serves to validate further the potential influence of emotional

governance via vagal tone. Respiration response and the age at which participants reported first playing video games demonstrated a significant reaction with uncanny images; participants who began playing video games as adults demonstrated a greater reaction than those who began playing video games in their teens and younger. This is likely due to a level of acclimation to "human-like non-humans" as depicted in video games, in that during video game play, whether first- or third-person, there is some symbolic avatar that has a human-like situation (e.g., start state, desired goal state, path choice, negative ramifications for misdirection) with which an individual will experience a deeper level of immersion and potentially enjoyment, or at the very least will attach personal identification significance onto. For uncanny pictures, anthropomporphisation of pets and age at which video games were first played -- with high anthropomorphism of pets exhibiting different levels of responses in their EEGs to uncanny images. With respect to Emotionality, only those who scored high differed significantly from people who scored moderately; there was no difference between moderate/low or high/low. This again shows support for the potential role of emotional boundedness or temperament and the desirability of further investigation into the effect(s) brought to the interaction by individuals with high and low vagal tone.

Mixed ANOVAs

A series of mixed ANOVAs were performed to advise for future studies with regards to traits and other potential characteristics of lifestyle and personality. The HEXACO trait of Openness was significant for ECG, again demonstrating the likelihood of vagal tone (and thereby emotional guardedness) in playing a role in physiological response; further investigation is needed to determine if this physiological effect is a contributor to a set of individual differences

that play a role in differentiating an "uncanny reaction" between individuals. The ATS measurement of Level of Extreme Anthropomorphism and Anthropomorphism of Gods/Deities also is shown to affect respiration; for Openness, low scorers exhibited greater reactivity (greater variability) than high or moderate scorers with neutral and uncanny images, whereas there was no real difference between high and moderate scorers. From this, it appears that Extreme Anthropomorphism and Anthropomorphism of Gods/Deities may serve as a mitigating factor in the absence of a higher Emotionality score; further research is needed to evaluate whether this is a trade-off in a functional way, or in the sense of individual differences of personality components.

With regard to Extreme Anthropomorphisation and respiration, people who scored highly on Extreme Anthropomorphism demonstrated greater differences in respiration reactivity overall. The same cannot be said of moderate and low-scorers. Of these reactivity changes, participants who scored high on Extreme Anthropomorphism exhibited increasingly more negative respiratory changes, while there was not as much difference with moderate and low Extreme Anthropomorphism scorers.

For level of Anthropomorphism of Gods/Deities and respiration, there is no difference until uncanny images are compared; for uncanny images, participants who scored low on Anthropomorphism of Gods/Deities exhibited a greater respiration response when looking at uncanny images. This was the only combination that exhibited a difference, and further investigation would be needed to determine if this is an effect of religiosity, degree of anthropomorphism in general, or another factor.

With respect to the stepwise regression correlation analyses, EEG activity (occipital lobe) was best predicted by anthropomorphism towards pets, followed by anthropomorphism towards gods or deities as a category. In consideration of non-artefact approximation of human behaviour, the development of a tradition of animal domestication as well as the expectation and anticipation of the wants and needs of deities are two tendencies most likely to occur by projecting a human-like mindset onto the target as a preferred method of drawing conclusions for observed events. Furthermore, speculating upon the probability of future chains of action and reaction in an material conditional sense. In other words, the question of "what would I be indicating or bringing about by this action if I were a (pet, deity)?" is likely answered in a primitive fashion first by drawing a direct parallel to human actions and needs rather than consideration of the non-human pet or deity in an abstracted sense, as a more sophisticated approach might take towards enquiry into the customs and traditions of other cultures or non-humans.

Respiratory change was only predicted by the HEXACO trait of Openness to Experience; while there is the aspect of absorption that may strongly relate to respiratory patterns:

> Openness to Experience: Persons with very high scores on the Openness to Experience scale become absorbed in the beauty of art and nature, are inquisitive about various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid

> creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional (hexaco.org).

With respiration, this may indicate a level of immersion in the stimuli not exhibited by other personality traits; while such a conclusion cannot be drawn conclusively from this study, it is a viable avenue of investigation for future studies as to whether Openness to Experience and/or immersion or narrative generation/development/accessibility holds a relationship to the perception of the uncanny.

In consideration of the general profile of Biopac response, it at first appears, and is recommended as an avenue of future investigation, that the biophysical reactions are subject to a slightly different constellation of traits and tendencies as the self-report measures. While these are different, they are by no means contradictory, and may represent different portions of a similar overall response. Better biophysical measures and a higher participant pool would be required to definitively discuss these traits and tendencies as being quantitatively different, and may still result in the same qualia of which all participants (and Society in general) term "uncanny".

With regard to the discussion of ratings and the proposal of a composite personality (h-E, EA) from Experiment 1, the same pattern of response occurs again in what is essentially a replicative portion of Experiment 1. From this, it is established that there is a solid contribution to the personality constellation being observed by the Emotionality and Extreme Anthropomorphism components. Again, exposure to video games plays a contributive role to this constellation.

From this, we can revisit the points of Experiment 1 discussion and draw some parallel to social support for a particular form of schemata having a relationship to video game involvement. It is not unreasonable to hypothesize from this point that the alternate reality (and in some cases, simulative and/or hyperreal) environments have broadened the candidate pool for the h-E, EA personality type with respect to what may be anthropomorphised, or take on human-like characteristics. Again, this points toward a categorical representation in templature, as opposed to Mori's representation along a continuum. The probability of categorical classifications has met with established support (see Literature Review), which finds further substantiation in the potential of a category inclined to feel more comfort *when* broadened categories are available as well as a wider spectrum from which to seek comfort and avoid anxiety (or, potentially, to experience heightened anxiety and awareness *because of* the broadened categories they experience), as opposed to an as-yet-to-be-identified personality type for whom the prospect of a broadened experience would serve to increase uncertainty and fear in the face of uncategorizable "Others". This is not to say that Mori's Cartesian representation is without benefit; for clearly-defined constructs within controlled situations, such a perspective may lead to a more manageable and easily conveyable result, and for this reason should not be abandoned insomuch as being utilized as yet another way of "describing the elephant", as it were.

From the analysis conducted on the other end of the spectrum of choices – the Pleasant stimuli – a similar HEXACO profile is observed as in Uncanny ratings. While anthropomorphism did not play a role in the Pleasant ratings – expectedly so – Emotionality, Openness to Experience, Honesty-Humility, and Agreeableness (in that order) do clearly predict the ability to identify non-extraordinary, pleasant stimuli. Future work may gain from investigation of a true opposing

end to the uncanny spectrum – a genuine contrapositive to the state of 'uncanny' – which would likely also include a form of anthropomorphism in its constellation. Further, it may benefit further personality and social investigation to more closely consider the contributions of Openness to Experience, Honesty-Humility, and Agreeableness as they contribute to the h-E, EA personality type.

It is recommended for future endeavors that a higher rate of compliant participation be obtained; eye data in particular suffered significantly from a lack of valid data sets. In addition, an EEG system better suited for appropriate sampling, such as a 64-live electrode unit (e.g., for iGBA sampling as in Zion-Golumbic, Golan, Anaki and Bentin, 2008; Kahlbrock, Butz, May, and Schnitzler, 2010) be used. Even though appropriate measures were taken such as the use of artefact removal via high-pass filtering, the occipital sampling of 40 – 80 Hz from a two-active EEG configuration is inadequate to draw anything other than superficial conclusions. Nevertheless, results do demonstrate that some visual events evince gamma band activity, however further specificity with relationship to image processing and higher cognitive processes cannot be speculated upon.

CHAPTER SEVEN: GENERAL DISCUSSION AND OVERALL CONCLUSION

It has been expressed that there is an anthropomorphically-based set of expectations that are brought to human-nonhuman interactions; these expectations are founded on the expectation of human-like behavior in the sense that human action or behavior have a reciprocate action or behavior in the non-human. In the case of well-planned interfaces and entities, these mappings proceed smoothly, and can enhance the user experience, while poor planning and/or execution on the part of designers can result in an uncanny valley reaction on the part of the user/observer. Uncanny valley reactions may occur under normal conditions, as this reaction is a normal part of the repertoire of human response, however, under normal circumstances, this reaction is limited to violations of the same set of mapping expectations – for example, the autonomous movement of a dead body, or the unnatural feeling of a realistic prosthetic arm. Where imperfection is allowable and expected, it may be endearing; where perfection – or near perfection – is unexpected, it will cause distraction, and possibly alarm and discomfort. One personal anecdotal example is in the Pirates of the Caribbean ride at Disney (synopsis and examples at wdwinfo.com, n.d.) – in one scene, as the guests' boat crosses under a bridge, visitors can see a realistic-looking animatronic pirate, swinging his leg over the side; looking up, it can be seen that the leg is hairy and the foot is dirty. Only upon closer inspection does the rider notice that the bottom of the foot itself is of an incorrect texture. Prior to this point, all attention is focused on the pirate's leg, to the almost complete exclusion of surrounding events; occasionally, guests will at first comment, 'wait – he's real!', however after closer inspection, attention refocuses towards other stimuli. The disorientation of expecting something real, and then realising that it is an audio-animatronic character has the result of drawing attention and creating shock in the viewer until resolution. In a similar way, seeing what appears to be a zombie on the back lot of a

movie studio smoking a cigarette and drinking a soda the expectations resulting in an appearance mapping are overridden by situational expectations stemming from the environment and movement behaviour resulting in a different type of mapping – we are likely to not have a visceral reaction of distaste although we may have a narrowing of attention until a point of resolution, instead assuming that this is an actor on break. Should these overriding elements not be present however, for example a jerkily-moving figure in a dimly-lit graveyard, it is likely that our reaction *would* be one of uncanny alarm.

In consideration of the potential for human-to-human interaction to have directly uncanny occurrences or overtones, it is highly likely that such events take place; most notably in Mori's continuum is the inclusion of a corpse, and then a zombie – a reanimated corpse that is, fundamentally, human – as stimuli in the lowest points of the Uncanny Valley. Reaction(s) based in an uncanny format may also play a role in caregiver ability/training with certain compromised or physically outside-of-norm populations, particularly where there appears to be no attributable source (i.e., an invisible pathogen) for the deviation from an expected schema for the recipient of the needed care. This potential interrelationship between ability/training and openness to deviation from a physical or behavioural template is certainly deserving of further investigation.

For some individuals, the inclination towards sympathy to the Other may be a greater inclination than those comprising the general population set, or it may be that individual inclinations to express such a facet may vary across situations and/or societal norms. Levels of immersion and involvement (as well as empathy and anthropomorphisation) may be a personality aspect similar

to the suspension of disbelief in that some individuals are naturally more capable than others, and the capacity to call up or suppress this state may be able to be a voluntary activity with acclimation and training or in some cases, therapeutic intervention.

APPENDIX A: EXPERIMENT 1 STIMULI

Study 1 Stimuli

Neutral & Pleasant Images







































































































MONEY



Uncanny Images


































































Love


















APPENDIX B: HEXACO PERSONALITY INVENTORY

HEXACO-PI-R

(Self Report Form)

DIRECTIONS

On the following pages you will find a series of statements about you. Please read each statement and decide how much you agree or disagree with that statement. Then write your response in the space next to the statement using the following scale:

5 = strongly agree

4 = agree

3 = neutral (neither agree nor disagree)

2 = disagree

1 = strongly disagree

Please answer every statement, even if you are not completely sure of your response.

Please provide the following information about yourself.

Sex (circle): Female Male

Age: _____ years

1 _____ I would be quite bored by a visit to an art gallery.

2 _____ I clean my office or home quite frequently.

3 _____ I rarely hold a grudge, even against people who have badly wronged me.

4 _____ I feel reasonably satisfied with myself overall.

5 _____ I would feel afraid if I had to travel in bad weather conditions.

6 _____ If I want something from a person I dislike, I will act very nicely toward that person in order to get it.

7 _____ I'm interested in learning about the history and politics of other countries.

8 _____ When working, I often set ambitious goals for myself.

9 _____ People sometimes tell me that I am too critical of others.

10 _____ I rarely express my opinions in group meetings.

11 _____ I sometimes can't help worrying about little things.

12 _____ If I knew that I could never get caught, I would be willing to steal a million dollars.

13 _____ I would like a job that requires following a routine rather than being creative.

14 _____ I often check my work over repeatedly to find any mistakes.

15 _____ People sometimes tell me that I'm too stubborn.

16 _____ I avoid making "small talk" with people.

17 _____ When I suffer from a painful experience, I need someone to make me feel comfortable.

18 _____ Having a lot of money is not especially important to me.

19 _____ I think that paying attention to radical ideas is a waste of time.

20 _____ I make decisions based on the feeling of the moment rather than on careful thought.

21 _____ People think of me as someone who has a quick temper.

22 _____ I am energetic nearly all the time.

23 _____ I feel like crying when I see other people crying.

24 _____ I am an ordinary person who is no better than others.

25 _____ I wouldn't spend my time reading a book of poetry.

26 _____ I plan ahead and organize things, to avoid scrambling at the last minute.

27 _____ My attitude toward people who have treated me badly is "forgive and forget".

28 _____ I think that most people like some aspects of my personality.

29 _____ I don’t mind doing jobs that involve dangerous work.

30 _____ I wouldn't use flattery to get a raise or promotion at work, even if I thought it would succeed.

Continue…

31 _____ I enjoy looking at maps of different places.

32 _____ I often push myself very hard when trying to achieve a goal.

33 _____ I generally accept people's faults without complaining about them.

34 _____ In social situations, I'm usually the one who makes the first move.

35 _____ I worry a lot less than most people do.

36 _____ I would be tempted to buy stolen property if I were financially tight.

37 _____ I would enjoy creating a work of art, such as a novel, a song, or a painting.

38 _____ When working on something, I don't pay much attention to small details.

39 _____ I am usually quite flexible in my opinions when people disagree with me.

40 _____ I enjoy having lots of people around to talk with.

41 _____ I can handle difficult situations without needing emotional support from anyone else.

42 _____ I would like to live in a very expensive, high-class neighborhood.

43 _____ I like people who have unconventional views.

44 _____ I make a lot of mistakes because I don't think before I act.

45 _____ I rarely feel anger, even when people treat me quite badly.

46 _____ On most days, I feel cheerful and optimistic.

47 _____ When someone I know well is unhappy, I can almost feel that person's pain myself.

48 _____ I wouldn't want people to treat me as though I were superior to them.

49 _____ If I had the opportunity, I would like to attend a classical music concert.

50 _____ People often joke with me about the messiness of my room or desk.

51 _____ If someone has cheated me once, I will always feel suspicious of that person.

52 _____ I feel that I am an unpopular person.

53 _____ When it comes to physical danger, I am very fearful.

54 _____ If I want something from someone, I will laugh at that person's worst jokes.

55 _____ I would be very bored by a book about the history of science and technology.

56 _____ Often when I set a goal, I end up quitting without having reached it.

57 _____ I tend to be lenient in judging other people.

58 _____ When I'm in a group of people, I'm often the one who speaks on behalf of the group.

59 _____ I rarely, if ever, have trouble sleeping due to stress or anxiety.

60 _____ I would never accept a bribe, even if it were very large.

Continue…

61 _____ People have often told me that I have a good imagination.

62 _____ I always try to be accurate in my work, even at the expense of time.

63 _____ When people tell me that I'm wrong, my first reaction is to argue with them.

64 _____ I prefer jobs that involve active social interaction to those that involve working alone.

65 _____ Whenever I feel worried about something, I want to share my concern with another person.

66 _____ I would like to be seen driving around in a very expensive car.

67 _____ I think of myself as a somewhat eccentric person.

68 _____ I don't allow my impulses to govern my behavior.

69 _____ Most people tend to get angry more quickly than I do.

70 _____ People often tell me that I should try to cheer up.

71 _____ I feel strong emotions when someone close to me is going away for a long time.

72 _____ I think that I am entitled to more respect than the average person is.

73 _____ Sometimes I like to just watch the wind as it blows through the trees.

74 _____ When working, I sometimes have difficulties due to being disorganized.

75 _____ I find it hard to fully forgive someone who has done something mean to me.

76 _____ I sometimes feel that I am a worthless person.

77 _____ Even in an emergency I wouldn't feel like panicking.

78 _____ I wouldn't pretend to like someone just to get that person to do favors for me.

79 _____ I've never really enjoyed looking through an encyclopedia.

80 _____ I do only the minimum amount of work needed to get by.

81 _____ Even when people make a lot of mistakes, I rarely say anything negative.

82 _____ I tend to feel quite self-conscious when speaking in front of a group of people.

83 _____ I get very anxious when waiting to hear about an important decision.

84 _____ I'd be tempted to use counterfeit money, if I were sure I could get away with it.

85 _____ I don't think of myself as the artistic or creative type.

86 _____ People often call me a perfectionist.

87 _____ I find it hard to compromise with people when I really think I'm right.

88 _____ The first thing that I always do in a new place is to make friends.

89 _____ I rarely discuss my problems with other people.

90 _____ I would get a lot of pleasure from owning expensive luxury goods.

Continue…

91 _____ I find it boring to discuss philosophy.

92 _____ I prefer to do whatever comes to mind, rather than stick to a plan.

93 _____ I find it hard to keep my temper when people insult me.

94 _____ Most people are more upbeat and dynamic than I generally am.

95 _____ I remain unemotional even in situations where most people get very sentimental.

96 _____ I want people to know that I am an important person of high status.

97 _____ I have sympathy for people who are less fortunate than I am.

98 _____ I try to give generously to those in need.

99 _____ It wouldn't bother me to harm someone I didn't like.

100 _____ People see me as a hard-hearted person.

APPENDIX C: HEXACO SCALE DESCRIPTIONS

Domain-Level Scales

Honesty-Humility: Persons with very high scores on the Honesty-Humility scale avoid manipulating others for personal gain, feel little temptation to break rules, are uninterested in lavish wealth and luxuries, and feel no special entitlement to elevated social status. Conversely, persons with very low scores on this scale will flatter others to get what they want, are inclined to break rules for personal profit, are motivated by material gain, and feel a strong sense of self-importance.

Emotionality: Persons with very high scores on the Emotionality scale experience fear of physical dangers, experience anxiety in response to life's stresses, feel a need for emotional support from others, and feel empathy and sentimental attachments with others. Conversely, persons with very low scores on this scale are not deterred by the prospect of physical harm, feel little worry even in stressful situations, have little need to share their concerns with others, and feel emotionally detached from others.

eXtraversion: Persons with very high scores on the Extraversion scale feel positively about themselves, feel confident when leading or addressing groups of people, enjoy social gatherings and interactions, and experience positive feelings of enthusiasm and energy. Conversely, persons with very low scores on this scale consider themselves unpopular, feel awkward when they are the center of social attention, are indifferent to social activities, and feel less lively and optimistic than others do.

Agreeableness (versus Anger): Persons with very high scores on the Agreeableness scale forgive the wrongs that they suffered, are lenient in judging others, are willing to compromise and cooperate with others, and can easily control their temper. Conversely, persons with very low scores on this scale hold grudges against those who have harmed them, are rather critical of others' shortcomings, are stubborn in defending their point of view, and feel anger readily in response to mistreatment.

Conscientiousness: Persons with very high scores on the Conscientiousness scale organize their time and their physical surroundings, work in a disciplined way toward their goals, strive for accuracy and perfection in their tasks, and deliberate carefully when making decisions. Conversely, persons with very low scores on this scale tend to be unconcerned with orderly surroundings or schedules, avoid difficult tasks or challenging goals, are satisfied with work that contains some errors, and make decisions on impulse or with little reflection.

Openness to Experience: Persons with very high scores on the Openness to Experience scale become absorbed in the beauty of art and nature, are inquisitive about various domains of knowledge, use their imagination freely in everyday life, and take an interest in unusual ideas or people. Conversely, persons with very low scores on this scale are rather unimpressed by most works of art, feel little intellectual curiosity, avoid creative pursuits, and feel little attraction toward ideas that may seem radical or unconventional.

Facet-Level Scales

Honesty-Humility Domain

The *Sincerity* scale assesses a tendency to be genuine in interpersonal relations. Low scorers will flatter others or pretend to like them in order to obtain favors, whereas high scorers are unwilling to manipulate others.

The *Fairness* scale assesses a tendency to avoid fraud and corruption. Low scorers are willing to gain by cheating or stealing, whereas high scorers are unwilling to take advantage of other individuals or of society at large.

The *Greed Avoidance* scale assesses a tendency to be uninterested in possessing lavish wealth, luxury goods, and signs of high social status. Low scorers want to enjoy and to display wealth and privilege, whereas high scorers are not especially motivated by monetary or social-status considerations.

The *Modesty* scale assesses a tendency to be modest and unassuming. Low scorers consider themselves as superior and as entitled to privileges that others do not have, whereas high scorers view themselves as ordinary people without any claim to special treatment.

Emotionality Domain

The *Fearfulness* scale assesses a tendency to experience fear. Low scorers feel little fear of injury and are relatively tough, brave, and insensitive to physical pain, whereas high scorers are strongly inclined to avoid physical harm.

The *Anxiety* scale assesses a tendency to worry in a variety of contexts. Low scorers feel little stress in response to difficulties, whereas high scorers tend to become preoccupied even by relatively minor problems.

The *Dependence* scale assesses one's need for emotional support from others. Low scorers feel self-assured and able to deal with problems without any help or advice, whereas high scorers want to share their difficulties with those who will provide encouragement and comfort.

The *Sentimentality* scale assesses a tendency to feel strong emotional bonds with others. Low scorers feel little emotion when saying good-bye or in reaction to the concerns of others, whereas high scorers feel strong emotional attachments and an empathic sensitivity to the feelings of others.

Extraversion Domain

The *Social Self-Esteem* scale assesses a tendency to have positive self-regard, particularly in social contexts. High scorers are generally satisfied with themselves and consider themselves to have likable qualities, whereas low scorers tend to have a sense of personal worthlessness and to see themselves as unpopular.

The *Social Boldness* scale assesses one's comfort or confidence within a variety of social situations. Low scorers feel shy or awkward in positions of leadership or when speaking in public, whereas high scorers are willing to approach strangers and are willing to speak up within group settings.

The *Sociability* scale assesses a tendency to enjoy conversation, social interaction, and parties. Low scorers generally prefer solitary activities and do not seek out conversation, whereas high scorers enjoy talking, visiting, and celebrating with others.

The *Liveliness* scale assesses one's typical enthusiasm and energy. Low scorers tend not to feel especially cheerful or dynamic, whereas high scorers usually experience a sense of optimism and high spirits.

Agreeableness Domain

The *Forgivingness* scale assesses one's willingness to feel trust and liking toward those who may have caused one harm. Low scorers tend "hold a grudge" against those who have offended them, whereas high scorers are usually ready to trust others again and to re-establish friendly relations after having been treated badly.

The *Gentleness* scale assesses a tendency to be mild and lenient in dealings with other people. Low scorers tend to be critical in their evaluations of others, whereas high scorers are reluctant to judge others harshly.

The *Flexibility* scale assesses one's willingness to compromise and cooperate with others. Low scorers are seen as stubborn and are willing to argue, whereas high scorers avoid arguments and accommodate others' suggestions, even when these may be unreasonable.

The *Patience* scale assesses a tendency to remain calm rather than to become angry. Low scorers tend to lose their tempers quickly, whereas high scorers have a high threshold for feeling or expressing anger.

Conscientiousness Domain

The *Organization* scale assesses a tendency to seek order, particularly in one's physical surroundings. Low scorers tend to be sloppy and haphazard, whereas high scorers keep things tidy and prefer a structured approach to tasks.

The *Diligence* scale assesses a tendency to work hard. Low scorers have little self-discipline and are not strongly motivated to achieve, whereas high scorers have a strong "'work ethic" and are willing to exert themselves.

The *Perfectionism* scale assesses a tendency to be thorough and concerned with details. Low scorers tolerate some errors in their work and tend to neglect details, whereas high scorers check carefully for mistakes and potential improvements.

The *Prudence* scale assesses a tendency to deliberate carefully and to inhibit impulses. Low scorers act on impulse and tend not to consider consequences, whereas high scorers consider

their options carefully and tend to be cautious and self-controlled.

Openness to Experience Domain

The *Aesthetic Appreciation* scale assesses one's enjoyment of beauty in art and in nature. Low scorers tend not to become absorbed in works of art or in natural wonders, whereas high scorers have a strong appreciation of various art forms and of natural wonders.

The *Inquisitiveness* scale assesses a tendency to seek information about, and experience with, the natural and human world. Low scorers have little curiosity about the natural or social sciences, whereas high scorers read widely and are interested in travel.

The *Creativity* scale assesses one's preference for innovation and experiment. Low scorers have little inclination for original thought, whereas high scorers actively seek new solutions to problems and express themselves in art.

The *Unconventionality* scale assesses a tendency to accept the unusual. Low scorers avoid eccentric or nonconforming persons, whereas high scorers are receptive to ideas that might seem strange or radical.

Interstitial Scale

The *Altruism (versus Antagonism)* scale assesses a tendency to be sympathetic and soft-hearted toward others. High scorers avoid causing harm and react with generosity toward those who are weak or in need of help, whereas low scorers are not upset by the prospect of hurting others and may be seen as hard-hearted.

APPENDIX D: HEXACO SCORING KEY

Honesty-Humility	
Sincerity	6R, 30, 54R, 78
Fairness	12R, 36R, 60, 84R
Greed-Avoidance	18, 42R, 66R, 90R
Modesty	24, 48, 72R, 96R
Emotionality	
Fearfulness	5, 29R, 53, 77R
Anxiety	11, 35R, 59R, 83
Dependence	17, 41R, 65, 89R
Sentimentality	23, 47, 71, 95R
Extraversion	
Social Self-Esteem	4, 28, 52R, 76R
Social Boldness	10R, 34, 58, 82R
Sociability	16R, 40, 64, 88
Liveliness	22, 46, 70R, 94R
Agreeableness	
Forgiveness	3, 27, 51R, 75R
Gentleness	9R, 33, 57, 81
Flexibility	15R, 39, 63R, 87R
Patience	21R, 45, 69, 93R
Conscientiousness	
Organization	2, 26, 50R, 74R
Diligence	8, 32, 56R, 80R
Perfectionism	14, 38R, 62, 86
Prudence	20R, 44R, 68, 92R
Openness to Experience	
Aesthetic Appreciation	1R, 25R, 49, 73
Inquisitiveness	7, 31, 55R, 79R
Creativity	13R, 37, 61, 85R
Unconventionality	19R, 43, 67, 91R
(interstitial facet scale) Altruism	97, 98, 99R, 100R

Notes

Items indicated with R are reverse-keyed items; for these items, responses should be reversed prior to computing scale scores: 5 → 1, 4 → 2, 3 → 3, 2 → 4, 1 →5

Facet scale scores should be computed as means across all items in facet, after recoding of reverse-keyed items. Note that the facet scales of the 100- and 60-item versions of the HEXACO-PI-R are very short and are not intended to have high levels of internal-consistency reliability. They are recommended for use as predictors of conceptually related criterion variables and as indicators of the HEXACO personality factors.

Factor scale scores should be computed as means across all items in factor. If orthogonal factor scale scores are desired, these can be calculated as varimax-rotated principal components of facet scales as calculated by a computer statistical package. (Note that a moderately large sample size (~250) may be needed to produce a stable component solution.)

The Altruism facet scale is associated with several factors. When calculating scores for the six factor scales, the Altruism facet scale items are not included. However, if factor scores are to be computed as principal components, the Altruism scale can be included along with the other 24 facet scales. (This facet generally divides its loadings between Honesty-Humility, Emotionality, and Agreeableness.)

APPENDIX E: 145-ITEM ANTHROPOMORPHIC TENDENCIES SCALE

ATS

Please read each statement carefully. Indicate the strength of your agreement with each statement by filling in the blank using the following 5-point scale. There are no right or wrong answers to any of these statements. We are interested in your honest reactions and opinions.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

_____ 1. I would yell at a COMPUTER if it did something I did not like.

_____ 2. I would not praise a GOD OR HIGHER POWER when it does something I like.

_____ 3. A GOD OR HIGHER POWER does not have a personality like a person has a personality.

_____ 4. I would hit a CAR if it did something I did not like.

_____ 5. A GOD OR HIGHER POWER has a spirit or life-force like people do.

_____ 6. When I talk to a BACKPACK, I do not believe it understands me.

_____ 7. A GOD OR HIGHER POWER cannot communicate with people.

_____ 8. I would not praise a PET when it does something I like.

_____ 9. I would hit a MICROWAVE if it did something I did not like.

_____ 10. When I am clearly upset, a GOD OR HIGHER POWER does not know.

_____ 11. A BACKPACK does not have a personality like a person has a personality.

_____ 12. I do not act as if a GOD OR HIGHER POWER has a spirit or life-force like people do.

_____ 13. When I talk to a PET, I do not believe it understands me.

_____ 14. I would yell at a CAR if it did something I did not like.

_____ 15. When I talk to a HOUSE PLANT, I do not believe it understands me.

_____ 16. A GOD OR HIGHER POWER is intelligent like a human is intelligent.

_____ 17. If I were to get rid of a BACKPACK, it would feel abandoned.

_____ 18. When I talk to a GOD OR HIGHER POWER, I do not believe it understands me.

_____ 19. I would hit a COMPUTER if it did something I did not like.

_____ 20. A PET has a spirit or life-force like people do.

_____ 21. I treat a BACKPACK like a human.

_____ 22. I would apologize to a GOD OR HIGHER POWER for accidentally hurting it.

_____ 23. I do not act as if a HOUSE PLANT has a spirit or life-force like people do.

_____ 24. A PET does not have a personality like a person has a personality.

_____ 25. I would talk to a COMPUTER.

_____ 26. I would apologize to a PET for accidentally hurting it.

_____ 27. A PET is intelligent like a human is intelligent.

_____ 28. When I am clearly upset, a CAR does not know.

_____ 29. A CAR has a spirit or life-force like people do.

_____ 30. When I am clearly upset, a PET does not know.

_____ 31. I do not act as if a STOMACH has a spirit or life-force like people do.

_____ 32. A PET likes certain people better than others.

_____ 33. A PET cannot communicate with people.

_____ 34. I would not buy a present for a PET.

_____ 35. I do not act as if a MICROWAVE has a spirit or life-force like people do.

_____ 36. A COMPUTER does not do things just to annoy me.

_____ 37. I would not apologize to a GOD OR HIGHER POWER for neglecting it.

_____ 38. If I were to get rid of a COMPUTER, it would feel abandoned.

_____ 39. I would not praise a HOUSE PLANT when it does something I like.

_____ 40. A MICROWAVE has a spirit or life-force like people do.

_____ 41. A MICROWAVE is intelligent like a human is intelligent.

_____ 42. When I am clearly upset, a COMPUTER does not know.

_____ 43. If a PET were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 44. I do not act as if a COMPUTER has a spirit or life-force like people do.

_____ 45. A COMPUTER does not have a personality like a person has a personality.

_____ 46. A STUFFED TOY is intelligent like a human is intelligent.

_____ 47. I would not buy a present for a HOUSE PLANT.

_____ 48. A MICROWAVE likes certain people better than others.

_____ 49. LUCK is intelligent like a human is intelligent.

_____ 50. I would not praise a STOMACH when it does something I like.

_____ 51. A STUFFED TOY does not have a personality like a person has a personality.

_____ 52. When I am clearly upset, a MICROWAVE does not know.

_____ 53. I would not praise a MICROWAVE when it does something I like.

_____ 54. A STUFFED TOY cannot communicate with people.

_____ 55. I would talk to a GOD OR HIGHER POWER.

_____ 56. I would not apologize to a COMPUTER for neglecting it.

_____ 57. An OCEAN does not do things just to annoy me.

_____ 58. If a HOUSE PLANT were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 59. A STOMACH does not have a personality like a person has a personality.

_____ 60. If I were to get rid of a MICROWAVE, it would feel abandoned.

_____ 61. A COMPUTER has a spirit or life-force like people do.

_____ 62. An OCEAN does not have a personality like a person has a personality.

_____ 63. I would not apologize to a BACKPACK for neglecting it.

_____ 64. I do not act as if a CAR has a spirit or life-force like people do.

_____ 65. I treat a PET like a human.

_____ 66. I do not act as if a PET has a spirit or life-force like people do.

_____ 67. An BACKPACK does not do things just to annoy me.

_____ 68. I treat a COMPUTER like a human.

_____ 69. I would talk to a PET.

_____ 70. I would not praise an INSECT when it does something I like.

_____ 71. If I were to get rid of a PET, it would feel abandoned.

_____ 72. I treat a GOD OR HIGHER POWER like a human.

_____ 73. A MICROWAVE does not do things just to annoy me.

_____ 74. I do not act as if LUCK has a spirit or life-force like people do.

_____ 75. I would not buy a present for a BACKPACK.

_____ 76. If I were to get rid of a HOUSE PLANT, it would feel abandoned.

_____ 77. When I talk to a CAR, I do not believe it understands me.

_____ 78. I treat a MICROWAVE like a human

_____ 79. I would talk to a BACKPACK.

_____ 80. If a MICROWAVE were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 81. I treat a HOUSE PLANT like a human

_____ 82. An OCEAN cannot communicate with people.

_____ 83. When I talk to LUCK, I do not believe it understands me.

_____ 84. I would name a STOMACH.

_____ 85. If a BACKPACK were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 86. A HOUSE PLANT does not have a personality like a person has a personality.

_____ 87. If a COMPUTER were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 88. A CAR does not do things just to annoy me.

_____ 89. LUCK cannot communicate with people.

_____ 90. If I were to get rid of an INSECT, it would feel abandoned.

_____ 91. I would not apologize to an INSECT for neglecting it.

_____ 92. A HOUSE PLANT does not have a personality like a person has a personality.

_____ 93. I would not apologize to an PET for neglecting it.

_____ 94. I would not praise a BACKPACK when it does something I like.

_____ 95. When I talk to a MICROWAVE, I do not believe it understands me.

_____ 96. When I am clearly upset, an INSECT does not know.

_____ 97. I would not apologize to a MICROWAVE for neglecting it.

_____ 98. When I am clearly upset, a HOUSE PLANT does not know.

_____ 99. I would not apologize to a CAR for neglecting it.

_____ 100. I treat a CAR like a human

_____ 101. I would not apologize to a CAR for accidentally hurting it.

_____ 102. If a CAR were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 103. I would name a CAR.

_____ 104. A CAR does not have a personality like a person has a personality.

_____ 105. When I am clearly upset, a STUFFED TOY does not know.

_____ 106. I would not praise a CAR when it does something I like.

_____ 107. I would hit a STUFFED TOY if it did something I did not like.

_____ 108. If I were to get rid of a CAR, it would feel abandoned.

_____ 109. I would yell at a HOUSE PLANT if it did something I did not like.

_____ 110. I treat an OCEAN like a human

_____ 111. I would not apologize to a STUFFED TOY for neglecting it.

_____ 112. I would yell at a BACKPACK if it did something I did not like.

_____ 113. An INSECT is intelligent like a human is intelligent.

_____ 114. If an OCEAN were to be destroyed, I would not mourn it like I would mourn the loss of a human.

_____ 115. I would yell at a STUFFED TOY if it did something I did not like.

_____ 116. An INSECT does not have a personality like a person has a personality.

_____ 117. I would not apologize to an OCEAN for accidentally hurting it.

_____ 118. I would talk to an HOUSE PLANT.

_____ 119. I would yell at an OCEAN if it did something I did not like.

_____ 120. I do not act as if a STUFFED TOY has a spirit or life-force like people do.

_____ 121. I would not apologize to a HOUSE PLANT for accidentally hurting it.

_____ 122. I would not praise an OCEAN when it does something I like.

_____ 123. An INSECT has a spirit or life-force like people do.

_____ 124. A COMPUTER likes certain people better than others.

_____ 125. I would talk to a STOMACH.

_____ 126. I would not apologize to a STUFFED TOY for accidentally hurting it.

_____ 127. When I am clearly upset, a STOMACH does not know.

_____ 128. An OCEAN is intelligent like a human is intelligent.

_____ 129. I would not apologize to an OCEAN for neglecting it.

_____ 130. I would apologize to a STOMACH for accidentally hurting it.

_____ 131. LUCK does not do things just to annoy me.

_____ 132. A CAR likes certain people better than others.

_____ 133. I would not apologize to an STOMACE for neglecting it.

_____ 134. An OCEAN has a spirit or life-force like people do.

_____ 135. I would yell at a MICROWAVE if it did something I did not like.

_____ 136. I would not apologize to a HOUSE PLANT for neglecting it.

_____ 137. I would talk to a STUFFED TOY.

_____ 138. A HOUSE PLANT has a spirit or life-force like people do.

_____ 139. A GOD OR HIGHER POWER does not do things just to annoy me.

_____ 140. I would talk to an OCEAN.

_____ 141. LUCK likes certain people better than others.

_____ 142. I would not apologize to a STOMACH for neglecting it.

_____ 143. I would not praise LUCK when it does something I like.

_____ 144. When I talk to a STOMACH, I do not believe it understands me.

_____ 145. An OCEAN likes certain people better than others.

APPENDIX F: ATS FACTOR LOADINGS

Factor Loadings (Rotated)

	Component													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
When I am clearly upset, a COMPUTER does not know.	**.68**	-.02	.07	.00	.13	-.06	.02	-.04	.01	.06	.01	.01	.00	-.08
I do not act as if a COMPUTER has a spirit or life-force like people do.	**.67**	-.02	.06	-.06	.05	-.07	-.09	-.03	-.12	.01	.00	.10	-.04	-.06
A STUFFED TOY cannot communicate with people.	**.66**	.01	.05	-.05	.12	.00	-.03	-.15	-.03	.04	-.05	.05	-.04	-.11
A COMPUTER does not have a personality like a person has a personality.	**.66**	-.03	.03	-.08	.07	-.10	-.10	-.06	-.05	.04	.04	.14	.01	-.04
A MICROWAVE does not do things just to annoy me.	**.65**	-.01	.10	-.05	.00	-.04	-.08	-.03	-.03	.05	.00	.10	.05	-.04
I would not praise a MICROWAVE when it does something I like.	**.65**	-.02	.06	-.06	.12	-.08	-.18	-.02	-.01	.07	-.06	.01	.04	.05
When I am clearly upset, a MICROWAVE does not know.	**.65**	.00	.12	.04	.12	.01	-.05	-.01	.04	.04	-.03	.03	-.02	.03
An OCEAN does not do things just to annoy me.	**.65**	.00	.10	-.04	.10	-.02	-.08	.01	.01	.17	.02	.10	.12	-.13
I would not apologize to a BACKPACK for neglecting it.	**.64**	-.01	.04	.04	.02	-.11	-.12	-.02	.01	.04	-.07	.07	.10	.04
I would not buy a present for a BACKPACK.	**.64**	-.06	.11	.00	.09	.00	.00	-.02	-.01	.07	-.05	.03	.05	-.05
When I am clearly upset, a CAR does not know.	**.63**	-.04	.05	-.01	.13	-.21	-.12	-.10	-.08	.01	.03	.03	.03	-.13
When I talk to a BACKPACK, I do not believe it understands me.	**.62**	.01	.12	-.02	.10	-.02	.02	-.08	.05	-.06	.08	-.05	-.02	.05
A STOMACH does not have a personality like a person has a personality.	**.62**	.05	.05	-.01	.09	-.03	-.09	-.01	-.07	.10	-.01	.01	.17	-.05
An OCEAN does not have a personality like a person has a personality.	**.61**	.02	.01	-.05	-.01	-.07	-.08	-.02	-.19	.32	-.07	.06	.04	-.03
I do not act as if a MICROWAVE has a spirit or life-force like people do.	**.61**	-.03	.13	.02	.21	-.05	-.03	.00	-.06	.00	-.03	.04	.11	.03
A STUFFED TOY does not have a personality like a person has a personality.	**.60**	.01	.03	.02	.14	-.04	-.02	-.27	-.01	.03	-.03	.10	-.02	.01
A MICROWAVE has a spirit or life-force like people do.	**-.60**	.01	-.09	.08	-.11	.02	.02	.03	.06	-.07	-.01	-.01	-.03	.11
I would not apologize to a COMPUTER for neglecting it.	**.59**	-.01	.04	.00	.08	-.11	-.10	-.12	-.03	.07	-.17	.00	.05	.04
I do not act as if a CAR has a spirit or life-force like people do.	**.58**	.04	-.06	-.12	.01	-.31	-.05	-.11	-.10	.01	-.05	.06	.01	-.09
When I talk to a HOUSE PLANT, I do not believe it understands me.	**.58**	.03	.03	-.03	.07	.00	-.01	-.13	-.12	.05	-.06	-.03	.05	.05
A MICROWAVE likes certain people better than others.	**-.58**	.00	-.08	.03	-.08	.03	.07	.06	.06	-.06	.03	-.06	.05	.17

I do not act as if a HOUSE PLANT has a spirit or life-force like people do.	**.57**	.04	-.02	-.02	.12	-.09	-.03	-.03	-.32	.16	-.14	.01	.03	-.01
When I talk to a CAR, I do not believe it understands me.	**.57**	.03	.02	-.09	.00	-.20	-.03	-.12	-.01	.02	.02	-.01	.06	-.08
I would not buy a present for a HOUSE PLANT.	**.56**	.01	.11	.01	.12	-.07	-.03	-.04	-.11	.08	-.16	-.05	.05	.02
I do not act as if LUCK has a spirit or life-force like people do.	**.56**	.04	.01	-.05	.04	-.02	-.06	-.04	-.05	.10	.03	.11	.07	-.02
I would not praise a STOMACH when it does something I like.	**.56**	-.01	.03	-.06	.01	-.07	-.13	-.04	-.07	.12	-.19	.09	.30	-.06
A STUFFED TOY is intelligent like a human is intelligent.	**-.56**	.03	-.07	.06	-.03	.01	.08	.16	.10	-.07	.06	-.01	.02	.03
I do not act as if a STOMACH has a spirit or life-force like people do.	**.55**	.01	.05	.01	.02	-.12	-.07	-.05	-.13	.06	.03	.06	.29	.04
A BACKPACK does not do things just to annoy me.	**.54**	-.01	.09	.00	.36	-.06	-.06	-.02	-.06	.03	.03	.10	.17	-.13
I treat a MICROWAVE like a human.	**-.54**	.07	-.11	.04	-.10	.07	.12	-.02	.05	-.05	-.04	.08	.01	-.03
If I were to get rid of a MICROWAVE, it would feel abandoned.	**-.53**	.03	-.11	.03	-.05	.05	.12	.06	.09	-.02	.10	-.05	.03	.01
A MICROWAVE is intelligent like a human is intelligent.	**-.53**	.00	-.13	.00	-.05	.02	.05	.03	.09	-.03	.00	.00	-.06	.12
A COMPUTER does not do things just to annoy me.	**.52**	.06	-.01	-.15	.05	-.10	-.08	-.10	.04	.01	-.12	.18	.12	-.31
I would not praise a HOUSE PLANT when it does something I like.	**.51**	.01	-.02	-.03	.11	-.09	-.18	-.03	-.22	.06	-.19	.00	.21	-.02
If a HOUSE PLANT were to be destroyed, I would not mourn it like I would mourn the loss of a human.	**.51**	-.07	.06	-.01	.03	-.06	.01	-.14	-.13	.07	-.16	-.01	.05	-.03
If I were to get rid of a COMPUTER, it would feel abandoned.	**-.51**	.04	-.03	.04	-.05	.14	.11	.06	.11	-.05	.10	.01	-.01	.12
I would not praise an INSECT when it does something I like.	**.50**	.03	.02	-.01	.07	-.04	-.12	-.11	-.28	.13	-.17	.08	-.02	-.03
A COMPUTER has a spirit or life-force like people do.	**-.50**	.02	-.07	.02	-.10	.07	.07	.10	.09	-.09	-.03	-.13	-.01	.17
I would talk to a BACKPACK.	**-.50**	.00	-.07	.06	-.02	.06	.29	.09	.02	-.07	.11	-.03	-.06	-.03
If a MICROWAVE were to be destroyed, I would not mourn it like I would mourn the loss of a human.	**.49**	-.02	.04	-.03	.01	.07	.02	-.06	.03	.01	-.07	.01	.08	-.11
I treat a HOUSE PLANT like a human.	**-.49**	-.03	.07	.03	-.01	.07	.11	.10	.24	-.14	.24	.06	.03	.06
LUCK is intelligent like a human is intelligent.	**-.49**	-.03	-.01	.03	.00	.03	.08	.09	.09	-.07	.10	-.11	-.02	.12
An OCEAN cannot communicate with people.	**.48**	.08	-.05	-.07	-.02	.01	-.02	-.09	-.16	.37	-.12	.01	.06	-.04
When I talk to LUCK, I do not believe it understands me.	**.47**	.07	.04	-.04	.06	-.03	.03	-.14	-.09	.02	-.03	.11	.10	.01
I would name a STOMACH.	**-.47**	.02	-.06	.06	.05	.05	.15	.05	.17	.00	.06	-.04	-.17	.13

I treat a COMPUTER like a human.	**-.47**	-.02	-.01	.11	.05	.11	.17	.08	.06	-.06	.00	-.06	.01	.11
If a BACKPACK were to be destroyed, I would not mourn it like I would mourn the loss of a human.	**.46**	-.02	.07	-.08	.20	-.09	-.05	-.05	-.04	.06	-.03	-.03	.12	.09
A HOUSE PLANT does not have a personality like a person has a personality.	**.45**	.03	.04	-.07	.30	-.03	-.06	-.10	-.26	.08	-.12	-.07	.07	-.04
A CAR has a spirit or life-force like people do.	**-.45**	.02	.00	.10	-.13	.31	.04	.08	.16	-.09	.04	.00	.01	.19
If a COMPUTER were to be destroyed, I would not mourn it like I would mourn the loss of a human.	**.44**	.04	.02	-.09	.02	-.10	-.04	-.04	.00	.08	.00	.08	.06	-.06
A CAR does not do things just to annoy me.	**.44**	.04	-.02	-.19	.10	-.19	-.07	-.08	.01	-.01	-.06	.18	.17	-.24
LUCK cannot communicate with people.	**.44**	.07	-.06	-.02	.14	-.03	-.06	-.07	-.08	.05	-.12	.23	.07	-.08
I treat a BACKPACK like a human.	**-.44**	.08	-.09	-.01	-.35	.10	.14	.06	.08	-.02	.02	.04	-.06	.05
If I were to get rid of a BACKPACK, it would feel abandoned.	**-.43**	.04	-.03	-.04	-.24	.10	.20	.18	.10	-.04	.15	.06	-.07	.14
If I were to get rid of an INSECT, it would feel abandoned.	**-.43**	-.02	.01	-.01	-.08	.08	.17	.16	.28	-.06	.17	-.05	-.02	-.01
I would not apologize to an INSECT for neglecting it.	**.42**	.04	.00	-.01	.13	.01	.02	-.13	-.36	.13	-.25	.10	.10	.02
If I were to get rid of a HOUSE PLANT, it would feel abandoned.	**-.42**	-.06	-.02	.04	-.08	.13	.03	.17	.15	-.13	.31	-.07	-.02	.03
A BACKPACK does not have a personality like a person has a personality.	**.41**	-.02	.05	-.02	.37	-.04	.01	-.12	-.01	.13	.03	.10	.03	.04
LUCK does not have a personality like a person has a personality.	**.40**	.01	.01	.03	.34	-.09	-.12	-.05	-.09	.09	-.16	.10	-.02	-.21
When I am clearly upset, a GOD OR HIGHER POWER does not know.	-.01	**.81**	.01	-.03	.00	.01	-.04	-.06	-.01	.01	.03	-.01	.00	-.03
A GOD OR HIGHER POWER cannot communicate with people.	.04	**.80**	.02	-.01	.01	-.01	-.04	-.05	-.01	.04	.01	.01	-.02	-.03
When I talk to a GOD OR HIGHER POWER, I do not believe it understands me.	.02	**.80**	-.06	-.03	-.03	.01	.03	-.02	.04	-.01	.00	.01	.00	-.02
I do not act as if a GOD OR HIGHER POWER has a spirit or life-force like people do.	.05	**.78**	-.02	.00	.04	-.03	.01	.00	-.02	.01	-.04	.03	-.01	.02
I would not apologize to a GOD OR HIGHER POWER for neglecting it.	.02	**.76**	-.10	-.06	-.01	.01	.01	-.04	.01	.03	-.01	-.03	.06	.01
I would talk to a GOD OR HIGHER POWER.	.18	**-.75**	.14	.07	.02	-.02	-.05	.02	.00	-.02	.05	-.02	.00	.01
I would not praise a GOD OR HIGHER POWER when it does something I like.	-.01	**.74**	.00	-.05	.00	.00	-.03	.02	.02	.02	.03	.04	.00	.04

I would apologize to a GOD OR HIGHER POWER for accidentally hurting it.	.04	**-.73**	.10	.07	.02	.03	.02	.00	.06	-.07	.07	.04	-.08	.02
A GOD OR HIGHER POWER has a spirit or life-force like people do.	.01	**-.73**	.06	-.01	-.01	.10	.01	.02	.03	.02	-.04	-.01	-.02	-.01
A GOD OR HIGHER POWER is intelligent like a human is intelligent.	.03	**-.70**	.13	.03	-.01	.08	.00	.00	.03	.04	.03	.01	-.05	.06
A GOD OR HIGHER POWER does not have a personality like a person has a personality.	.06	**.68**	-.04	.05	.03	-.15	-.05	-.01	-.03	-.02	-.02	.04	-.01	.03
I treat a GOD OR HIGHER POWER like a human.	-.01	**-.56**	.17	.06	.02	.06	-.01	.01	.03	-.01	.13	.01	-.07	-.01
I treat a PET like a human.	.08	-.04	**.67**	.11	.02	.04	-.01	.04	.02	-.04	.07	-.08	-.02	-.01
I do not act as if a PET has a spirit or life-force like people do.	-.05	.03	**-.66**	.01	-.01	-.05	.06	.04	-.10	.03	-.09	.09	-.09	.00
If a PET were to be destroyed, I would not mourn it like I would mourn the loss of a human.	-.06	.03	**-.63**	-.03	.01	-.07	.08	-.02	.02	.03	.08	.06	-.01	.06
A PET does not have a personality like a person has a personality.	-.02	.05	**-.63**	-.04	.01	-.09	.02	-.01	-.07	.01	-.01	.07	.12	.04
A PET has a spirit or life-force like people do.	.11	.01	**.61**	.00	.07	.06	.02	.04	.18	-.07	.00	-.06	-.10	.02
When I am clearly upset, a PET does not know.	-.06	.09	**-.59**	-.06	.06	-.07	.00	-.06	.03	.06	-.01	-.06	.08	-.07
A PET cannot communicate with people.	-.17	.09	**-.59**	.01	.01	.00	-.06	-.02	-.04	.04	-.03	-.05	-.05	-.07
I would not buy a present for a PET.	-.08	.11	**-.59**	.00	.02	-.05	.07	-.03	.00	.02	.03	.00	.06	.05
A PET is intelligent like a human is intelligent.	-.04	-.08	**.57**	.07	.00	.09	.02	.05	.14	-.01	.01	-.05	-.08	.07
I would not apologize to a PET for neglecting it.	-.11	.06	**-.56**	.01	-.11	-.03	-.03	.04	.03	.04	-.16	-.03	.00	-.04
I would apologize to a PET for accidentally hurting it.	.22	-.11	**.55**	.11	.11	.06	.00	.02	.06	.04	.04	-.01	-.06	.03
A PET likes certain people better than others.	.38	-.11	**.55**	.04	.14	.02	-.03	.01	-.01	-.01	.03	-.01	.00	.12
If I were to get rid of a PET, it would feel abandoned.	.31	-.06	**.54**	.02	.06	.01	-.01	.05	-.04	.00	.05	.03	.03	.06
I would talk to a PET.	.31	-.11	**.50**	.07	.04	.03	-.03	.03	-.04	.03	.03	.00	.04	-.05
When I talk to a PET, I do not believe it understands me.	.02	.15	**-.50**	-.04	-.01	.03	-.14	-.08	.05	.03	-.02	-.04	.03	-.03
I would not praise a PET when it does something I like.	-.11	.03	**-.47**	-.06	-.07	-.01	-.01	.09	.06	.02	-.08	-.04	-.01	.06
I would hit a COMPUTER if it did something I did not like.	-.03	-.05	.04	**.71**	.03	.06	.12	.09	.05	.00	.03	-.02	-.04	.08
I would yell at a CAR if it did something I did not like.	-.01	-.05	.07	**.67**	.02	.26	.14	.00	.00	-.04	.08	-.04	-.08	.02
I would yell at a COMPUTER if it did something I did not like.	.03	-.08	.11	**.64**	-.02	.05	.02	.07	-.02	.02	.01	-.17	.01	.02

I would hit a CAR if it did something I did not like.	-.04	.00	.05	**.64**	.04	.04	.15	.03	.02	-.08	-.06	-.03	-.03	.08
I would hit a MICROWAVE if it did something I did not like.	-.05	-.04	-.01	**.63**	-.01	.07	.33	.03	.06	-.02	.02	.02	.04	.01
I would talk to a COMPUTER.	-.07	-.10	.13	**.54**	-.03	.20	.04	.10	.07	.03	.26	-.09	-.10	.14
I would not praise a BACKPACK when it does something I like.	.39	-.01	.03	.05	**.53**	-.14	-.12	-.07	.00	.08	-.04	.03	-.02	-.07
When I talk to a MICROWAVE, I do not believe it understands me.	.36	-.04	.14	-.01	**.48**	-.03	.06	-.09	-.02	-.04	.06	.04	.06	.01
When I am clearly upset, an INSECT does not know.	.37	.00	.01	.03	**.45**	.02	-.11	-.07	-.20	.10	-.12	.05	.01	-.21
I would not apologize to a MICROWAVE for neglecting it.	.39	.00	.07	.06	**.43**	-.05	-.05	.05	-.09	.04	-.01	.06	.15	-.03
When I am clearly upset, a HOUSE PLANT does not know.	.36	.04	.02	-.03	**.40**	-.07	-.05	-.07	-.04	.08	-.18	.07	.07	.06
I would apologize to a CAR for accidentally hurting it.	-.16	-.08	.15	.26	-.06	**.61**	.10	.18	.00	-.12	.17	-.10	-.09	.07
I treat a CAR like a human.	-.19	-.11	.14	.18	-.07	**.56**	.12	.05	.08	-.10	.10	-.06	-.10	.14
I would not apologize to a CAR for neglecting it.	.38	.07	-.08	-.13	.06	**-.53**	-.11	-.06	-.09	.08	-.18	.04	.11	.01
If a CAR were to be destroyed, I would not mourn it like I would mourn the loss of a human.	.19	.04	-.09	-.07	.08	**-.50**	.01	-.08	-.01	.19	.10	.16	-.02	-.11
I would name a CAR.	-.01	-.13	.16	.21	-.03	**.47**	.05	.05	-.02	-.06	.02	-.03	-.01	.00
A CAR does not have a personality like a person has a personality.	.20	.09	-.12	-.09	.07	**-.44**	.01	-.16	-.01	.12	-.05	.24	.00	-.14
I would not praise a CAR when it does something I like.	.29	.11	-.08	-.23	.04	**-.42**	-.08	-.05	-.06	.03	-.19	.04	.12	.02
If I were to get rid of a CAR, it would feel abandoned.	-.39	-.02	.03	.06	.01	**.41**	.14	.17	.14	-.01	.07	.02	-.11	.14
I would hit a STUFFED TOY if it did something I did not like.	-.21	.01	-.01	.23	-.09	.11	**.60**	.11	.11	-.08	.04	-.06	-.03	.11
I would yell at a HOUSE PLANT if it did something I did not like.	-.28	.02	-.06	.12	-.06	.11	**.60**	.05	.12	-.03	.08	-.07	-.08	.12
I would yell at a BACKPACK if it did something I did not like.	-.17	-.04	-.02	.30	-.13	.00	**.56**	-.01	-.08	-.06	.09	-.05	-.07	.01
I would yell at a STUFFED TOY if it did something I did not like.	-.28	-.02	-.09	.11	.01	.03	**.55**	.23	.09	-.04	.05	-.09	-.05	.07
I would yell at an OCEAN if it did something I did not like.	-.21	-.03	-.01	.19	-.13	.17	**.45**	.01	.03	-.26	.10	-.10	-.11	.11
I would yell at a MICROWAVE if it did something I did not like.	-.26	-.04	.00	.37	-.03	.08	**.43**	.06	.12	.02	.10	.02	-.07	-.04
I would apologize to a STUFFED TOY for accidentally hurting it.	-.17	-.09	.14	.19	-.08	.24	.12	**.53**	.02	-.14	.25	-.06	-.12	.09
When I talk to a STUFFED TOY, I do not believe it understands me.	.28	.04	.02	-.03	.11	-.09	-.05	**-.53**	-.02	.01	.06	.16	-.01	-.08
When I am clearly upset, a STUFFED TOY does not know.	.29	.05	-.03	.01	.11	-.10	-.10	**-.52**	-.01	.11	.04	.15	-.07	-.06

I would not apologize to a STUFFED TOY for neglecting it.	.05	.05	-.04	-.11	.09	-.08	-.05	**-.49**	-.08	.09	-.21	.02	.16	.06
I do not act as if a STUFFED TOY has a spirit or life-force like people do.	.35	.02	-.03	-.06	.28	-.07	-.06	**-.47**	-.05	.05	-.13	.08	.01	-.01
I would talk to a STUFFED TOY.	-.19	-.10	.16	.16	.02	.11	.14	**.45**	.08	-.06	.24	-.05	-.08	.09
An INSECT has a spirit or life-force like people do.	-.21	-.01	.17	.04	-.05	.03	.05	.04	**.63**	-.09	.02	-.03	-.08	.03
A HOUSE PLANT has a spirit or life-force like people do.	-.29	-.04	.08	.03	-.02	.06	.07	.08	**.50**	-.24	.14	-.01	-.02	.04
An INSECT does not have a personality like a person has a personality.	.30	.06	-.08	.00	.19	-.10	-.05	-.02	**-.50**	.05	.00	.09	.10	-.09
An INSECT is intelligent like a human is intelligent.	-.21	-.05	.12	.07	-.19	.07	.05	.05	**.42**	-.05	.03	-.03	-.13	.14
I treat an OCEAN like a human.	-.15	.01	.08	.00	-.04	.06	.06	.06	.06	**-.58**	.00	-.01	-.06	-.04
If an OCEAN were to be destroyed, I would not mourn it like I would mourn the loss of a human.	.11	-.02	-.12	.03	.04	-.17	-.02	-.08	-.08	**.55**	-.07	.11	.03	.01
I would apologize to an OCEAN for accidentally hurting it.	-.23	.00	.03	.07	-.19	.10	.17	.09	.10	**-.53**	.27	.03	-.13	.05
I would not praise an OCEAN when it does something I like.	.19	.09	-.02	-.04	.19	-.05	-.08	-.05	-.01	**.49**	-.10	.14	.17	-.03
I would not apologize to an OCEAN for neglecting it.	.25	.06	-.04	-.03	.24	-.09	-.04	-.08	-.04	**.48**	-.13	.11	.13	.02
An OCEAN has a spirit or life-force like people do.	-.38	-.06	.09	.07	.00	.09	.07	.08	.33	**-.46**	.07	.03	.00	.11
I would talk to an OCEAN.	-.28	-.09	.08	.07	.04	.16	.18	.10	.15	**-.45**	.28	.04	-.08	.07
An OCEAN is intelligent like a human is intelligent.	-.20	-.07	.08	.04	-.07	.01	.01	.09	.08	**-.40**	-.01	-.08	-.02	.04
I would apologize to a HOUSE PLANT for accidentally hurting it.	-.14	-.03	.14	.11	-.02	.18	.15	.21	.14	-.25	**.59**	.02	-.11	.09
I would talk to a HOUSE PLANT.	-.13	-.10	.18	.16	-.04	.16	.13	.16	.11	-.12	**.52**	.03	-.10	.09
I would not apologize to a HOUSE PLANT for neglecting it.	.22	.06	-.12	-.08	.16	-.16	-.04	-.13	-.15	.19	**-.56**	.03	.15	-.08
A GOD OR HIGHER POWER does not do things just to annoy me.	.11	-.05	-.07	-.05	.07	-.04	-.06	-.06	-.06	.01	.07	**.66**	.04	-.01
LUCK does not do things just to annoy me.	.15	.05	-.01	-.10	.06	-.12	-.07	-.11	-.02	.03	-.04	**.65**	.06	-.07
LUCK likes certain people better than others.	-.11	-.02	.14	.16	-.02	.07	.12	.04	.04	-.05	-.03	**-.53**	-.01	.24
I would not praise LUCK when it does something I like.	.16	.09	-.13	-.10	.09	-.15	-.08	-.01	.03	.15	-.13	**.45**	.14	.06
When I am clearly upset, a STOMACH does not know.	.18	.10	-.17	-.05	.09	-.04	-.02	.02	-.03	.22	-.04	.07	**.54**	-.08
I would apologize to a STOMACH for accidentally hurting it.	-.20	-.08	.12	.16	-.03	.20	.19	.15	.11	-.15	.16	-.07	**-.49**	.08
I would not apologize to a STOMACH for neglecting it.	.39	.07	-.11	-.01	.01	-.18	-.18	-.08	-.17	.09	-.20	.05	**.45**	-.04

I would talk to a STOMACH.	-.10	-.07	.17	.26	-.01	.17	.11	.09	.06	-.06	.22	-.09	**-.44**	.06
When I talk to a STOMACH, I do not believe it understands me.	.38	.04	.05	.00	.25	-.05	-.08	-.10	-.09	.04	-.01	-.02	**.43**	-.16
A COMPUTER likes certain people better than others.	-.29	.01	.04	.17	-.12	.17	.10	.12	.02	.01	.08	-.08	-.10	**.62**
A CAR likes certain people better than others.	-.31	-.02	.04	.20	-.11	.30	.10	.09	.07	-.04	.08	-.09	-.13	**.60**
An OCEAN likes certain people better than others.	-.32	-.02	-.01	.05	-.14	.04	.20	.13	.10	-.29	.08	-.03	-.06	**.40**
I would apologize to a MICROWAVE for accidentally hurting it.	-.37	.01	-.08	.01	-.18	.08	.16	.12	.07	-.09	.10	.02	-.09	.06
A STUFFED TOY has a spirit or life-force like people do.	-.39	-.01	.00	.08	-.08	.03	.09	.36	.10	-.07	-.01	-.01	.03	.08
I would not praise a COMPUTER when it does something I like.	.24	.08	-.10	-.26	.14	-.19	-.09	-.06	-.03	.08	-.15	.09	.12	-.04
A CAR cannot communicate with people.	.33	.02	-.03	-.11	.08	-.21	-.06	-.06	-.04	.06	-.01	.02	.10	-.07
A HOUSE PLANT cannot communicate with people.	.36	.04	-.07	-.01	.06	-.08	-.07	-.04	-.21	.10	-.31	-.01	.04	-.01
I would name a STUFFED TOY.	.03	-.18	.23	.18	-.01	.06	-.02	.23	.07	-.07	.10	-.09	-.09	.00
A COMPUTER cannot communicate with people.	.27	.05	-.05	-.02	.04	-.06	-.03	-.03	-.07	.07	-.05	.04	.08	-.05
I would yell at LUCK if it did something I did not like.	-.16	-.03	.00	.18	-.03	.12	.34	.08	.07	-.09	.09	-.30	-.15	.08
I would talk to LUCK.	-.27	-.09	.06	.14	.02	.07	.18	.12	.08	-.10	.24	-.33	-.08	.01
I would name a COMPUTER.	-.28	-.01	.04	.11	.06	.22	.11	.05	.11	.00	.06	.01	-.07	.18
A COMPUTER is intelligent like a human is intelligent.	-.37	-.07	.04	.11	-.01	.15	.00	.06	.08	-.03	-.01	.00	-.08	.01
A GOD OR HIGHER POWER likes certain people better than others.	-.19	.04	.12	.12	.00	-.02	.05	.04	.06	-.04	.00	-.24	-.03	.11
I would hit a PET if it did something I did not like.	-.03	-.07	-.04	.17	-.06	.03	.05	-.02	-.02	.03	-.02	-.02	-.04	-.01
I would yell at a STOMACH if it did something I did not like.	-.21	.00	.02	.16	-.03	.11	.34	.13	.03	-.05	.04	-.07	-.36	.06
A PET does not do things just to annoy me.	.22	.06	-.21	-.13	.01	-.03	-.01	-.05	-.03	.06	-.08	.16	.12	-.10
I would yell at an INSECT if it did something I did not like.	-.16	-.05	.07	.26	.02	.07	.38	.07	.20	-.02	.16	.00	-.10	.02
I would apologize to a COMPUTER for accidentally hurting it.	-.39	-.04	.04	.04	-.01	.24	.24	.14	.05	-.05	.19	-.03	-.08	.07
I would hit an INSECT if it did something I did not like.	.06	-.04	.07	.15	.02	.01	.16	.06	.04	-.05	.04	.01	-.06	.03
I would apologize to an INSECT for accidentally hurting it.	-.23	-.07	.07	.07	.00	.06	.20	.10	.30	-.09	.30	-.10	-.08	.00
I would yell at a GOD OR HIGHER POWER if it did something I did not like.	-.03	-.09	.10	.21	.02	.01	.13	.08	.05	-.02	.06	-.17	-.02	.06
A BACKPACK has a spirit or life-force like people do.	-.29	.03	-.02	-.01	-.10	.04	.03	.06	.10	-.13	.01	-.02	-.03	.08

I would name an INSECT.	-.25	-.05	.08	.13	.00	.05	.15	.17	.32	-.12	.27	-.05	.00	-.05
I would apologize to a BACKPACK for accidentally hurting it.	-.25	.01	-.04	.06	-.11	.12	.16	.12	.03	-.12	.08	-.11	-.07	.05
A CAR is intelligent like a human is intelligent.	-.25	-.04	.04	.07	-.09	.31	.04	.17	.12	-.07	-.06	-.04	-.02	.12
I would name a MICROWAVE.	-.26	.03	.00	.10	-.13	.02	.11	.01	.11	-.06	-.03	-.09	-.02	.12
I would name a HOUSE PLANT.	-.10	-.05	.17	.12	.01	.15	.12	.08	.05	-.11	.28	.02	-.04	.02
A MICROWAVE does not have a personality like a person has a personality.	.22	.03	-.04	-.08	.10	-.04	.05	-.10	-.01	.08	-.12	.10	.04	-.03
A MICROWAVE cannot communicate with people.	.24	-.02	.02	-.02	.17	.04	.03	-.01	-.02	.18	.03	-.02	-.01	.02
I would talk to an INSECT.	-.02	-.06	.15	.23	.05	.15	.13	.16	.19	-.12	.27	.07	-.02	.03
I would not buy a present for a STUFFED TOY.	.31	.03	.08	-.03	.28	.00	-.03	-.22	-.01	.06	-.07	.13	.04	-.01
I do not act as if a BACKPACK has a spirit or life-force like people do.	.39	-.03	.06	.07	.25	-.02	-.04	-.09	.02	.12	-.04	.11	.03	.08
An INSECT likes certain people better than others.	-.16	-.06	.10	.13	-.03	.08	.18	.14	.24	-.10	.10	-.15	-.07	.38
An INSECT cannot communicate with people.	.18	.03	-.10	-.04	.21	-.05	-.10	-.10	-.28	.23	-.08	.08	.05	-.07
I would name a BACKPACK.	-.32	.02	-.01	.06	-.26	.08	.21	.10	.05	-.07	.04	-.01	-.05	.13
A HOUSE PLANT likes certain people better than others.	-.14	-.05	.11	.08	-.07	.03	.06	.08	.04	-.13	.22	-.18	-.10	.20
If an INSECT were to be destroyed, I would not mourn it like I would mourn the loss of a human.	.27	-.01	.04	-.01	.36	-.04	.01	-.12	-.31	.11	-.07	.12	.00	-.07
I would talk to a MICROWAVE.	-.26	.01	-.01	.25	-.11	.07	.22	-.04	-.03	-.01	.39	-.07	.00	.14
I would yell at a PET if it did something I did not like.	.16	-.08	.24	.24	.18	.01	-.01	-.07	-.03	.04	-.06	-.02	-.05	.00
A STUFFED TOY does not do things just to annoy me.	.36	.00	.07	-.06	.38	.00	-.07	-.02	.07	.07	-.05	.15	.04	-.07
I would name an OCEAN.	-.10	-.04	.05	.07	-.03	.08	.06	-.03	.11	-.34	.07	.09	-.08	.08
I would not buy a present for a CAR.	.30	.03	-.02	-.01	.30	-.36	-.15	-.09	-.04	.04	-.04	.05	.06	-.21
An INSECT does not do things just to annoy me.	.31	.06	-.09	-.03	.16	-.06	-.13	-.09	-.13	.07	-.13	.22	.11	-.38
A STUFFED TOY likes certain people better than others.	-.38	.01	.03	.02	-.26	.09	.18	.37	.04	-.04	.03	-.02	-.01	.26
A STOMACH does not do things just to annoy me.	.39	.02	.01	-.04	.20	-.08	-.05	-.09	-.04	.06	-.01	.24	.39	-.12
I treat LUCK like a human.	-.30	-.02	-.01	.04	-.12	.12	.16	.05	.10	-.10	.02	-.14	-.06	.07
I would not buy a present for a COMPUTER.	.19	-.02	.08	.00	.09	-.11	-.10	-.07	.01	.03	.02	.08	.02	-.07

A HOUSE PLANT is intelligent like a human is intelligent.	-.39	-.01	-.03	.06	-.29	.06	.11	.06	.33	-.14	.12	.09	-.06	.09
When I talk to a COMPUTER, I do not believe it understands me.	.36	-.02	.09	.01	.26	-.07	-.14	-.15	-.03	-.02	-.02	.07	.11	-.17
A STOMACH cannot communicate with people.	.21	.08	-.11	-.05	.04	-.09	-.06	.00	-.13	.10	-.06	.05	.31	-.04
LUCK has a spirit or life-force like people do.	-.33	-.07	-.01	.10	-.15	.06	.07	.06	.10	-.13	.04	-.12	-.12	.13

APPENDIX G: EXPERIMENT 1 INFORMED CONSENT

Physiological Components of Uncanny Stimuli:
Substantiation of Self-Assessment and Individual Perception
in User Enjoyment and Comfort

Informed Consent

Principal Investigator(s): Tatiana T. Ballion

Faculty Supervisor: Dr. Valerie K. Sims

Investigational Site(s): University of Central Florida, Department of Psychology

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about two hundred people at UCF. You have been asked to take part in this research study because you are in a class eligible for SONA participation. You must be 18 years of age or older to be included in the research study.

The person doing this research is Tatiana Ballion of the University of Central Florida, Applied Experimental and Human Factors program. Because the researcher is a graduate student, she is being guided by Dr. Valerie Sims, a UCF faculty supervisor in Psychology.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.

- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to investigate how people classify images as "normal" or "uncanny", and gain insight into the reactive and decision making process.

What you will be asked to do in the study: You will be asked to answer demographics questions, followed by two questionnaires. Neither the demographics information nor the two questionnaires are used as a diagnostic tool – in other words, none of these questions classify you as any "type". After answering these questions, you will be asked to view a series of photographs and rate the pictures according to definitions you will be given by selecting the appropriate rating from a list.

Location: This study will be conducted on SONA.

Time required: We expect that you will be in this research study for no longer than two hours. It is expected that you will be completing this study outside of class.

Risks: There are no reasonably foreseeable risks or discomforts involved in taking part in this study.

Benefits: We cannot promise any benefits to you or others from your taking part in this research. However, possible benefits include SONA credit.

Alternatives: Instead of being in this research study, your choices may include: writing papers and submitting them to SONA, if eligible.

Compensation or payment: There is no direct compensation for taking part in this study. It is possible, however, that extra credit may be offered for your participation, but this benefit is at the discretion of your instructor.

Confidentiality: We will limit your personal data collected in this study to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of UCF.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research has hurt you, contact: Tatiana Ballion, Graduate Student, Applied Experimental and Human Factors, Department of Psychology, (407) 823-2794 or Dr.

Valerie Sims, Faculty Supervisor, Department of Psychology at (407) 823-0343 or by email at valerie.sims.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Your signature below indicates your permission to take part in this research.

DO NOT SIGN THIS FORM AFTER THE IRB EXPIRATION DATE BELOW

Name of participant

Signature of participant | Date

APPENDIX H: DEMOGRAPHIC QUESTIONNAIRE

DEMOGRAPHIC INFORMATION

Please fill in the blank or circle the appropriate response.

1. Age _____

2. Race _____

3. Gender: Male Female

4. I enjoy playing video games:

1 2 3 4 5 6 7
Strongly disagree Neutral Strongly agree

5. My level of playing video games is:

1 2 3 4 5 6 7
Novice Expert

6. How many hours a week do you spend playing video games? _____

7. How many years have you been playing video games? _____

8. At what age did you begin playing any video games? _____

9. Do you have any experience with beauty pageants? Yes No

If yes, what type of experience? Participating Attending/Watching

10. Do you have any military experience? Yes No

If yes, which branch _____

11. Do you wear corrective lenses (glasses or contacts)? Yes No

12. What is major? _____

13. What year in school are you? _____

14. Do you own any pets? Yes No

If yes, what kind? _____

15. Do you enjoy reading about or engaging in paranormal activities (e.g., astrology, séances, tarot, or aliens/U.F.O.s)? Yes No

16. What religion are you? _____

17. Do you enjoy watching horror movies? Yes No

APPENDIX I: EXPERIMENT 1 PICTURE INTRODUCTION/INSTRUCTIONS

You will be asked to view, rate, and describe several pictures. Please use the scale below to rate, and describe in your own words in the appropriate comment area. Please do not press the "Back" button.

Please note: EVERY PAGE HAS A PICTURE. Picture loading time may vary based on your computer's processing speed. PLEASE WAIT FOR EACH PICTURE TO LOAD. * The survey will notify you when you are out of the Pictures section.

Uncanny: This stimulus appears alarming or unnerving because of its features (or lack of). There is something that appears fundamentally “wrong” or “unhealthy” about this stimulus. If I were to meet this stimulus in a face-to-face situation, I would feel revulsion or fear quickly.

Neutral: This stimulus does not evoke any response, positive or negative. If I were to meet this stimulus in a face-to-face situation, I would have virtually no reaction.

Pleasant: This stimulus appears enjoyable or peace-inducing because of its features (or lack thereof). There is something that appears fundamentally “right” or “positive” about this stimulus. If I were to meet this stimulus in a face-to-face situation, I would feel pleasure or enjoyment quickly.

None of the above: Not conforming to any other description.

If the stimulus is not clearly meeting the criteria above, please mark "None of the above". For example, if you are presented a picture of a butterfly, and you personally find butterflies scary or disgusting, please adhere to the intention of the question, and mark "None of the above", and not "Uncanny".

APPENDIX J: EXPERIMENT 1 CORRELATIONS FOR REGRESSION ANALYSIS

Table 23: Correlations of Multiple Regression Analyses for Variables Predicting Participants' Ratings of Uncanny Images (N = 306)

Variable	UC	HH	EM	EX	AG	C	O	A	EA	G/D	P	N	E_VG	EXP	HRS	YRS
Honesty-Humility	.021															
Emotionality	.210	.162														
Extraversion	-.073	.017	-.145													
Agreeableness	-.022	.234	-.100	.217												
Conscientiousness	.019	.144	.201	.230	.117											
Openness to Experience	.034	.113	.076	.006	.089	.081										
Altruism	.109	.383	.417	.123	.266	.285	.220									
Extreme Anthropomorphism	.134	.135	.119	.130	.050	.191	.099	.324								
Anthropomorphism of Pets	-.076	-.152	-.069	-.121	-.106	-.009	.076	-.214	-.021							
Anthropomorphism towards Gods or Deities	.102	.083	.242	-.025	-.022	.071	.162	.276	.363	-.099						
Negative Anthropomorphism	.055	-.183	-.033	-.095	-.054	-.077	-.058	-.145	-.266	-.103	-.047					
VG Enjoyment	.073	-.092	-.235	-.061	.024	-.125	.114	-.063	.037	.060	.006	-.046				
VG Expertise	-.018	-.098	-.407	-.004	.148	-.134	.086	-.147	-.010	.111	-.085	-.023	.735			
VG Hrs/Wk	-.078	-.114	-.372	.002	.048	-.114	.032	-.166	.060	.112	-.044	-.023	.515	.586		
VG Years Playing	-.017	.035	-.114	-.057	-.005	.029	.139	-.030	.139	.046	.070	-.066	.488	.457	.283	
VG First Played	-.066	.055	.059	.013	-.081	.080	.049	.118	.060	-.110	.023	-.040	.055	-.023	-.066	-.146

APPENDIX K: EXPERIMENT 1 NEUTRAL AND PLEASANT REGRESSION ANALYSES

Table 24: Summary of Multiple Regression Analyses for Variables Predicting Participants' Ratings of Neutral Images (N = 309)

Variable	*B*	*SE B*	β	sr^2 (unique)
Honesty-Humility	1.808	2.003	0.057	
Emotionality	-3.758	2.228	-0.199	
Extraversion	3.630*	1.835	0.122	0.013
Agreeableness	-4.633*	2.118	-0.139	0.016
Conscientiousness	-0.291	1.935	-0.009	
Openness to Experience	-3.999*	1.709	-0.139	0.018
Altruism	2.156	1.880	0.086	
Extreme Anthropomorphism	-0.108	0.075	0.046	
Anthropomorphism of Pets	0.077	0.100	-0.076	
Anthropomorphism towards Gods or Deities	0.077	0.175	0.028	
Negative Anthropomorphism	-0.125	0.248	-0.030	
VG Enjoyment	1.464	0.825	0.156	
VG Expertise	*0.332*	*0.956*	*0.033*	
VG Hrs/Wk	-0.708	0.844	-0.080	
VG Years Playing	0.057	0.178	0.022	
VG First Played	-0.458*	0.224	-0.120	0.014
R^2		0.081[a]		
Adjusted R^2		0.031		
R		0.285		
F		1.624		

Note. * $p < .05$.
[a] Unique variability = .061; shared variability = .02.

Table 25: Summary of Multiple Regression Analyses for Variables Predicting Participants' Ratings of Pleasant Images (N = 306)

Variable	*B*	*SE B*	β	sr^2 (unique)
Honesty-Humility	-4.397*	1.946	-0.134	0.017
Emotionality	7.962*	2.205	0.243	0.043
Extraversion	1.091	1.787	0.035	
Agreeableness	4.044*	2.055	0.117	0.013
Conscientiousness	1.110	1.895	0.034	
Openness to Experience	3.854*	1.679	0.128	0.018
Altruism	2.168	1.828	0.084	
Extreme Anthropomorphism	0.085	0.073	0.072	
Anthropomorphism of Pets	-0.062	0.098	-0.036	
Anthropomorphism towards Gods or Deities	0.305	0.170	0.106	
Negative Anthropomorphism	-0.161	0.241	-0.038	
VG Enjoyment	-1.071	0.816	-0.110	
VG Expertise	0.950	0.836	0.103	
VG Hrs/Wk	0.114	0.183	0.042	
VG Years Playing	-0.194	0.180	-0.070	
VG First Played	0.459*	0.224	0.114	0.014
R^2		0.194[a]		
Adjusted R^2		0.150		
R		0.441		
F		4.369		

Note. * $p < .05$.
[a] Unique variability = .105; shared variability = .089.

APPENDIX L: EXPERIMENT 2 STIMULI

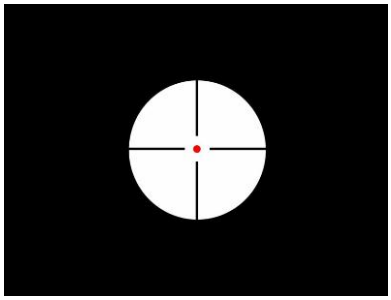
Evaluation Study Part Two

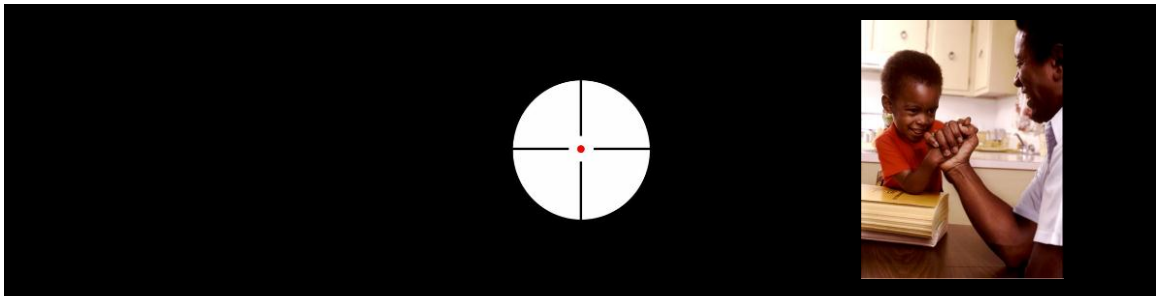
Introduction

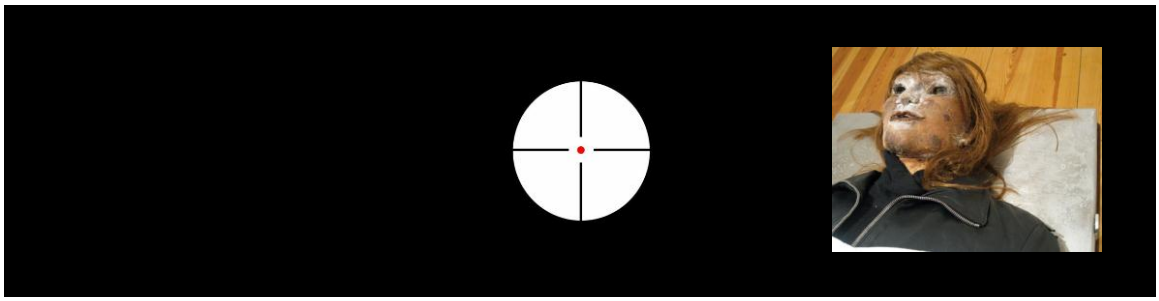
- Instructions: In this segment of the study, you will be shown several pictures. In-between the pictures, you will be shown a target.
- When the target comes up, please look at the center of the target. When the pictures are presented, please look at them as you normally would.
- As the slides advance, you may hear a low tone; please expect this, and do not let this tone startle or distract you. The purpose of the tone is to indicate to the experimenter when the slides are advancing.

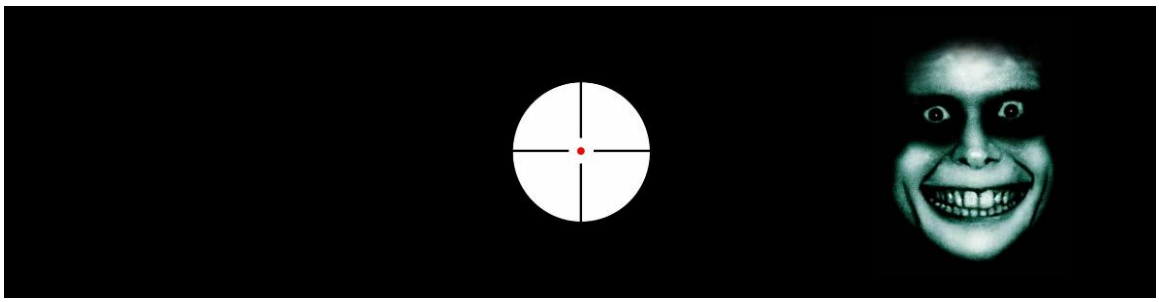
Instructions

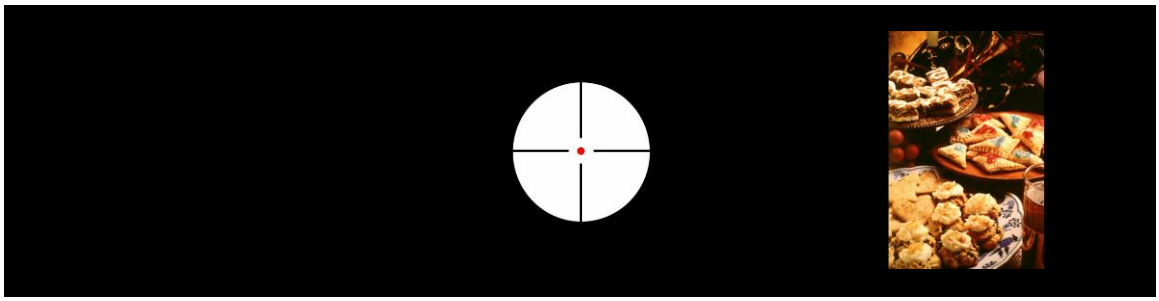
- During this segment, there are no "right" or "wrong" answers, and nothing to memorize.
- While the study is in progress, please sit still, facing the screen, and in an upright position. Please do not talk. After you have been disconnected, you may talk freely. Viewing the pictures will take approximately five minutes.
- If you need to discontinue participation in the study, please indicate so by raising your hand. Data collection will terminate as quickly as possible. Thank you.

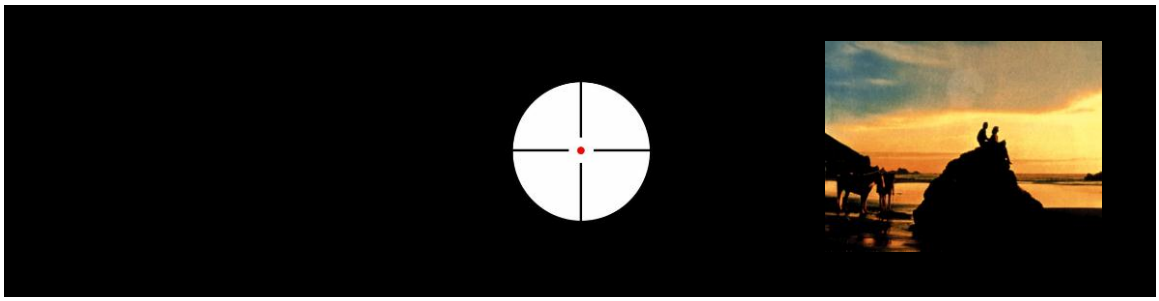


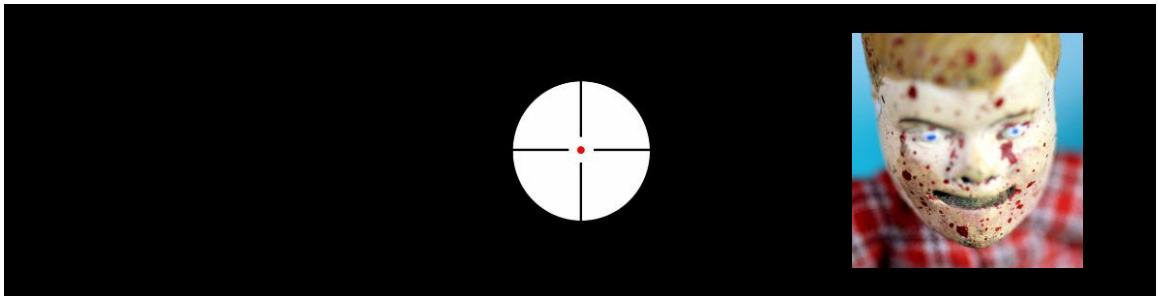


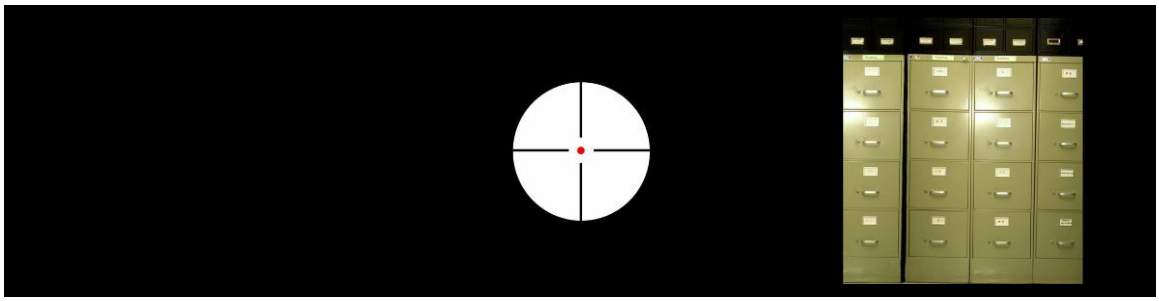


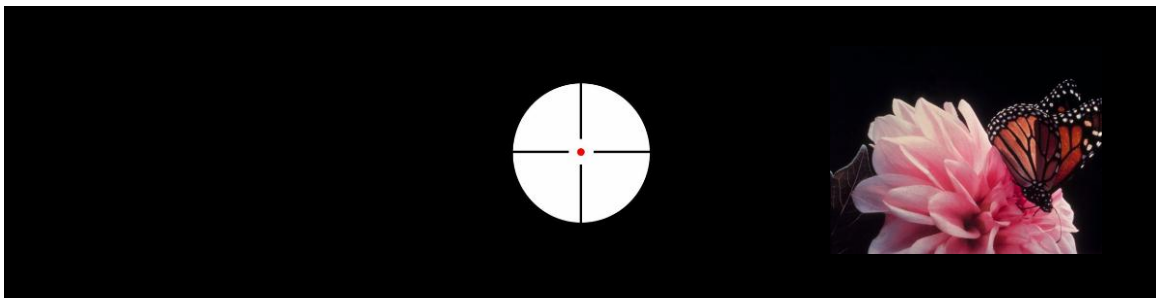


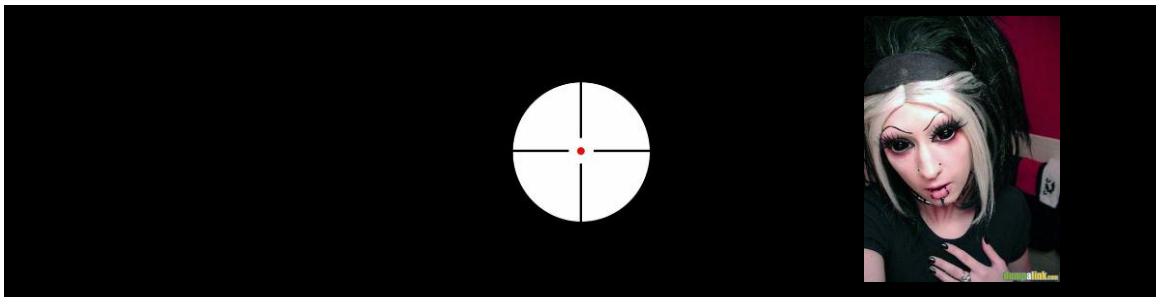


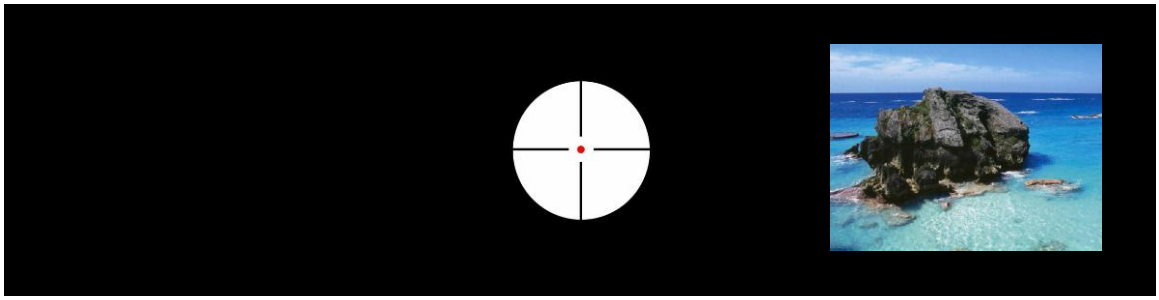


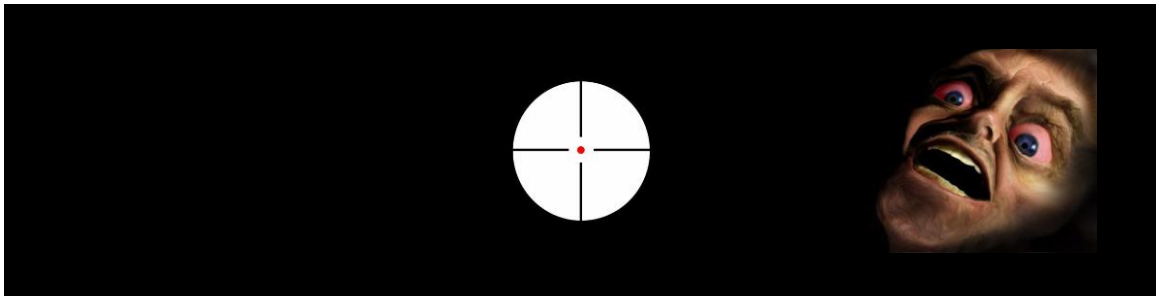


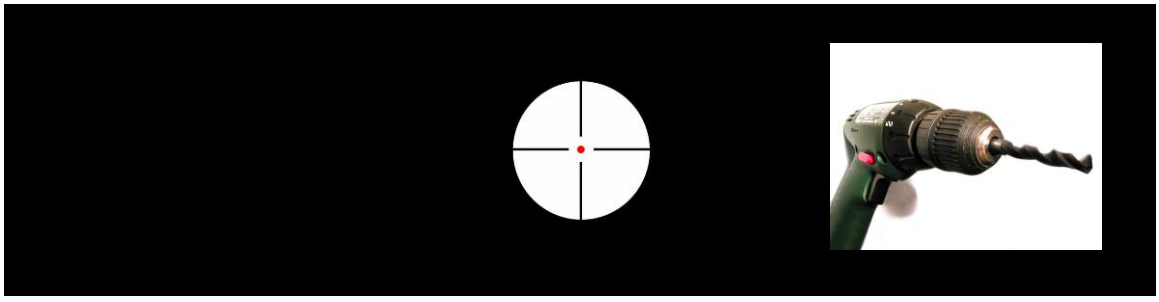


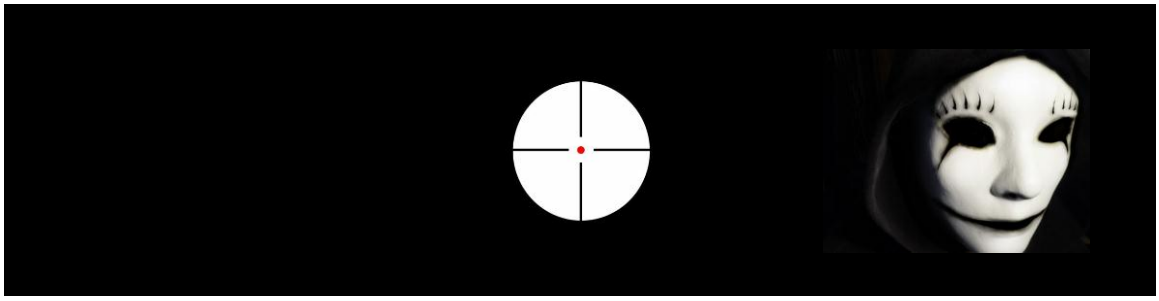


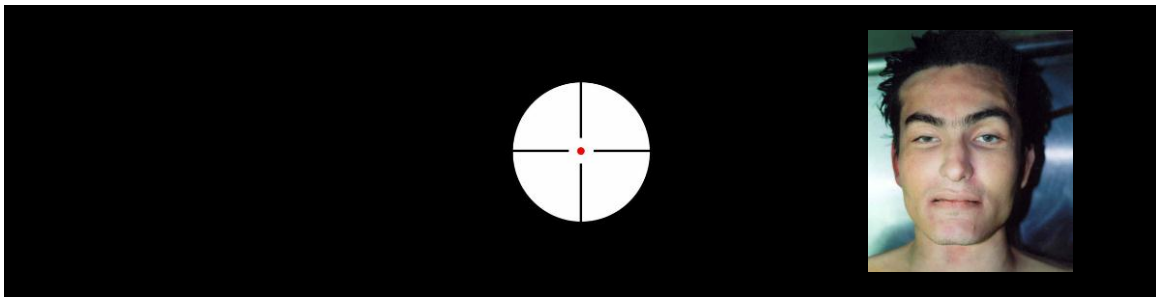


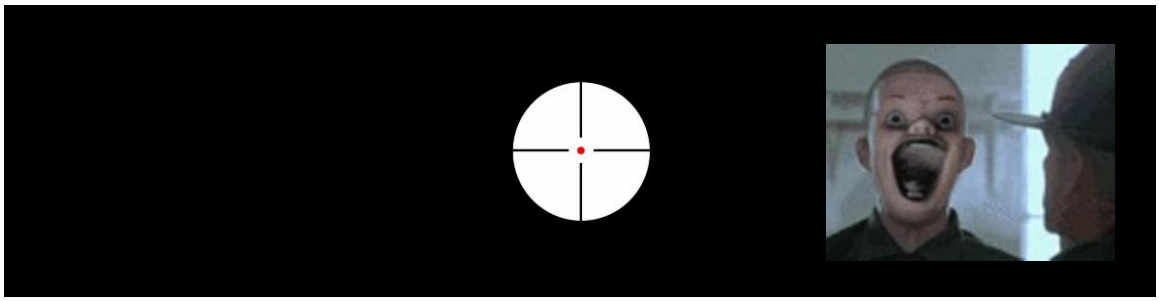


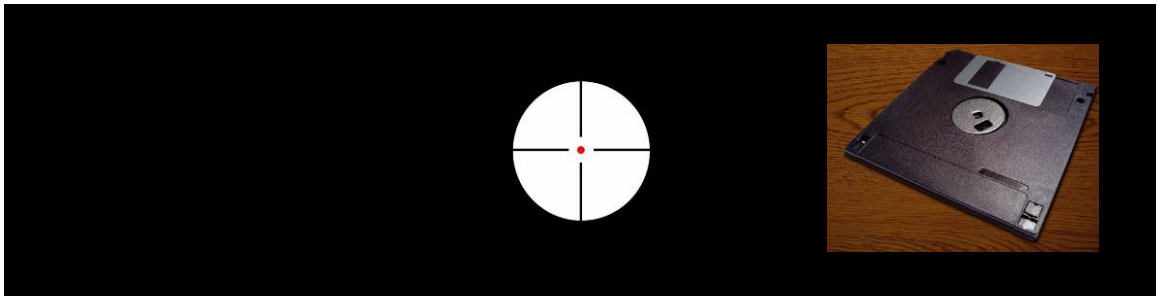


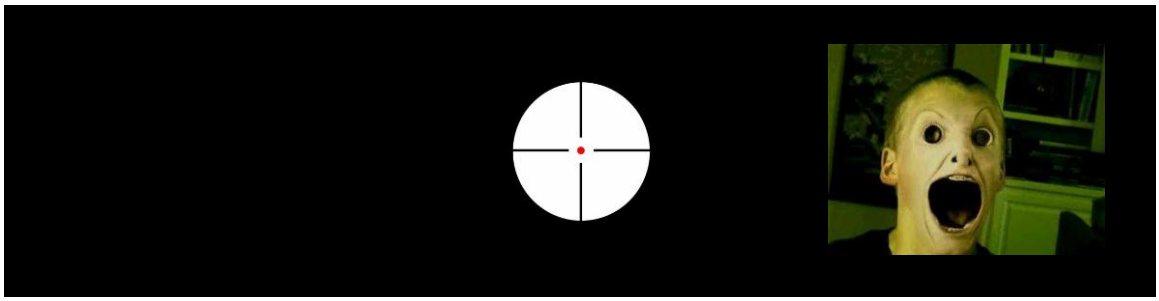


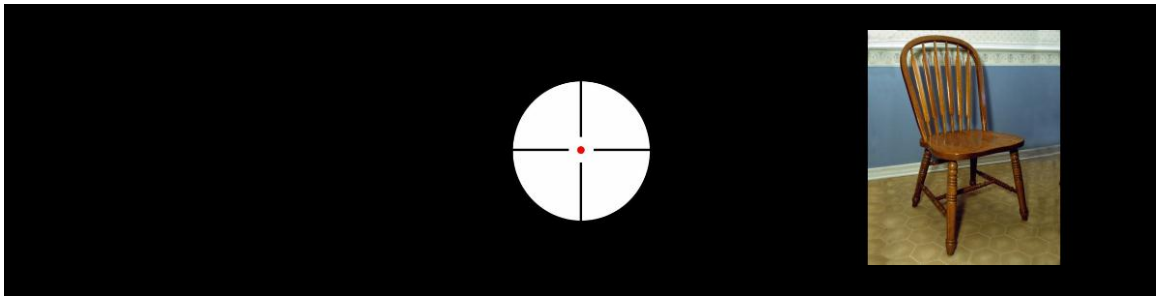


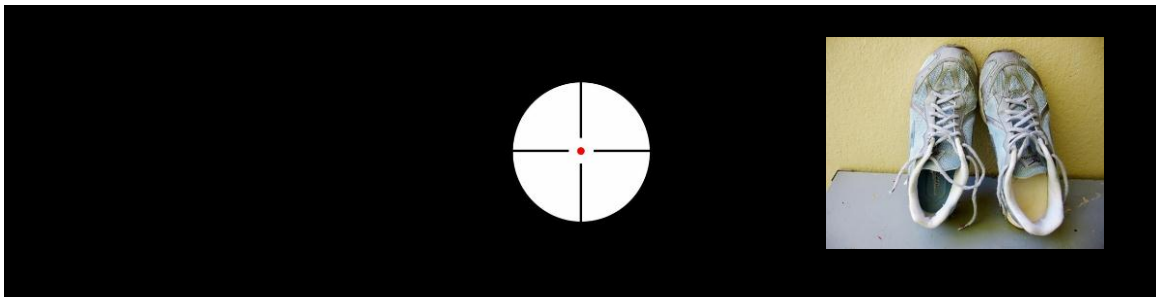


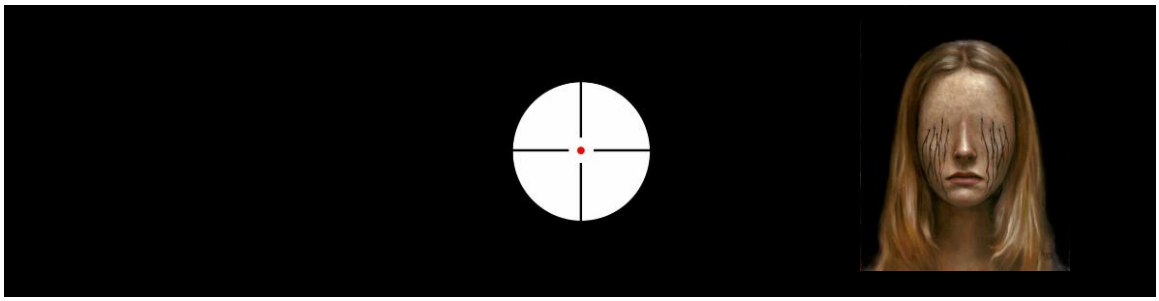


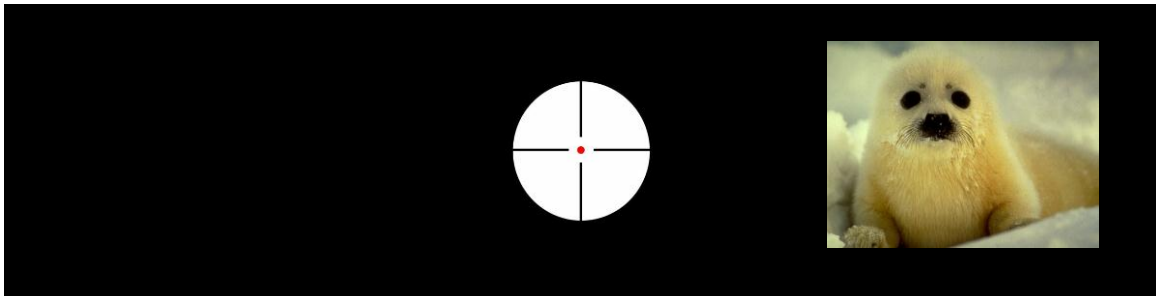


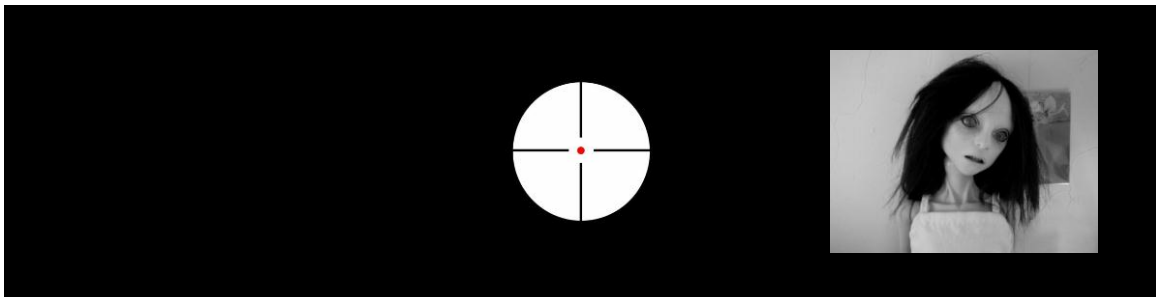


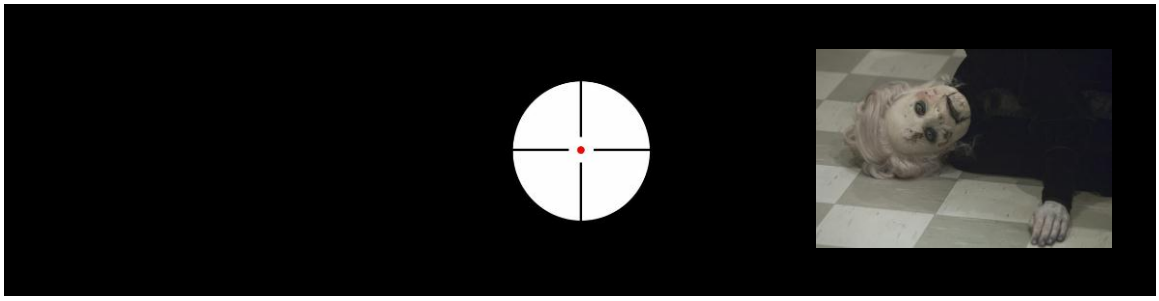


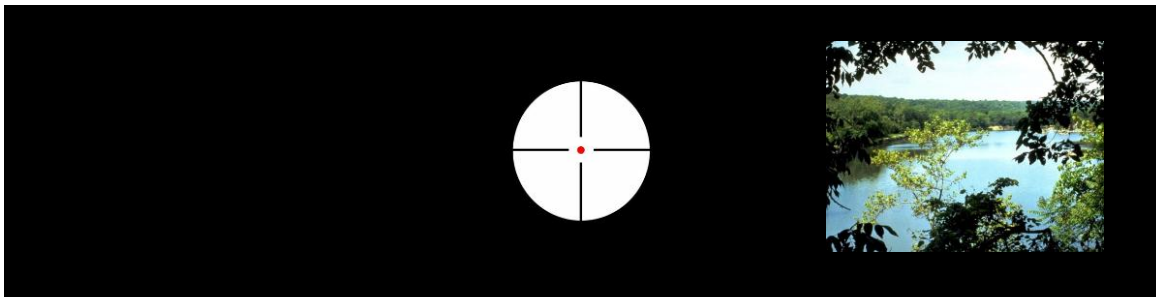


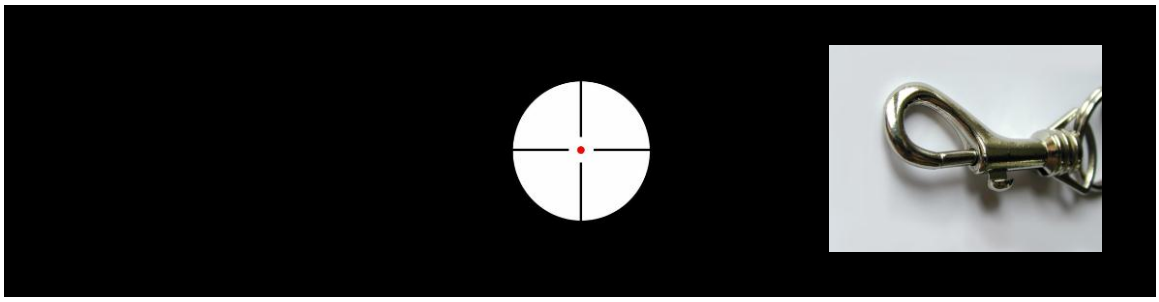


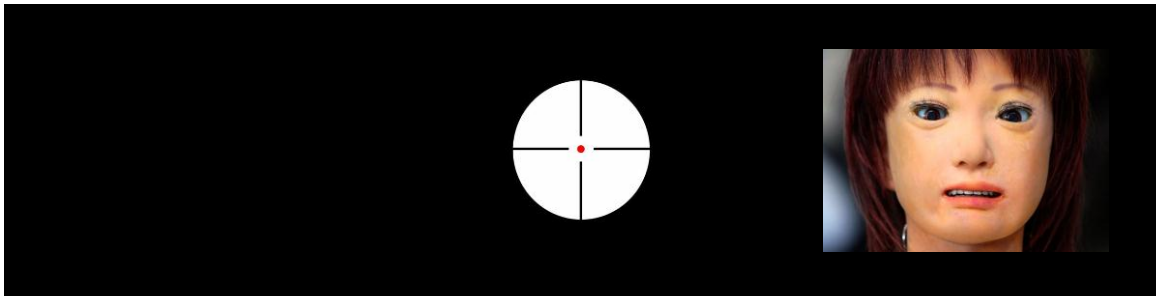


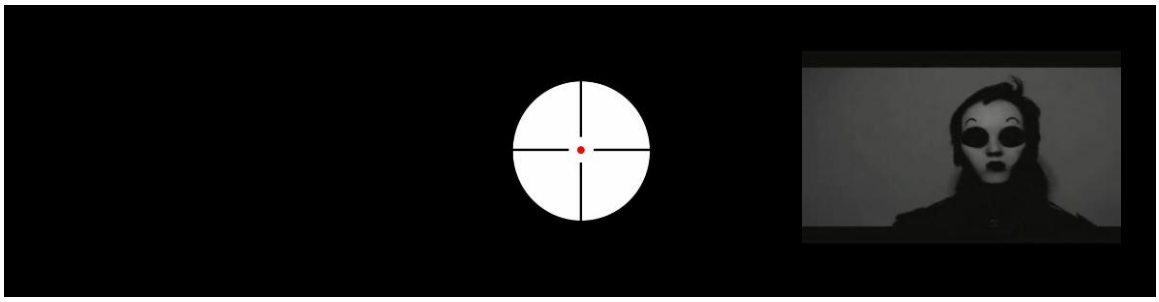


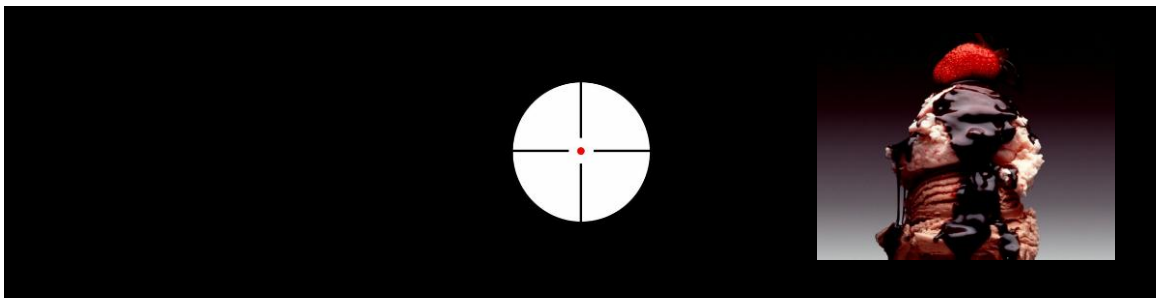


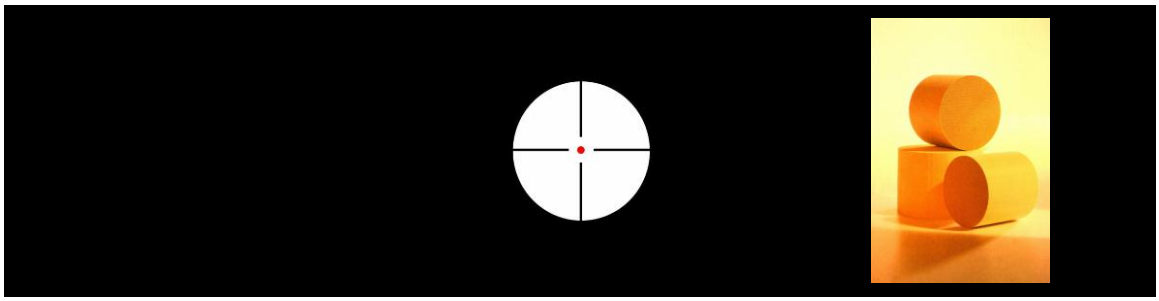


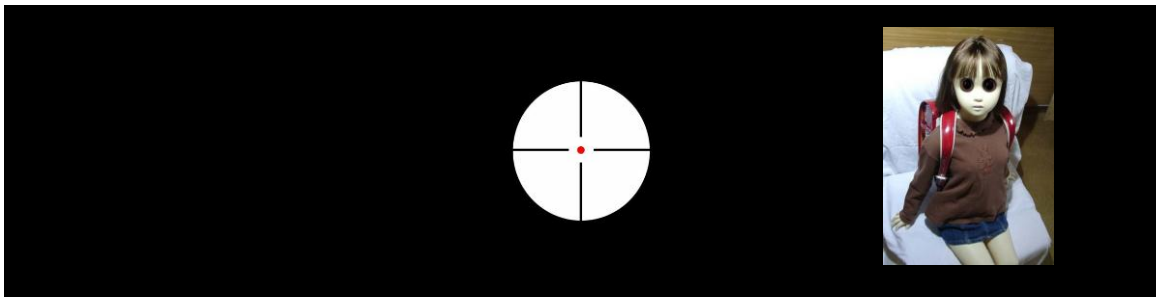


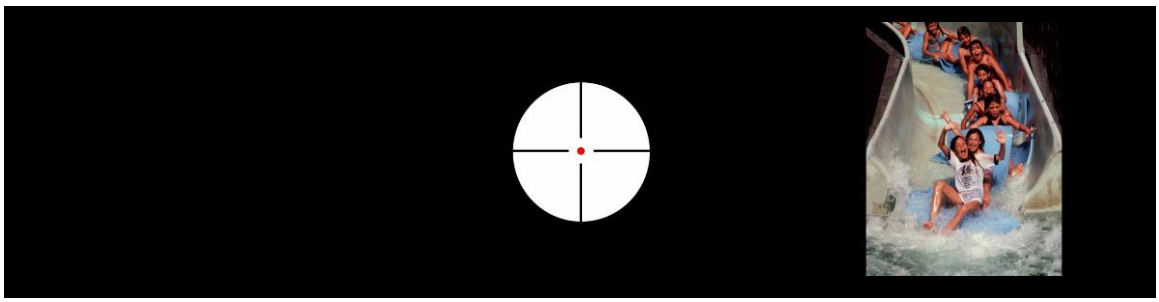


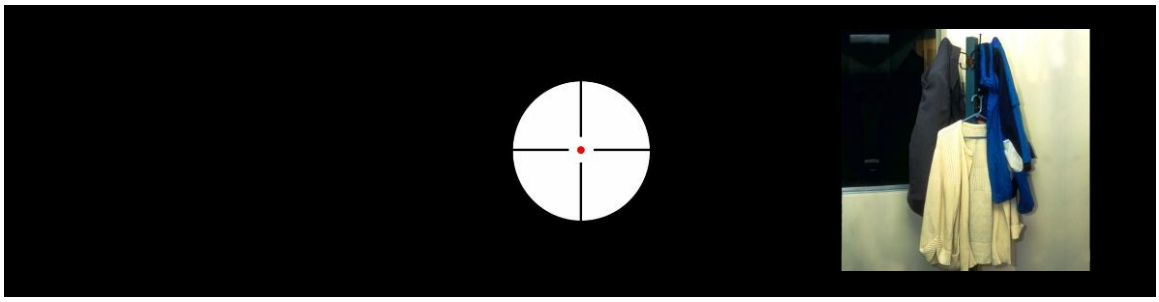


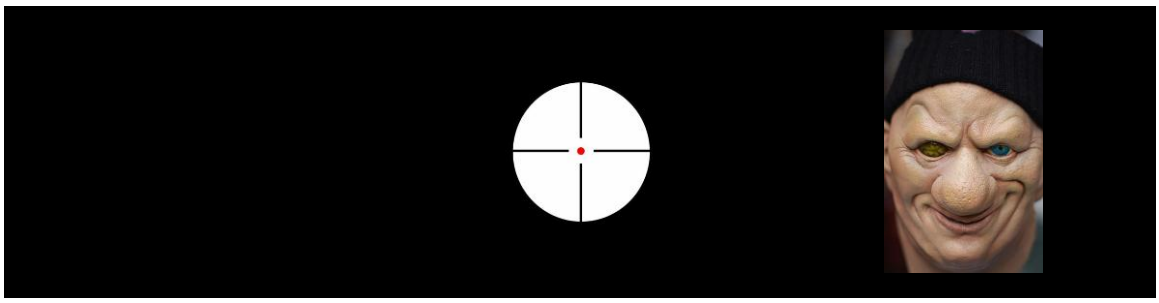


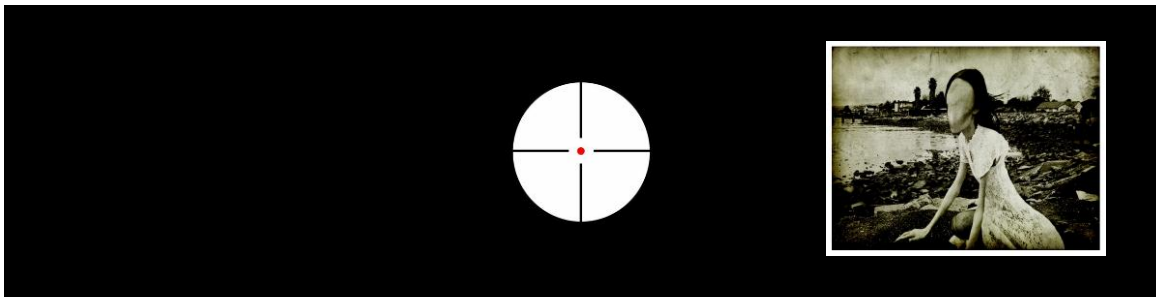


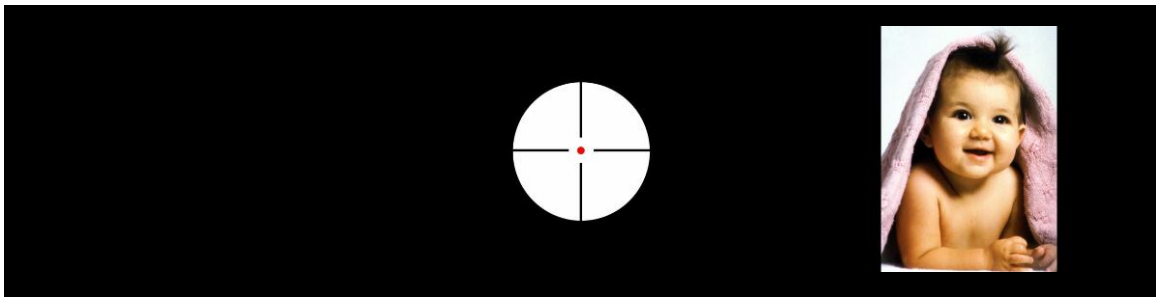


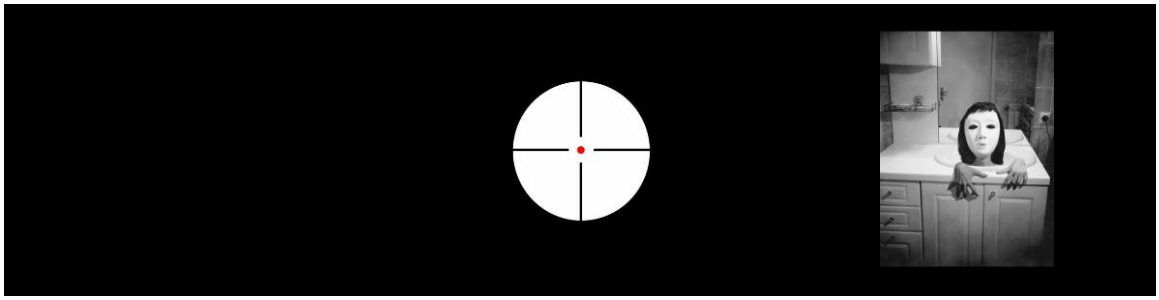


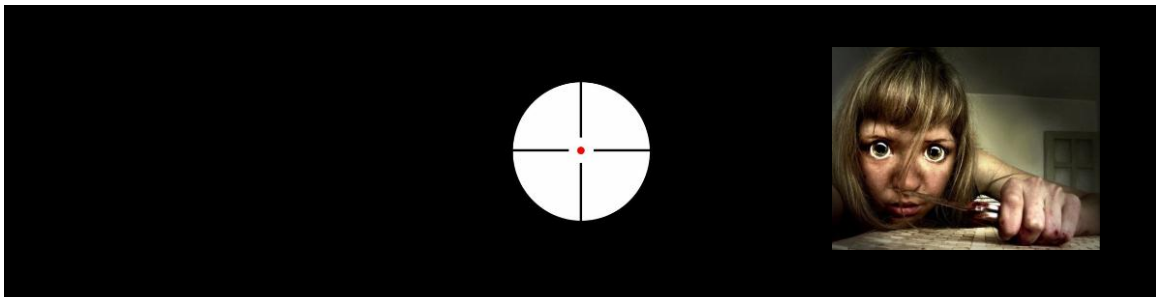


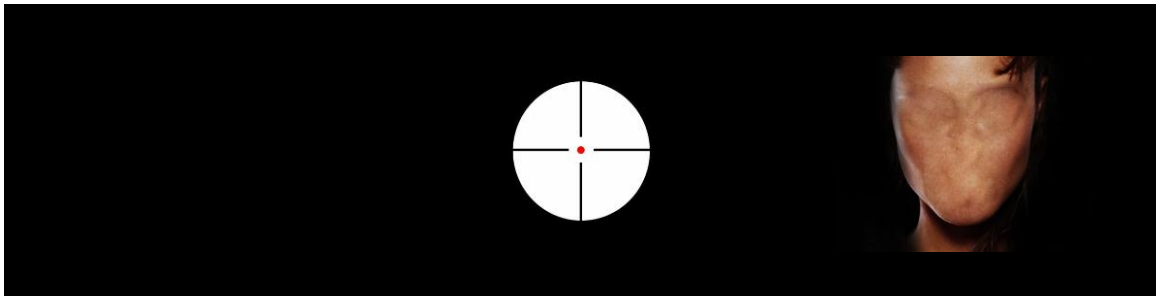


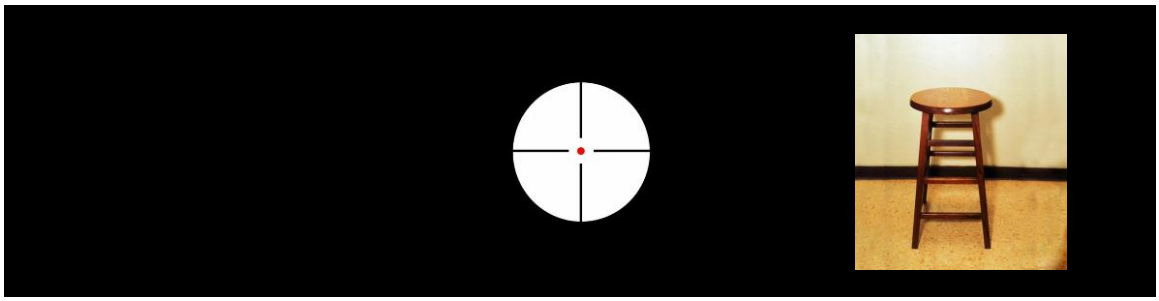


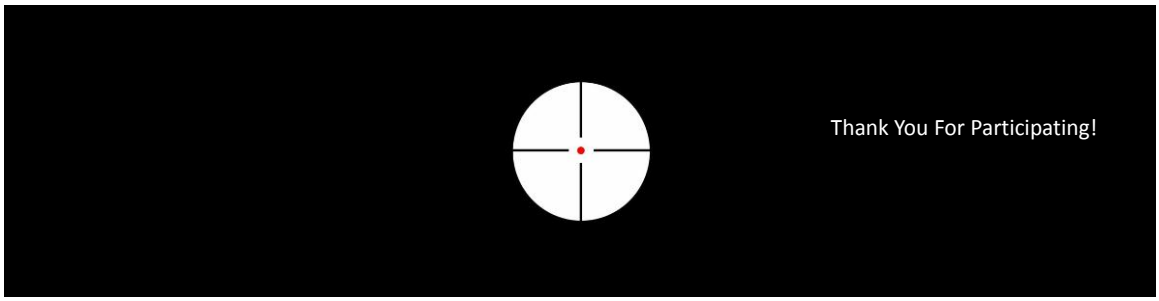








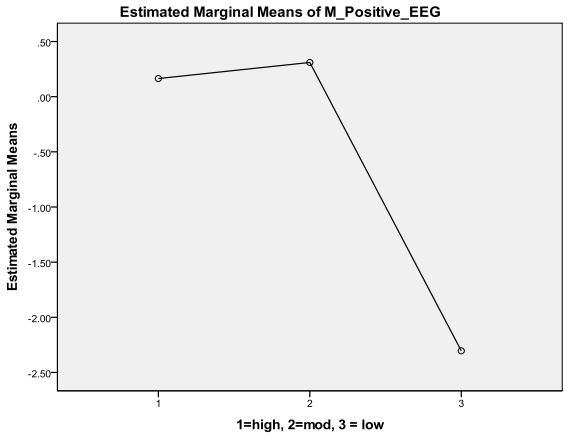



Thank You For Participating!

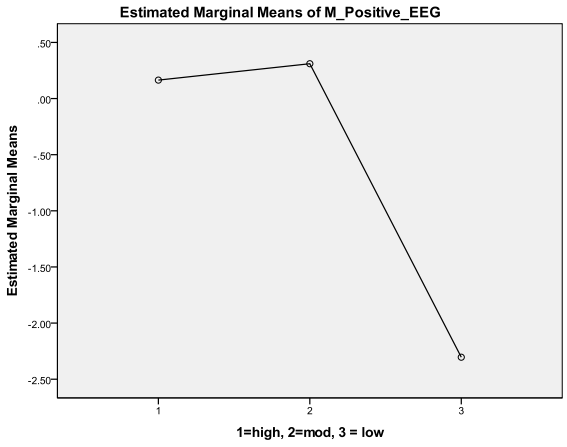
APPENDIX M: EXPERIMENT 2 EXPLORATORY ONE-WAY ANOVAS

Impact of level of emotionality on EEG responses to neutral, pleasant, and uncanny images

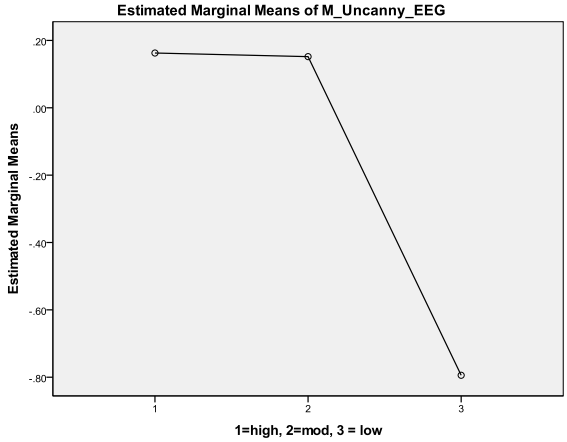
A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .043, p = .958.



A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = 1.13, p = .344.

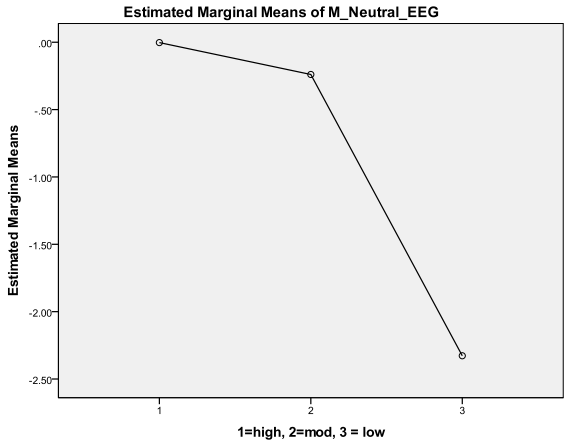


A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .144, p = .867.

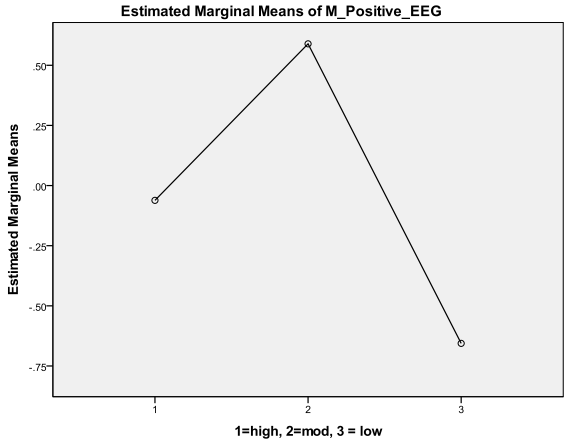


Impact of level of openness on EEG responses to neutral, pleasant, and uncanny images

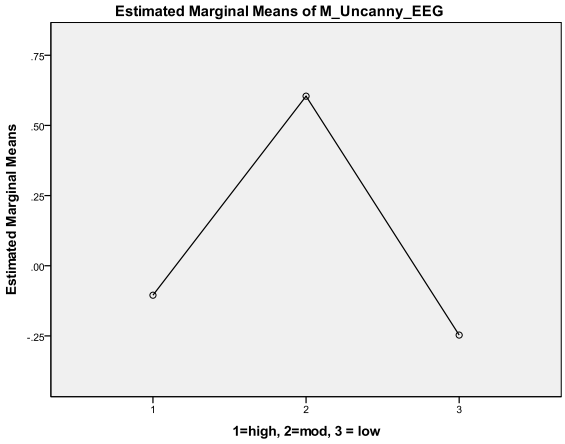
A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .428, p = .658.



A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .440, p = .651.

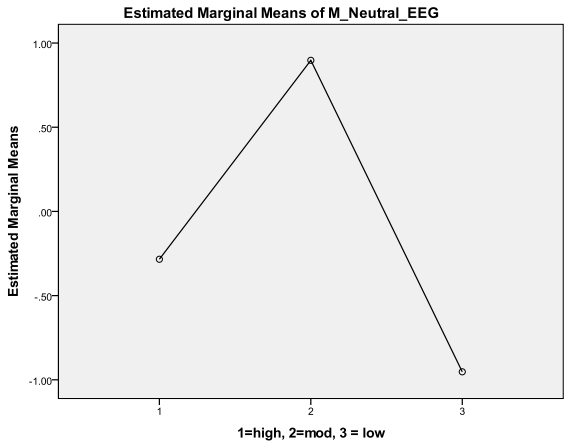


A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .426, p = .659.

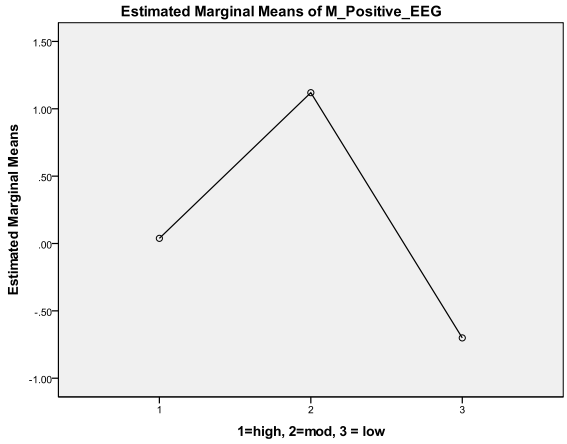


Impact of level of extreme anthropomorphism on EEG responses to neutral, pleasant, and uncanny images

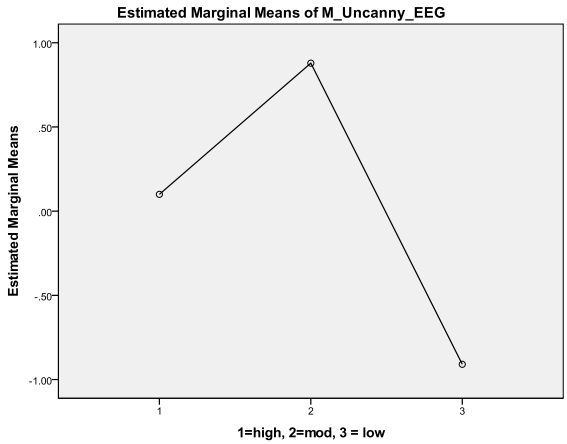
A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .409, p = .670.



A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .779, p = .473.

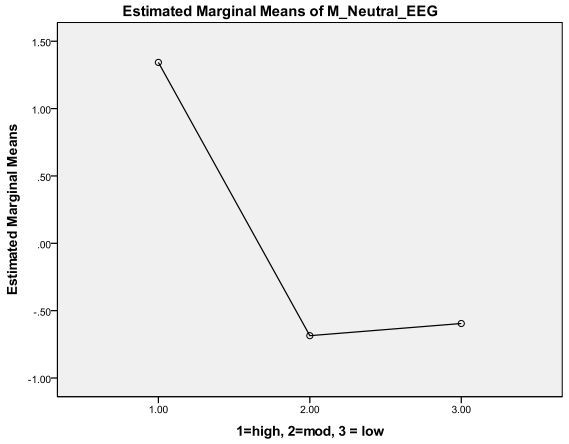


A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .678, p = .520.

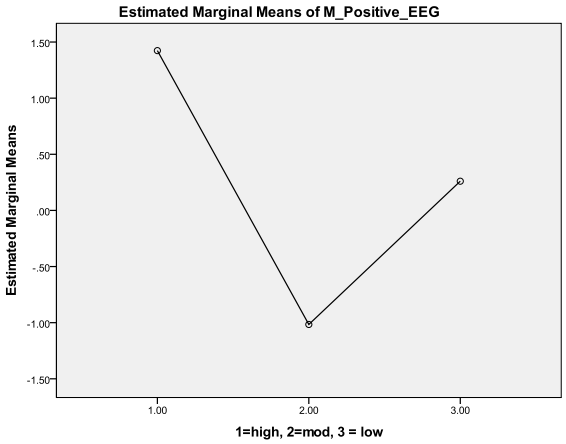


Impact of level of anthropomorphism of pets on EEG responses to neutral, pleasant, and uncanny images

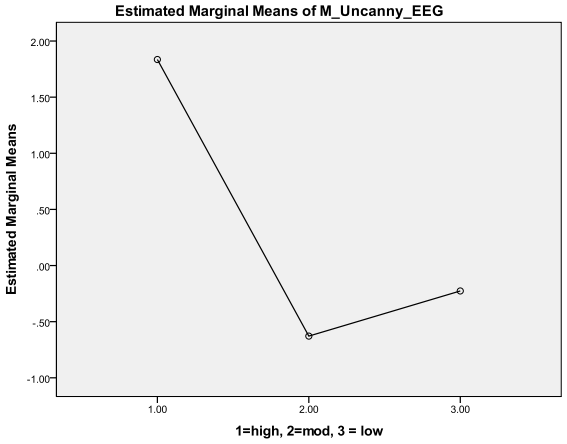
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = 1.39, p = .271.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was a statistically significant difference at the p < .05 level in EEG responses for the three groups: F (2, 19) = 4.093, p = .033.

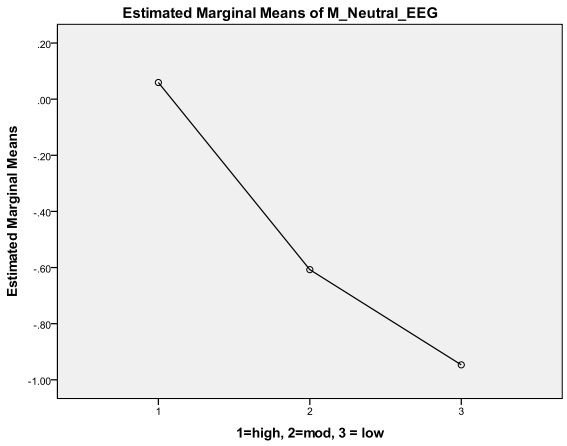


A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was statistically significant difference at the p < .05 level in EEG responses for the three groups: F (2, 19) = 4.95, p = .019.

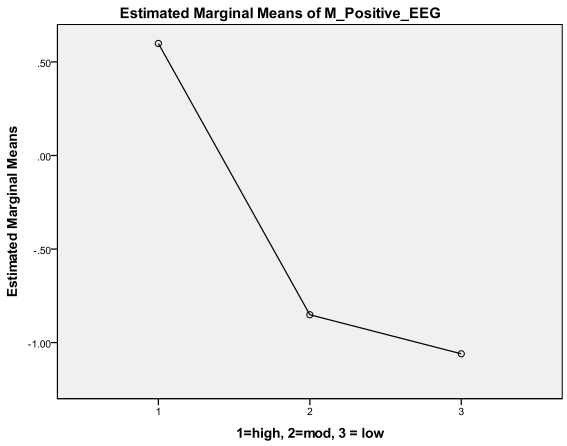


Impact of level of anthropomorphism of gods or deities on EEG responses to neutral, pleasant, and uncanny images

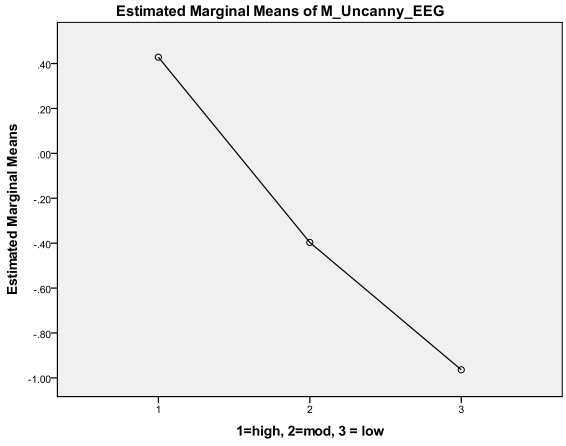
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .244, p = .786.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = 2.169, p = .142.



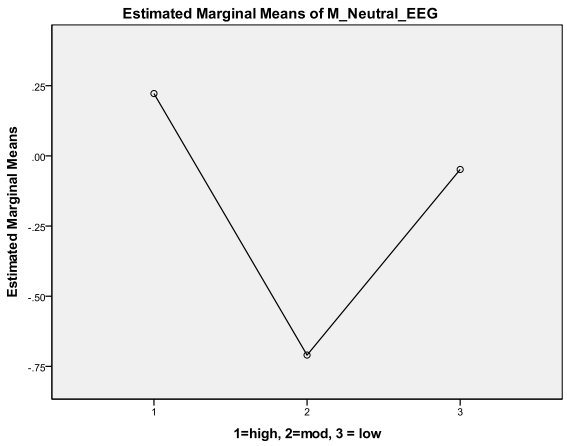
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in EEG responses for the three groups: F (2, 19) =



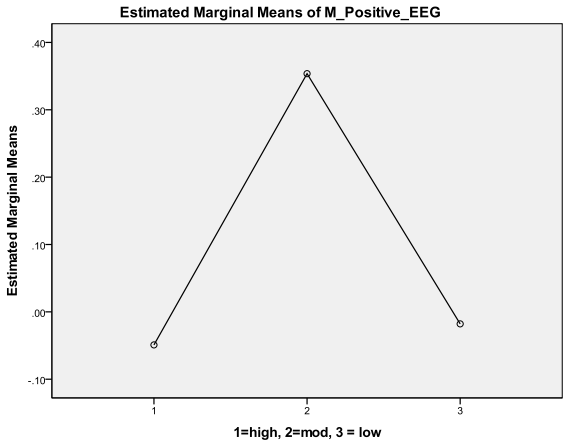
.920, p = .416.

Impact of level of video game enjoyment on EEG responses to neutral, pleasant, and uncanny images

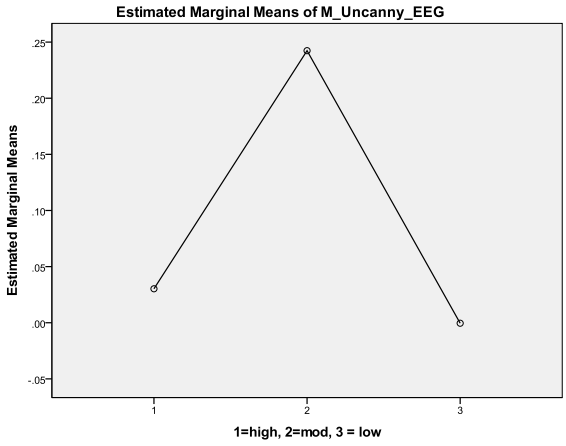
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .363, p = .700.



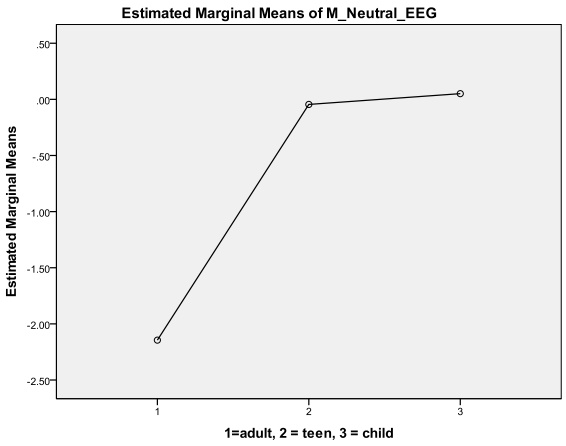
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .138, p = .872.



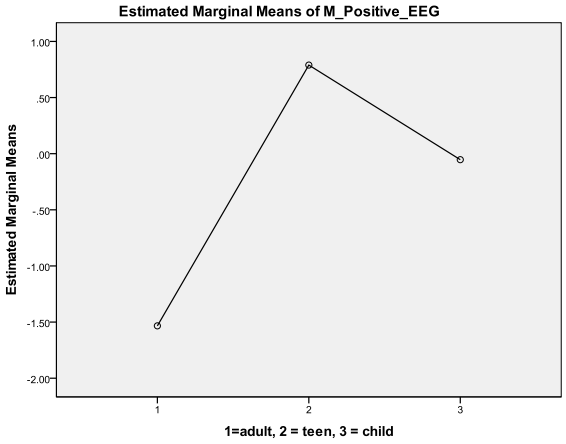
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .041, p = .959.



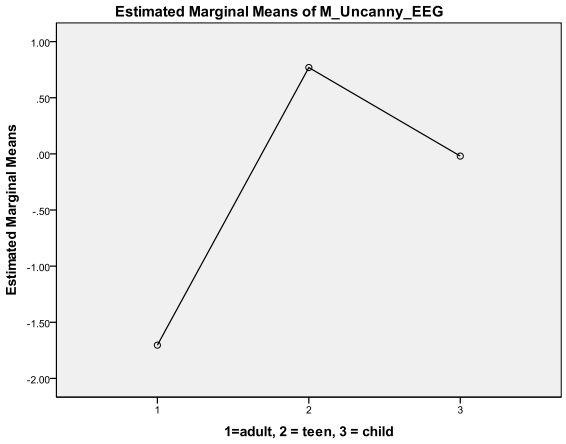
Impact of the age at which participants first played video games on EEG responses to neutral, pleasant, and uncanny images



A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on brain activity in the occipital lobe (EEG) when viewing neutral images. There was no significant difference in EEG responses for the three groups: F (2, 19) = .739, p = .491.



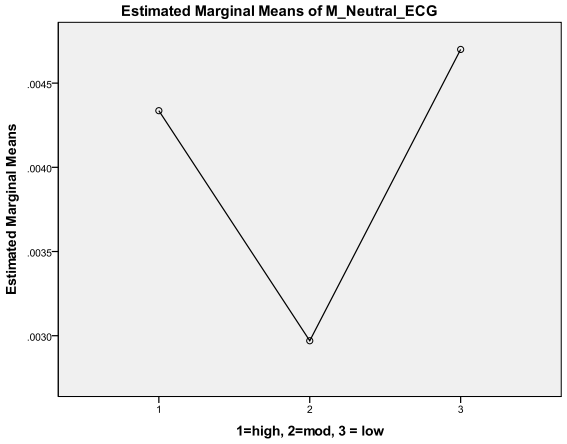
A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on brain activity in the occipital lobe (EEG) when viewing pleasant images. There was no significant difference in EEG responses for the three groups: F (2, 19) = 1.81, p = .191.



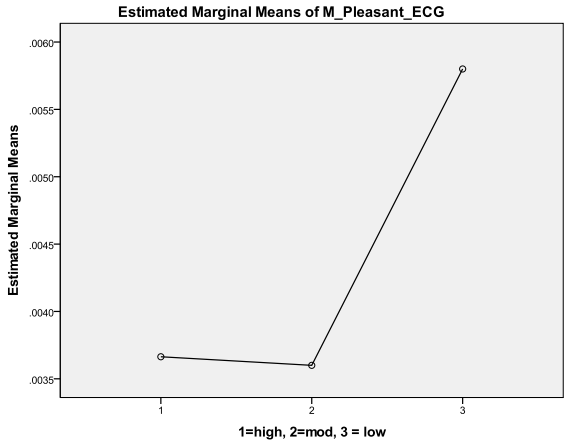
A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on brain activity in the occipital lobe (EEG) when viewing uncanny images. There was no significant difference in

EEG responses for the three groups: F (2, 19) = 2.05, p = .157.

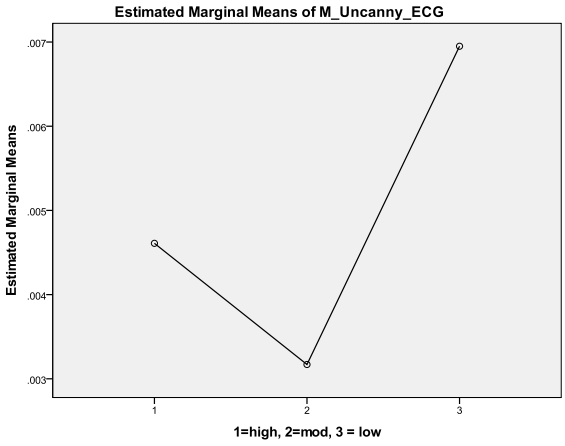
Impact of level of emotionality on ECG responses to neutral, pleasant, and uncanny images



A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = 2.30, p = .127.



A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .546, p = .588.

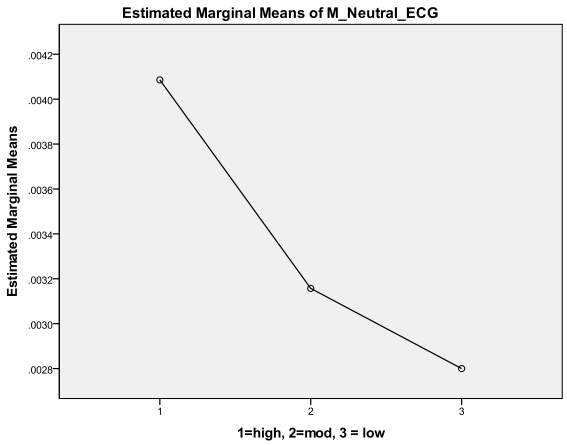


A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on electrical activity of the heart (ECG) when viewing uncanny images. There was no

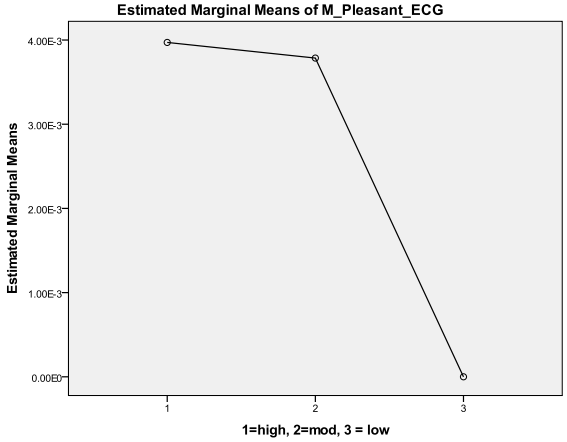
significant difference in ECG responses for the three groups: F (2, 19) = 2.28, p = .130.

Impact of level of openness on ECG responses to neutral, pleasant, and uncanny images

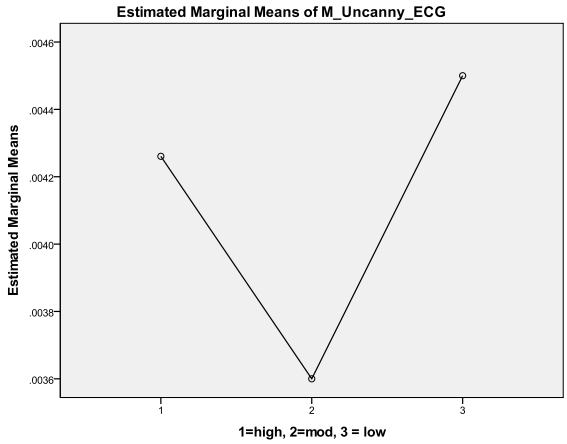
A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .932, p = .411.



A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = 2.06, p = .155.



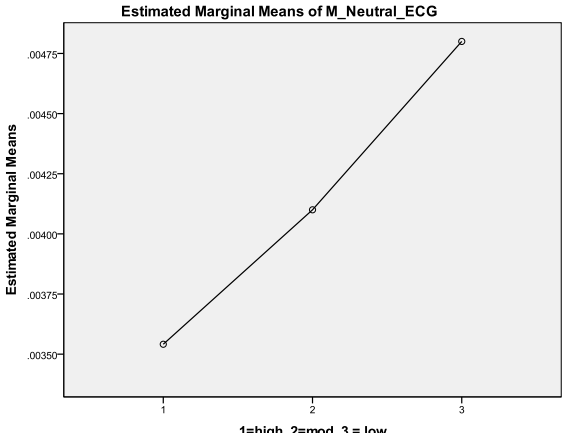
A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on electrical activity of the heart (ECG) when viewing uncanny images. There was no significant



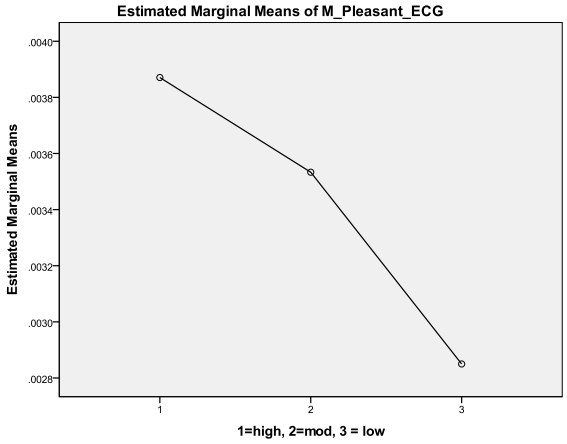
difference in ECG responses for the three groups: F (2, 19) = .215, p = .809.

Impact of level of extreme anthropomorphism on ECG responses to neutral, pleasant, and uncanny images

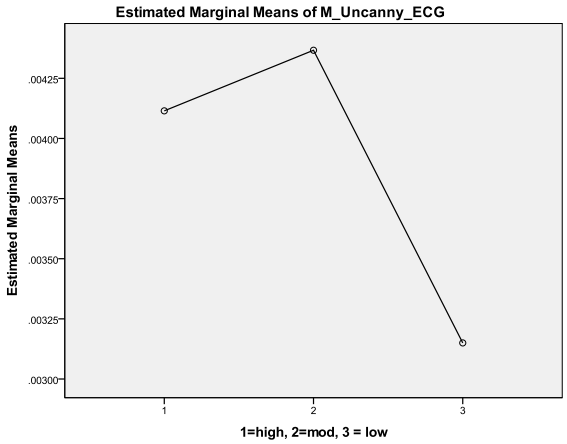
A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .605, p = .556.



A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .235, p = .793.



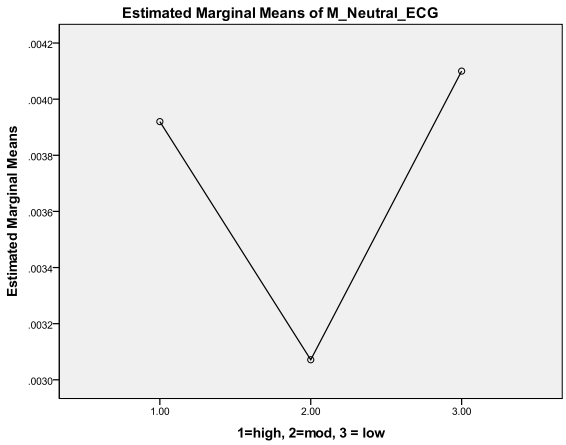
A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on electrical activity of the heart (ECG) when viewing uncanny images. There



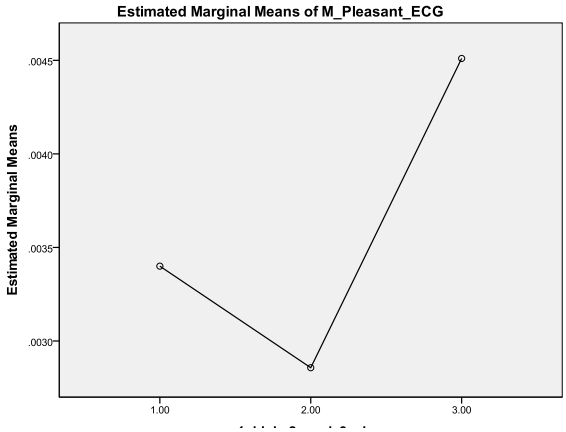
was no significant difference in ECG responses for the three groups: F (2, 19) = .190, p = .828.

Impact of level of anthropomorphism of pets on ECG responses to neutral, pleasant, and uncanny images

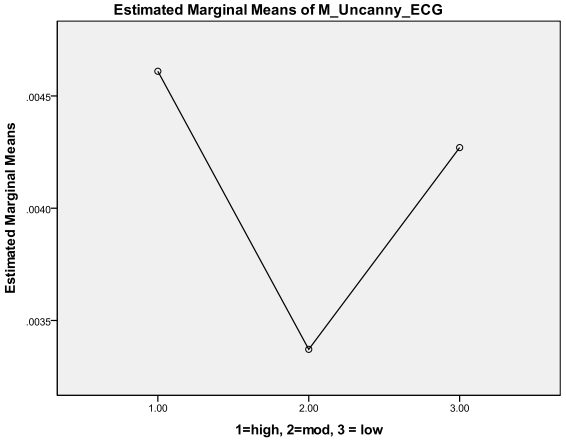
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .861, p = .439.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = 1.60, p = .227.

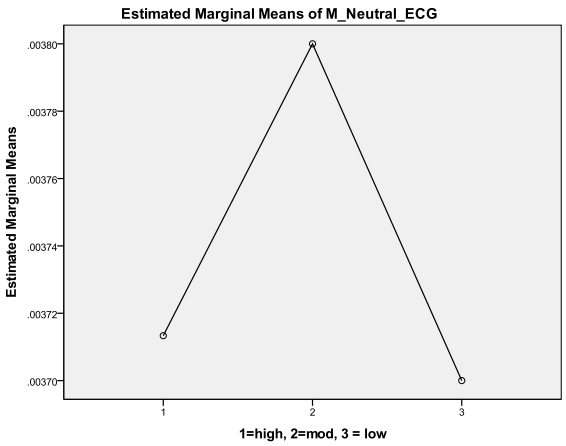


A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on electrical activity of the heart (ECG) when viewing uncanny images. There was no

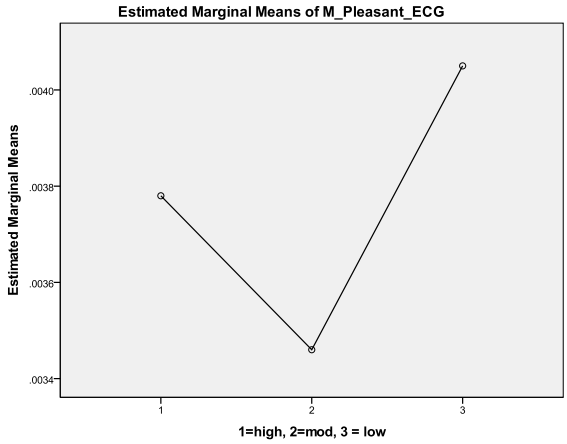


significant difference in ECG responses for the three groups: F (2, 19) = .522, p = .602.

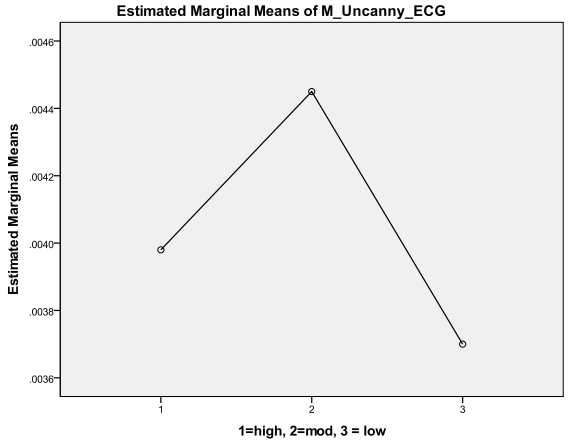
Impact of level of anthropomorphism of gods or deities on ECG responses to neutral, pleasant, and uncanny images



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .005, p = .995.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .070, p = .933.

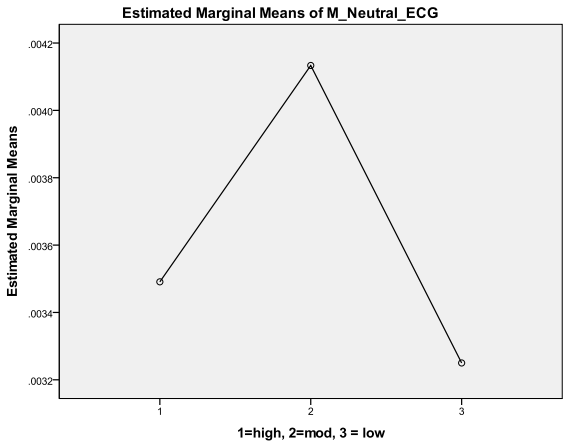


A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on electrical activity of the heart (ECG) when viewing uncanny images.

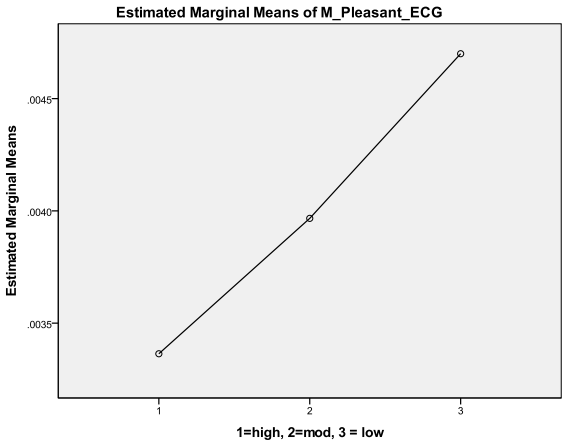
There was no significant difference in ECG responses for the three groups: F (2, 19) = .106, p = .900.

Impact of level of video game enjoyment on ECG responses to neutral, pleasant, and uncanny images

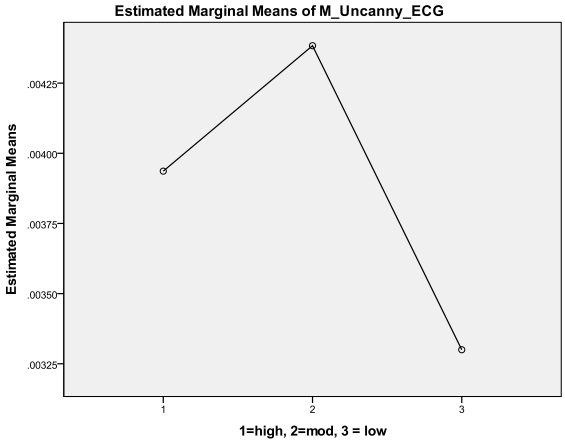
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .461, p = .638.



A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .464, p = .635.



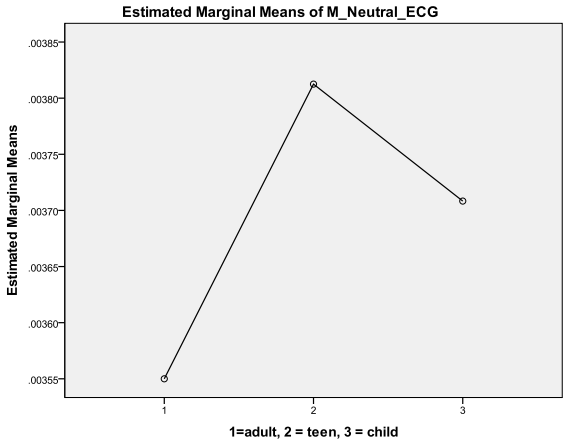
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on electrical activity of the heart (ECG)



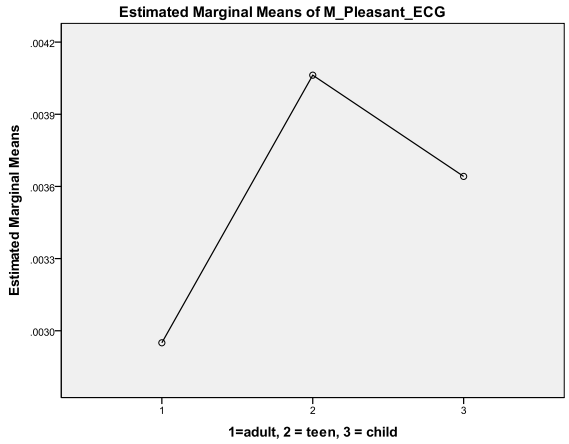
when viewing uncanny images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .217, p = .807.

Impact of the age at which participants first played video games on ECG responses to neutral, pleasant, and uncanny images

A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on electrical activity of the heart (ECG) when viewing neutral images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .022, p = .979.

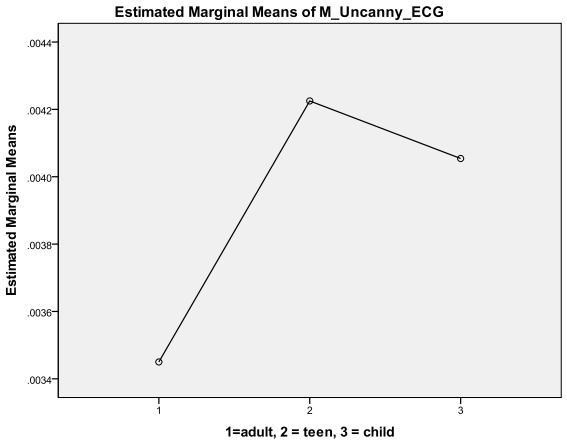


A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on electrical activity of the heart (ECG) when viewing pleasant images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .258, p = .775.



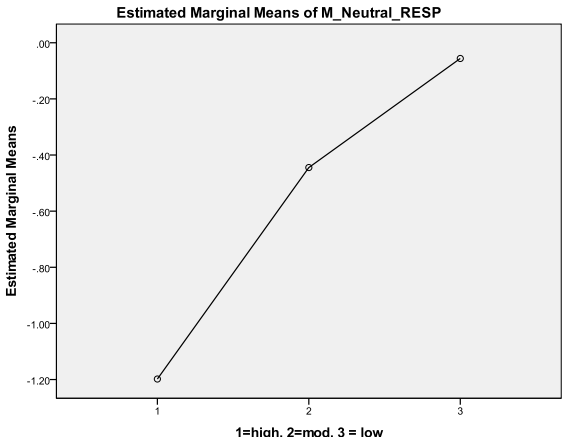
A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games

(adult, teen, and child) on electrical activity of the heart (ECG) when viewing uncanny images. There was no significant difference in ECG responses for the three groups: F (2, 19) = .091, p = .913.

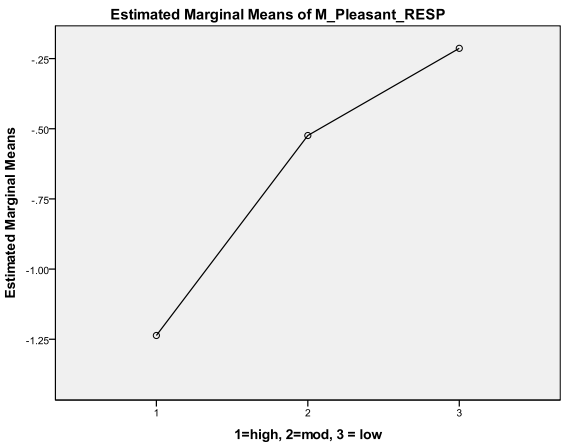


Impact of level of emotionality on respiration responses to neutral, pleasant, and uncanny images

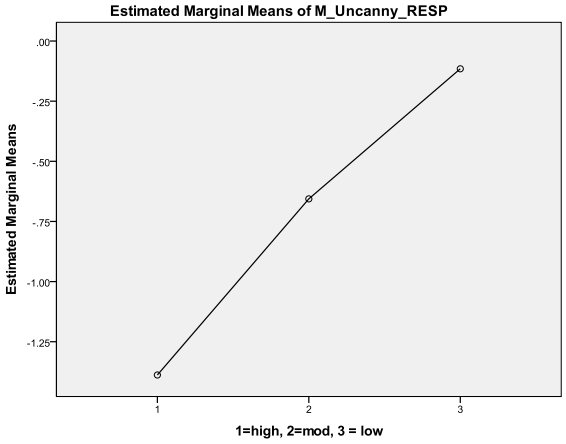
A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on respiration when viewing neutral images. There was a statistically significant difference at the p < .05 level in respiration responses for the three groups: F (2, 19) = 3.93, p = .037.



A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on respiration when viewing pleasant images. There was a statistically significant difference at the p < .05 level in respiration responses for the three groups: F (2, 19) = 3.53, p = .050.

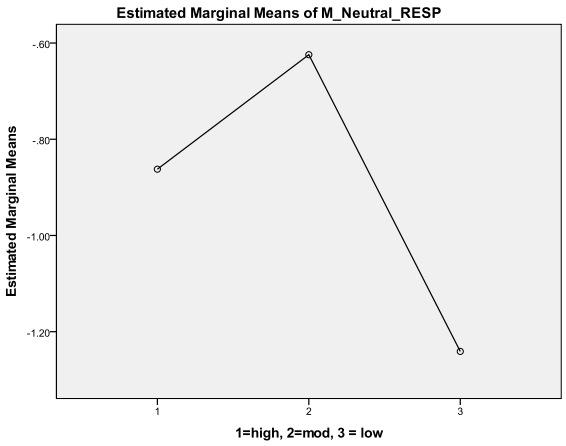


A one-way between groups analysis of variance was conducted to explore the impact of level of emotionality (high, moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 2.66, p = .096.

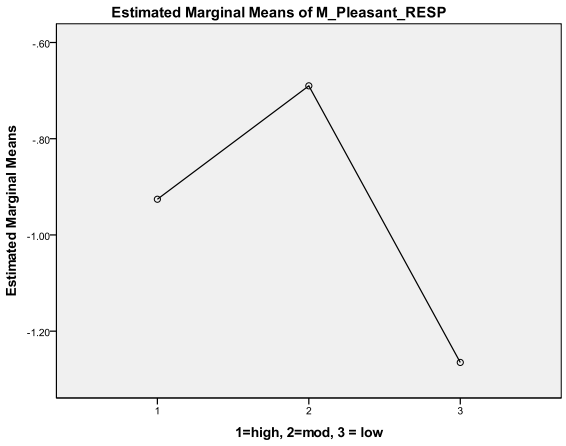


<u>Impact of level of openness on respiration responses to neutral, pleasant, and uncanny images</u>

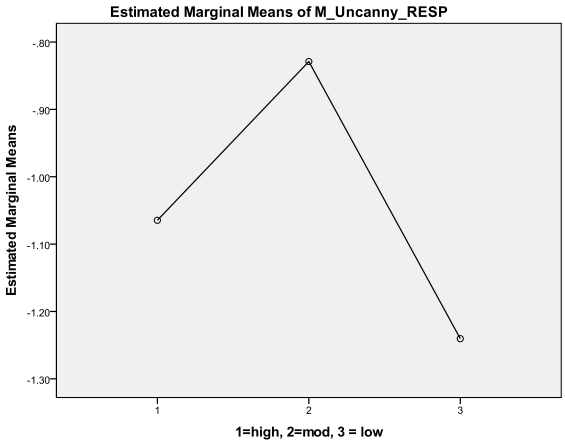
A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .377, p = .691.



A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .366, p = .698.

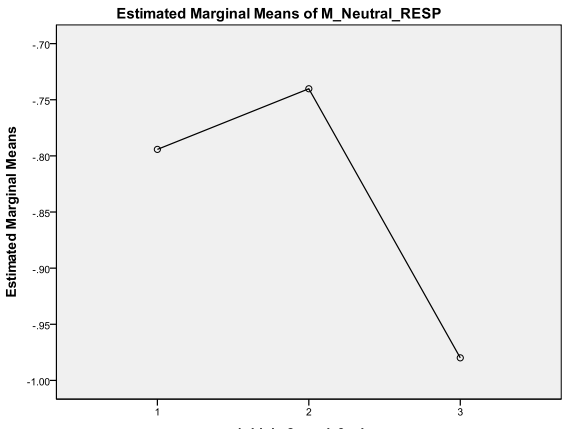


A one-way between groups analysis of variance was conducted to explore the impact of level of openness (high, moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .188, p = .830.

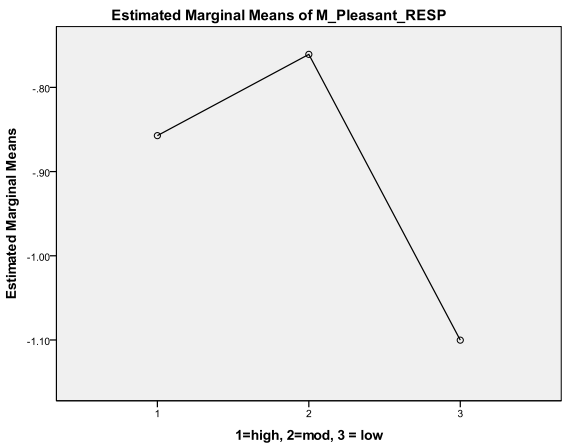


Impact of level of extreme anthropomorphism on respiration responses to neutral, pleasant, and uncanny images

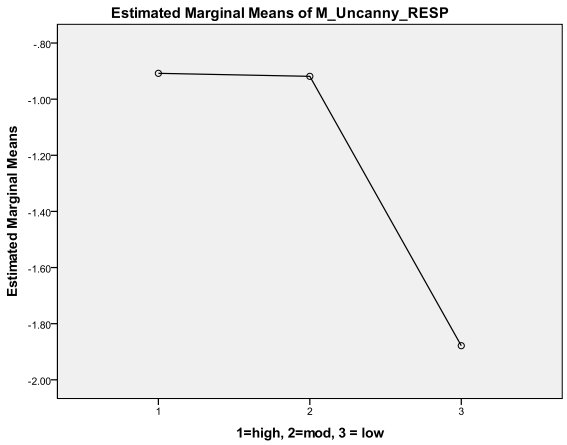
A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .060, p = .942.



A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .121, p = .887.

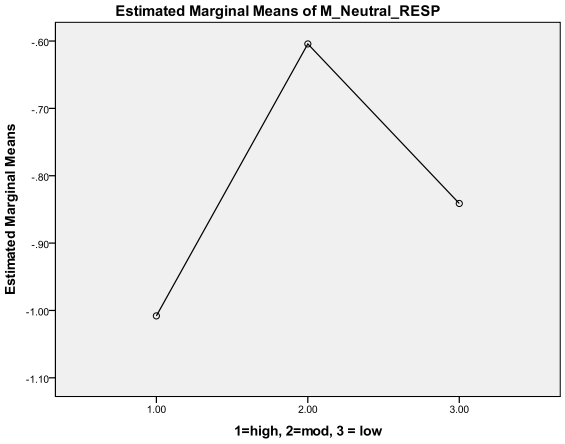


A one-way between groups analysis of variance was conducted to explore the impact of level of extreme anthropomorphism (high, moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 1.09, p = .356.

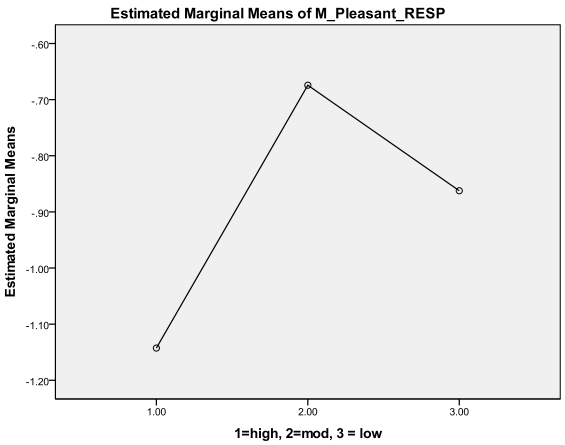


Impact of level of anthropomorphism of pets on respiration responses to neutral, pleasant, and uncanny images

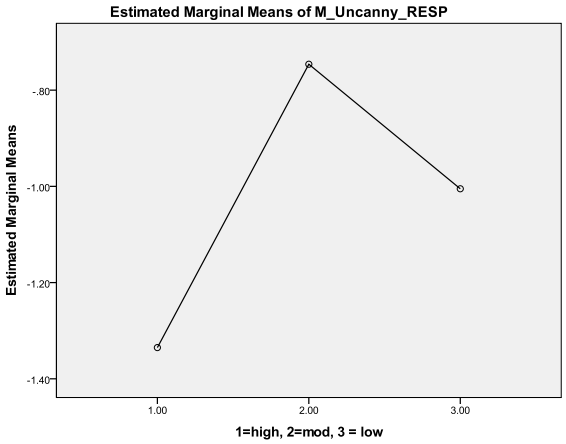
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .408, p = .670.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .561, p = .580.

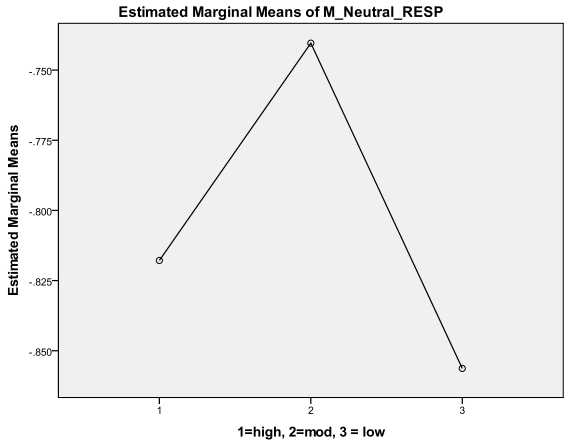


A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of pets (high, moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .618, p = .549.

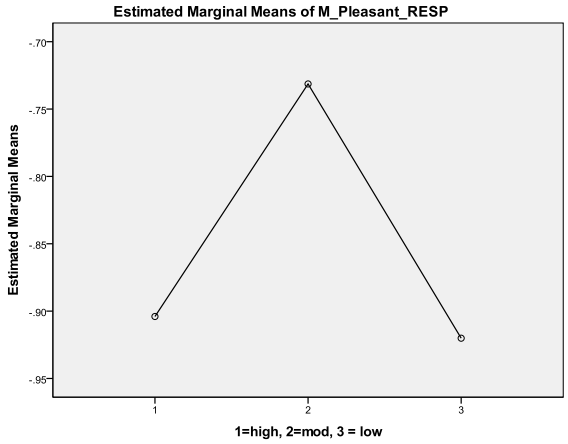


<u>Impact of level of anthropomorphism of gods or deities on respiration responses to neutral, pleasant, and uncanny images</u>

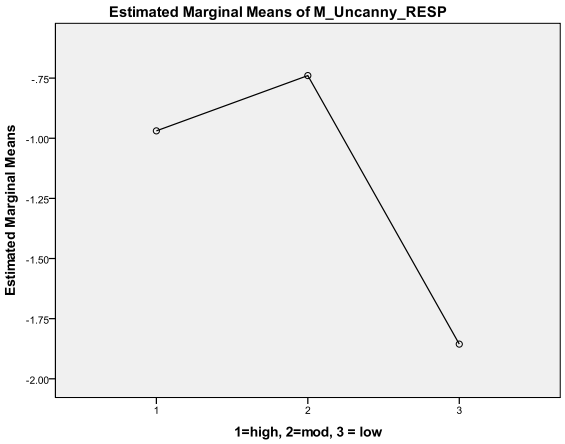
A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .022, p = .978.



A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high, moderate, and low) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .099, p = .906.

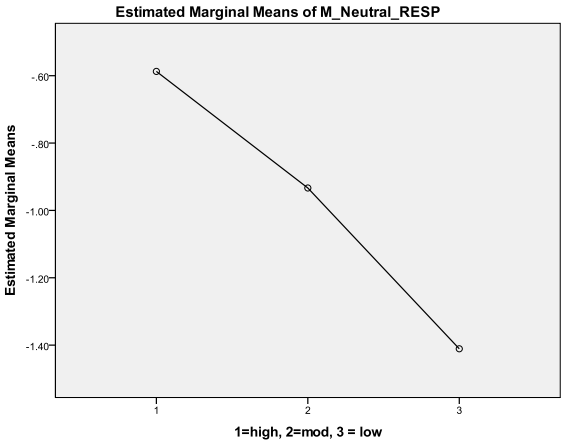


A one-way between groups analysis of variance was conducted to explore the impact of level of anthropomorphism of gods or deities (high moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 1.17, p = .332.

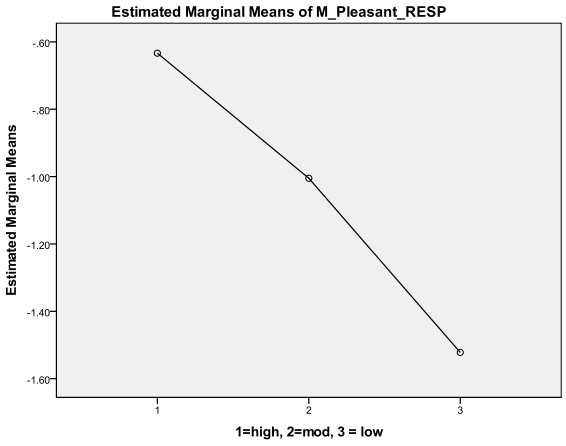


<u>Impact of level of video game enjoyment on respiration responses to neutral, pleasant, and uncanny images</u>

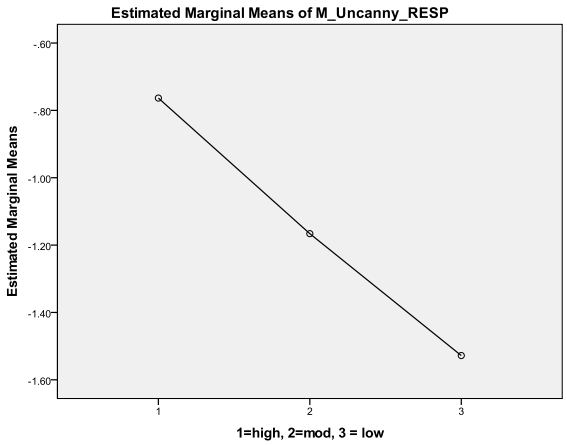
A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 1.240, p = .312.



A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 1.57, p = .233.

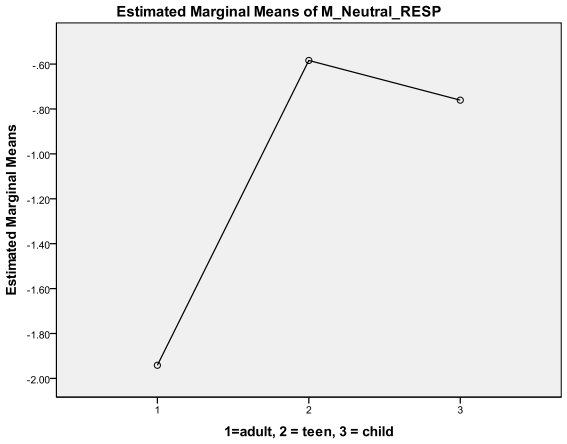


A one-way between groups analysis of variance was conducted to explore the impact of level of video game enjoyment (high, moderate, and low) on respiration when viewing uncanny images. There was no significant difference in respiration responses for the three groups: F (2, 19) = .891, p = .427.

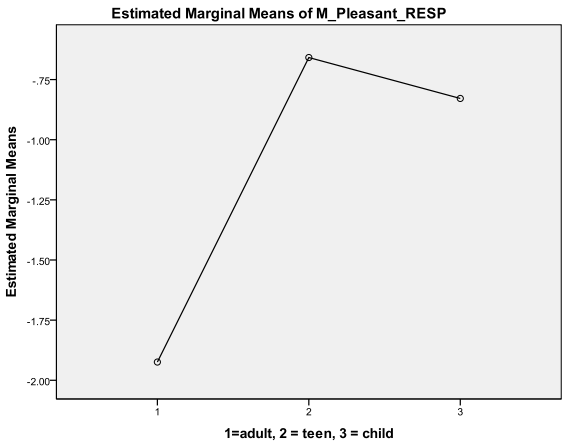


<u>Impact of the age at which participants first played video games on respiration responses to neutral, pleasant, and uncanny images</u>

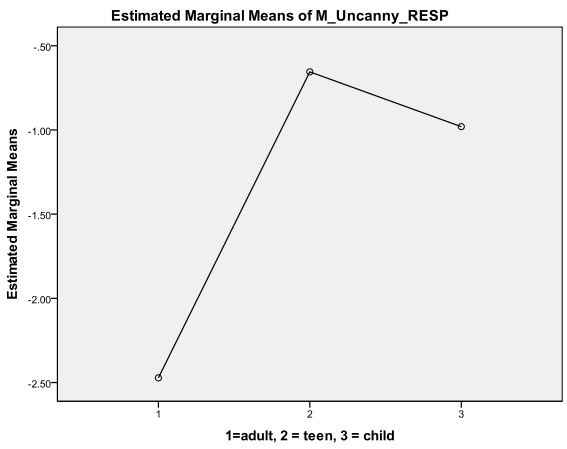
A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on respiration when viewing neutral images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 3.108, p = .068.



A one-way between groups analysis of variance was conducted to explore the impact of the age at which participants first played video games (adult, teen, and child) on respiration when viewing pleasant images. There was no significant difference in respiration responses for the three groups: F (2, 19) = 2.79, p = .087.



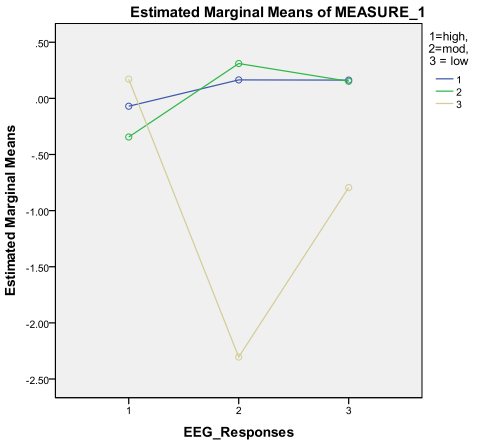
A one-way between groups analysis of variance was conducted to explore the impact of age the age at which participants first played video games (adult, teen, and child) on respiration when viewing uncanny images. There was a statistically significant difference at the $p < .05$ level in respiration responses for the three groups: F (2, 19) = 4.46, p = .026.



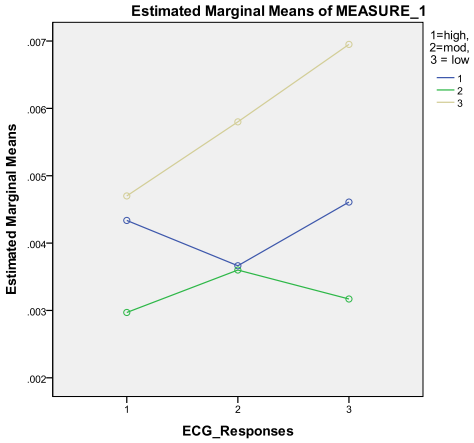
APPENDIX N: EXPERIMENT 2 EXPLORATORY MIXED-MODEL ANOVAs

Impact of level of emotionality on physiological responses to neutral, pleasant, and uncanny images

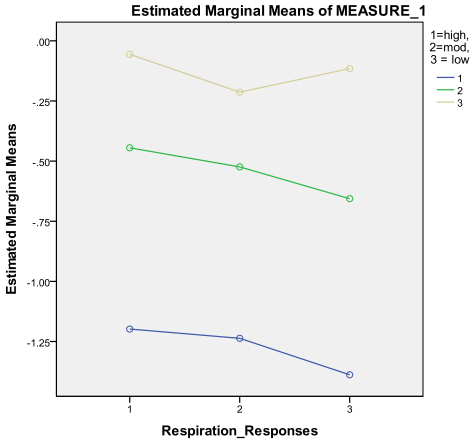
A mixed between-within subjects ANOVA was conducted to assess the level of emotionality (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of emotionality and EEG responses, Wilks' Lambda = .88, F (4, 36) = 0.60, p = 0.66.



A mixed between-within subjects ANOVA was conducted to assess the level of emotionality (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was a nearly significant interaction between level of emotionality and ECG responses, Wilks' Lambda = 0.64, F (4, 36) = 2.22, p = 0.08.

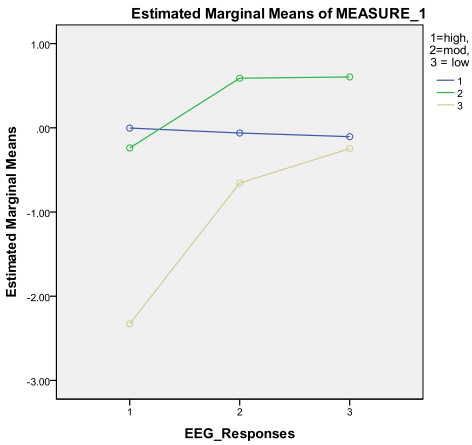


A mixed between-within subjects ANOVA was conducted to assess the level of emotionality (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of emotionality and respiration responses, Wilks' Lambda = 0.96, F (4, 36) = 0.18, p = 0.95.

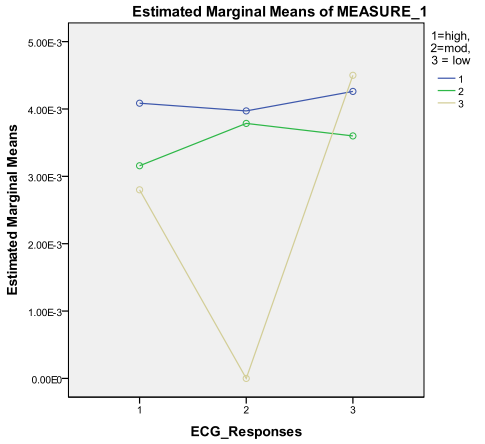


Impact of level of openness on physiological responses to neutral, pleasant, and uncanny images

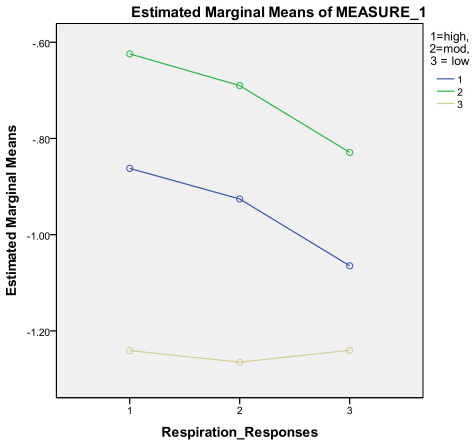
A mixed between-within subjects ANOVA was conducted to assess the level of openness (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of openness and EEG responses, Wilks' Lambda = .78, F (4, 36) = 1.22, p = 0.32.



A mixed between-within subjects ANOVA was conducted to assess the level of openness (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was a significant interaction between level of openness and ECG responses, Wilks' Lambda = 0.53, F (4, 36) = 3.35, p = 0.02.



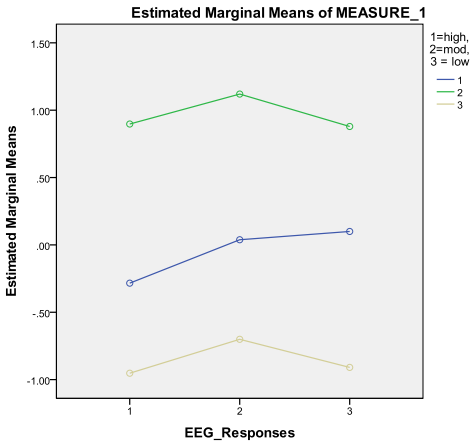
A mixed between-within subjects ANOVA was conducted to assess the level of openness (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of openness and



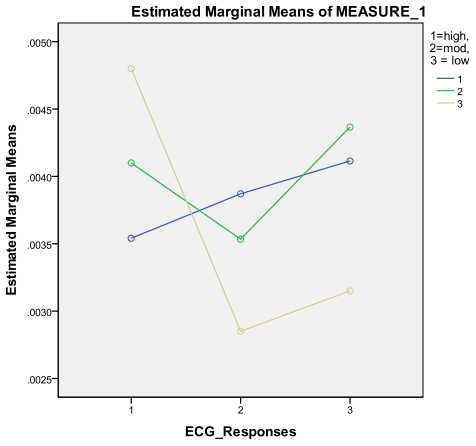
respiration responses, Wilks' Lambda = 0.98, F (4, 36) = 0.07, p = 0.99.

Impact of level of extreme anthropomorphism on physiological responses to neutral, pleasant, and uncanny images

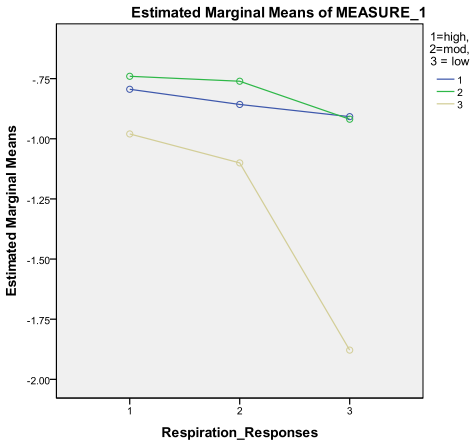
A mixed between-within subjects ANOVA was conducted to assess the level of extreme anthropomorphism (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of extreme anthropomorphism and EEG responses, Wilks' Lambda = .95, F (4, 36) = 0.22, p = 0.93.



A mixed between-within subjects ANOVA was conducted to assess the level of extreme anthropomorphism (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was a nearly significant interaction between level of extreme anthropomorphism and ECG responses, Wilks' Lambda = 0.64, F (4, 36) = 2.29, p = 0.08.



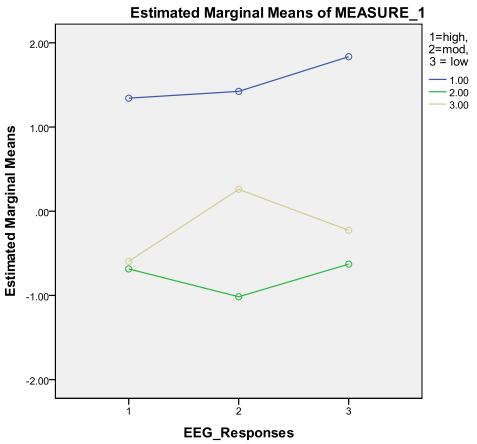
A mixed between-within subjects ANOVA was conducted to assess the level of extreme anthropomorphism (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was a



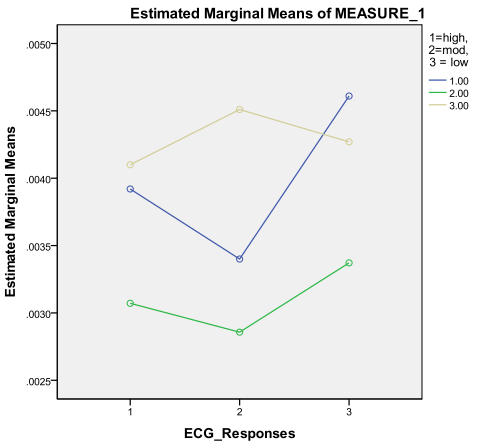
significant interaction between level of extreme anthropomorphism and respiration responses, Wilks' Lambda = 0.59, F (4, 36) = 2.69, p = 0.05.

Impact of level of anthropomorphism of pets on physiological responses to neutral, pleasant, and uncanny images

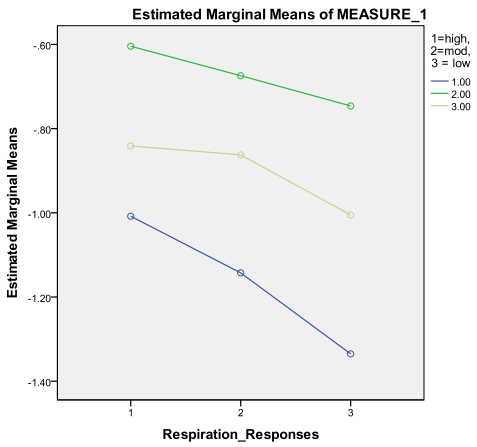
A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of pets (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of anthropomorphism of pets and EEG responses, Wilks' Lambda = .76, F (4, 36) = 1.34, p = 0.27.



A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of pets (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of anthropomorphism of pets and ECG responses, Wilks' Lambda = 0.83, F (4, 36) = 0.89, p = 0.48.



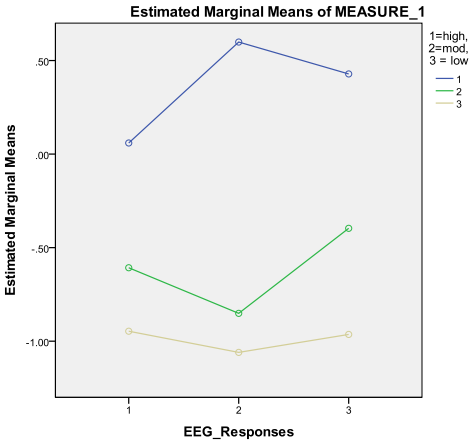
A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of pets (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of



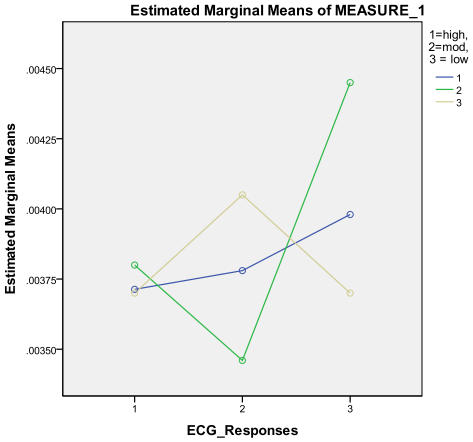
anthropomorphism of pets and respiration responses, Wilks' Lambda = 0.89, F (4, 36) = 0.51, p = 0.73.

Impact of level of anthropomorphism of God on physiological responses to neutral, pleasant, and uncanny images

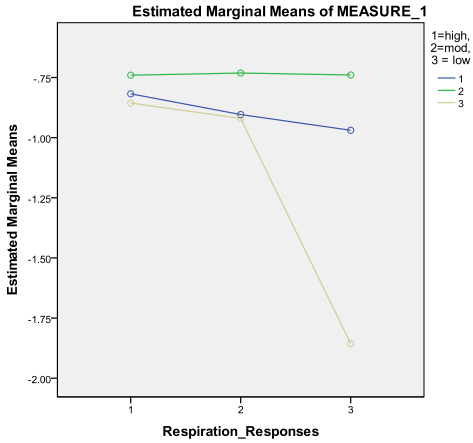
A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of God (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of anthropomorphism of God and EEG responses, Wilks' Lambda = .92, F (4, 36) = 0.38, p = 0.82.



A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of God (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of anthropomorphism of God and ECG responses, Wilks' Lambda = 0.92, F (4, 36) = 0.37, p = 0.82.

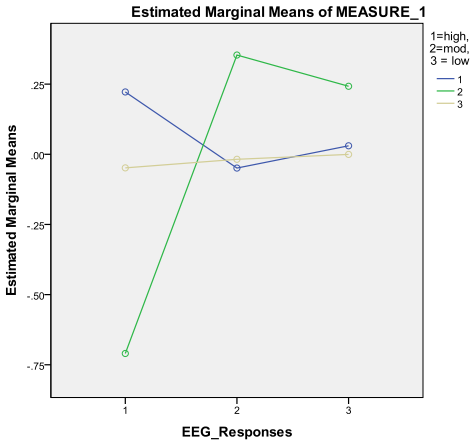


A mixed between-within subjects ANOVA was conducted to assess the level of anthropomorphism of God (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was a significant interaction between level of

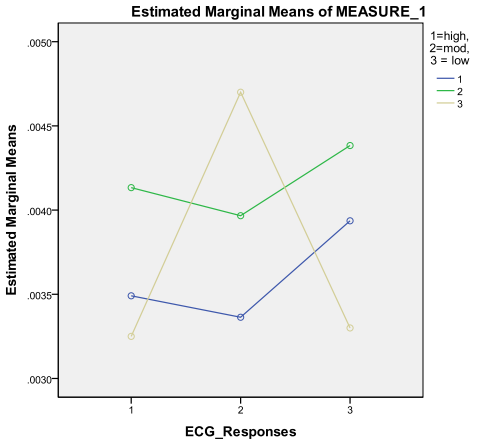


anthropomorphism of God and respiration responses, Wilks' Lambda = 0.43, F (4, 36) = 4.78, p = 0.003.

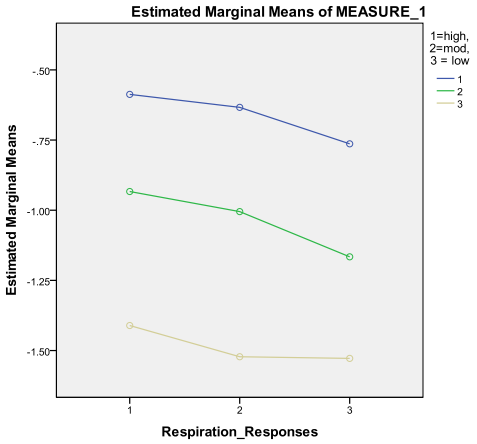
Impact of level of enjoyment in playing video games on physiological responses to neutral, pleasant, and uncanny images



A mixed between-within subjects ANOVA was conducted to assess the level of enjoyment (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of enjoyment and EEG responses, Wilks' Lambda = .87, F (4, 36) = 0.65, p = 0.63.



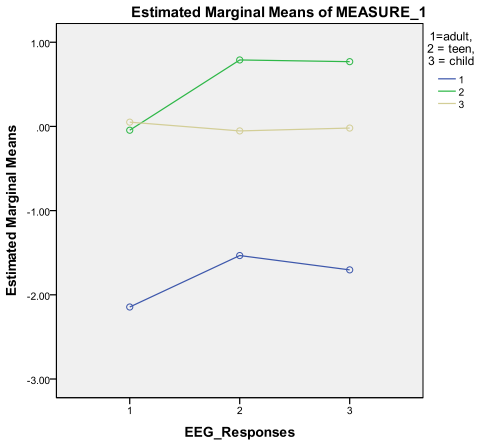
A mixed between-within subjects ANOVA was conducted to assess the level of enjoyment (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of enjoyment and ECG responses, Wilks' Lambda = 0.83, F (4, 36) = 0.88, p = 0.49.



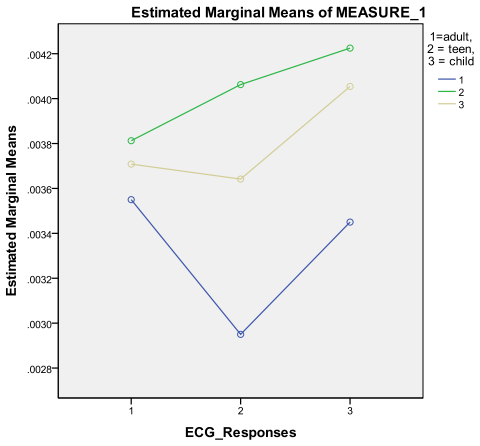
A mixed between-within subjects ANOVA was conducted to assess the level of enjoyment (high, moderate, and low) on individual's respiration responses to three types of images (neutral,

pleasant, and uncanny). There was no significant interaction between level of enjoyment and respiration responses, Wilks' Lambda = 0.97, F (4, 36) = 0.11, p = 0.98.

Impact of level of the age at which participants first played video games on physiological responses to neutral, pleasant, and uncanny images

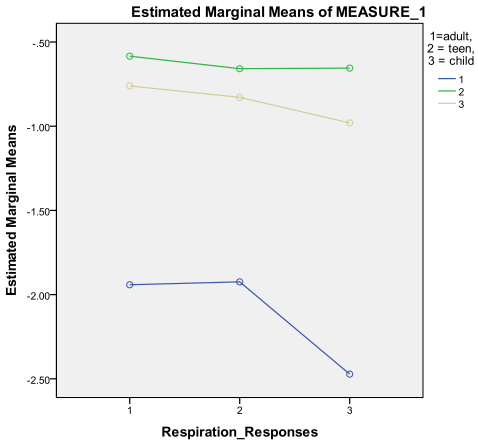


A mixed between-within subjects ANOVA was conducted to assess the level of the age at which participants first played video games (high, moderate, and low) on individual's EEG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of the age at which participants first played video games and EEG responses, Wilks' Lambda = .91, F (4, 36) = 0.48, p = 0.80.



A mixed between-within subjects ANOVA was conducted to assess the level of the age at which participants first played video games (high, moderate, and low) on individual's ECG responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of the age at which participants first played video games and ECG responses, Wilks' Lambda = 0.96, F (4, 36) = 0.15, p = 0.96.

A mixed between-within subjects ANOVA was conducted to assess the level of the age at which participants first played video games (high, moderate, and low) on individual's respiration responses to three types of images (neutral, pleasant, and uncanny). There was no significant interaction between level of the age at which participants first played video games and respiration responses, Wilks' Lambda = 0.84, F (4, 36) = 0.83, p = 0.51.



APPENDIX O: CREEPYPASTA

Candle Cove

This famous pasta is by Kris Straub of Ichor Falls.
==<u>'"NetNostalgia Forum - Television (local)"'</u>==
"""Skyshale033
Subject: Candle Cove local kid's show?"""
Does anyone remember this kid's show? It was called Candle Cove and I must have been 6 or 7. I never found reference to it anywhere so I think it was on a local station around 1971 or 1972. I lived in Ironton at the time. I don't remember which station, but I do remember it was on at a weird time, like 4:00 PM.

"""mike_painter65
Subject: Re: Candle Cove local kid's show?"""
it seems really familiar to me…..i grew up outside of ashland and was 9 yrs old in 72. candle cove…was it about pirates? i remember a pirate marionete at the mouth of a cave talking to a little girl

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
YES! Okay I'm not crazy! I remember Pirate Percy. I was always kind of scared of him. He looked like he was built from parts of other dolls, real low-budget. His head was an old porcelain baby doll, looked like an antique that didn't belong on the body. I don't remember what station this was! I don't think it was WTSF though.

"""Jaren_2005
Subject: Re: Candle Cove local kid's show?"""
Sorry to ressurect this old thread but I know exactly what show you mean, Skyshale. I think Candle Cove ran for only a couple months in '71, not '72. I was 12 and I watched it a few times with my brother. It was channel 58, whatever station that was. My mom would let me switch to it after the news. Let me see what I remember.
It took place in Candle cove, and it was about a little girl who imagined herself to be friends with pirates. The pirate ship was called the Laughingstock, and Pirate Percy wasn't a very good pirate because he got scared too easily. And there was calliope music constantly playing. Don't remember the girl's name. Janice or Jade or something. Think it was Janice.

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
Thank you Jaren!!! Memories flooded back when you mentioned the Laughingstock and channel 58. I remember the bow of the ship was a wooden smiling face, with the lower jaw submerged. It looked like it was swallowing the sea and it had that awful Ed Wynn voice and laugh. I especially remember how jarring it was when they switched from the wooden/plastic model, to the foam puppet version of the head that talked.

"""mike_painter65
Subject: Re: Candle Cove local kid's show?"""
ha ha i remember now too. ;) do you remember this part skyshale: "you have…to go…INSIDE."

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
Ugh mike, I got a chill reading that. Yes I remember. That's what the ship always told Percy when there was a spooky place he had to go in, like a cave or a dark room where the treasure was. And the camera would push in on Laughingstock's face with each pause. YOU HAVE… TO GO… INSIDE. With his two eyes askew and that flopping foam jaw and the fishing line that opened and closed it. Ugh. It just looked so cheap and awful.

You guys remember the villain? He had a face that was just a handlebar mustache above really tall, narrow teeth.

"""kevin_hart
Subject: Re: Candle Cove local kid's show?"""
i honestly, honestly thought the villain was pirate percy. i was about 5 when this show was on. nightmare fuel.

"""Jaren_2005
Subject: Re: Candle Cove local kid's show?"""
That wasn't the villain, the puppet with the mustache. That was the villain's sidekick, Horace Horrible. He had a monocle too, but it was on top of the mustache. I used to think that meant he had only one eye.

But yeah, the villain was another marionette. The Skin-Taker. I can't believe what they let us watch back then.

"""kevin_hart
Subject: Re: Candle Cove local kid's show?"""
jesus h. christ, the skin taker. what kind of a kids show were we watching? i seriously could not look at the screen when the skin taker showed up. he just descended out of nowhere on his strings, just a dirty skeleton wearing that brown top hat and cape. and his glass eyes that were too big for his skull. christ almighty.

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
Wasn't his top hat and cloak all sewn up crazily? Was that supposed to be children's skin??

"""mike_painter65
Subject: Re: Candle Cove local kid's show?"""
yeah i think so. rememer his mouth didn't open and close, his jaw just slid back and foth. i remember the little girl said "why does your mouth move like that" and the skin-taker didn't look at the girl but at the camera and said "TO GRIND YOUR SKIN"

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
I'm so relieved that other people remember this terrible show! I used to have this awful memory, a bad dream I had where the opening jingle ended, the show faded in from black, and all the characters were there, but the camera was just cutting to each of their faces, and they were just screaming, and the puppets and

marionettes were flailing spastically, and just all screaming, screaming. The girl was just moaning and crying like she had been through hours of this. I woke up many times from that nightmare. I used to wet the bed when I had it.

"""kevin_hart
Subject: Re: Candle Cove local kid's show?"""
i don't think that was a dream. i remember that. i remember that was an episode.

"""Skyshale033
Subject: Re: Candle Cove local kid's show?"""
No no no, not possible. There was no plot or anything, I mean literally just standing in place crying and screaming for the whole show.

"""kevin_hart
Subject: Re: Candle Cove local kid's show?"""
maybe i'm manufacturing the memory because you said that, but i swear to god i remember seeing what you described. they just screamed.[[Video:Candle Cove Intro (1970 Children's Show)|thumb|300px|right|This is the intro that played at the beginning of most episodes]]

"""Jaren_2005
Subject: Re: Candle Cove local kid's show?"""
Oh God. Yes. The little girl, Janice, I remember seeing her shake. And the Skin-Taker screaming through his gnashing teeth, his jaw careening so wildly I thought it would come off its wire hinges. I turned it off and it was the last time I watched. I ran to tell my brother and we didn't have the courage to turn it back on.

"""mike_painter65
Subject: Re: Candle Cove local kid's show?"""
i visited my mom today at the nursing home. i asked her about when i was littel in the early 70s, when i was 8 or 9 and if she remebered a kid's show, candle cove. she said she was suprised i could remember that and i asked why, and she said "because i used to think it was so strange that you said 'i'm gona go watch candle cove now mom' and then you would tune the tv to static and juts watch dead air for 30 minutes. you had a big imagination with your little pirate show."

Dead Bart

You know how Fox has a weird way of counting Simpsons episodes? They refuse to count a couple of them, making the amount of episodes inconsistent. The reason for this is a lost episode from season 1.

Finding details about this missing episode is difficult, no one who was working on the show at the time likes to talk about it. From what has been pieced together, the lost episode was written entirely by Matt Groening. During production of the first season, Matt started to act strangely. He was very quiet, seemed nervous and morbid. Mentioning this to anyone who was present results in them [[File:DAEDBORT.jpg|thumb]]getting very angry, and forbidding you to ever mention it to Matt.

I first heard of it at an event where David Silverman was speaking. Someone in the crowd asked about the episode, and Silverman simply left the stage, ending the presentation hours early. The episode's production number was 7G06, the title was Dead Bart. The episode labeled 7G06, Moaning Lisa, was made later and given Dead Bart's production code to hide the latter's existence.

In addition to getting angry, asking anyone who was on the show about this will cause them to do everything they can to stop you from directly communicating with Matt Groening. At a fan event, I managed to follow him after he spoke to the crowd, and eventually had a chance to talk to him alone as he was leaving the building. He didn't seem upset that I had followed him, probably expected a typical encounter with an obsessive fan. When I mentioned the lost episode though, all color drained from his face and he started trembling. When I asked him if he could tell me any details, he sounded like he was on the verge of tears. He grabbed a piece of paper, wrote something on it, and handed it to me. He begged me never to mention the episode again.

The piece of paper had a website address on it, I would rather not say what it was, for reasons you'll see in a second. I entered the address into my browser,

and I came to a site that was completely black, except for a line of yellow text, a download link. I clicked on it, and a file started downloading. Once the file was downloaded, my computer went crazy, it was the worst virus I had ever seen. System restore didn't work, the entire computer had to be rebooted. Before doing this though, I copied the file onto a CD. I tried to open it on my now empty computer, and as I suspected, there was an episode of The Simpsons on it.

The episode started off like any other episode, but had very poor quality animation. If you've seen the original animation for Some Enchanted Evening, it was similar, but less stable. The first act was fairly normal, but the way the characters acted was a little off. Homer seemed angrier, Marge seemed depressed, Lisa seemed anxious, Bart seemed to have genuine anger and hatred for his parents.

The episode was about the Simpsons going on a plane trip, near the end of the first act, the plane was taking off. Bart was fooling around, as you'd expect. However, as the plane was about 50 feet off the ground, Bart broke a window on the plane and was sucked out.

At the beginning of the series, Matt had an idea that the animated style of the Simpsons' world represented life, and that death turned things more realistic. This was used in this episode. The picture of Bart's corpse was barely recognizable, they took full advantage of it not having to move, and made an almost photo-realistic drawing of his dead body.

Act one ended with the shot of Bart's corpse. When act two started, Homer, Marge, and Lisa were sitting at their table, crying. The crying went on and on, it got more pained, and sounded more realistic, better acting than you would think possible. The animation started to decay even more as they cried, and you could hear murmuring in the background. The characters could barely be made out, they were stretching and blurring, they looked like deformed shadows with random bright colors thrown on them.

There were faces looking in the window, flashing in and out so you were never sure what they looked like.

This crying went on for all of act two.

Act three opened with a title card saying one year had passed. Homer, Marge, and Lisa were skeletally thin, and still sitting at the table. There was no sign of Maggie or the pets.

They decided to visit Bart's grave. Springfield was completely deserted, and as they walked to the cemetery the houses became more and more decrepit. They all looked abandoned. When they got to the grave, Bart's body was just lying in front of his tombstone, looking just like it did at the end of act one.

The family started crying again. Eventually they stopped, and just stared at Bart's body. The camera zoomed in on Homer's face. According to summaries, Homer tells a joke at this part, but it isn't audible in the version I saw, you can't tell what Homer is saying.

The view zoomed out as the episode came to a close. The tombstones in the background had the names of every Simpsons guest star on them. Some that no one had heard of in 1989, some that haven't been on the show yet. All of them had death dates on them.

For guests who died since, like Michael Jackson and George Harrison, the dates were when they would die. The credits were completely silent, and seemed handwritten. The final image was the Simpson family on their couch, like in the intros, but all drawn in hyper realistic, lifeless style of Bart's corpse.

A thought occurred to me after seeing the episode for the first time, you could try to use the tombstones to predict the death of living Simpsons guest stars, but there's something odd about most of the ones who haven't died yet.

All of their deaths are listed as the same date.

Suicide Mouse

==Background==

Suicidemouse.avi is a[[:Category:"Lost Episodes"| lost episode]] creepypasta and is widely seen as the forefather of the entire lost episode genre. This story is based off of an old, unseen Mickey Mouse episode. There is also a video that is based off of the creepypasta.

==The Delicious Pasta==

So do any of you remember those Mickey Mouse cartoons from the 1930s? The ones that were just put out on DVD a few years ago? Well, I hear there is one that was unreleased to even the most avid classic disney fans.

According to sources, it's nothing special. It's just a continuous loop (like Flinstones) of mickey walking past 6 buildings that goes on for two or three minutes before fading out. Unlike the cutesy tunes put in though, the song on this cartoon was not a song at all, just a constant banging on a piano as if the keys for a minute and a half before going to white noise for the remainder of the film.

It wasn't the jolly old Mickey we've come to love either, Mickey wasn't dancing, not even smiling, just kind of walking as if you or I were walking, with a normal facial expression, but for some reason his head tilted side to side as he kept this dismal look.

Up until a year or two ago, everyone believed that after it cut to black and that was it.

When Leonard Maltin was reviewing the cartoon to be put in the complete series, he decided it was too junk to be on the DVD, but wanted to have a digital copy due to the fact that it was a creation of Walt. When he had a digitized version up on his computer to look at the file, he noticed something.

The cartoon was actually 9 minutes and 4 seconds long.

This is what my source emailed to me, in full (he is a personal assistant of one of the higher executives at Disney, and acquaintance of Mr. Maltin himself):

"After it cut to black, it stayed like that until the 6th minute, before going back into Mickey walking. The sound was different this time. It was a murmur. It wasn't a language, but more like a gurgled cry. As the noise got more indistinguishable and loud over the next minute, the picture began to get weird.

The sidewalk started to go in directions that seemed impossible based on the physics of Mickeys walking. And the dismal face of the mouse was slowly curling into a smirk.

On the 7th minute, the murmur turned into a bloodcurdling scream (the kind of scream painful to hear) and the picture was getting more obscure. Colors were happening that shouldn't have been possible at the time. Mickey face began to fall apart. his eyes rolled on the bottom of his chin like two marbles in a fishbowl, and his curled smile was pointing upward on the left side of his face.

The buildings became rubble floating in midair and the sidewalk was still impossibly navigating in warped directions, a few seeming inconcievable with what we, as humans, know about direction. Mr. Maltin got disturbed and left the room, sending an employee to finish the video and take notes of everything happening up until the last second, and afterward immediately store the disc of the cartoon into the vault. This distorted screaming lasted until 8 minutes and a few seconds in, and then it abruptly cuts to the mickey mouse face at the credits of the end of every video with what sounded like a broken music box playing in the background.

This happened for about 30 seconds, and whatever was in that remaining 30 seconds I haven't been able to get a sliver of information about. From a security guard working under me who was making rounds outside of that room, I was told that after the last frame, the employee stumbled out of the room with pale skin saying "Real suffering is not known" 7 times before speedily taking the guards pistol and offing himself on the spot.

The thing I could get out of Leonard Maltin was that the last frame was a piece of Russian text that roughly said "the sights of hell bring its viewers back in". As far as I know, no one else has seen it, but there have been dozens of attempts at getting the file on rapidshare by employees inside the studios, all of whom have been promptly terminated of their jobs.

Whether it got online or not is up for debate, but if rumors serve me right, it's online somewhere under "suicidemouse.avi". If you ever find a copy of the film, I want you to never view it, and to contact me by phone immediately, regardless of the time. When a Disney Death is covered up as well as this, it means this has to be something huge.

Get back at me,

TR"

I've yet to find a copy of this, but it is out there. I know it.

==The Video==

User jojacob666 uploaded a video onto youtube based off the pasta.

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