



The Relationship between Individual Differences and Human Territoriality, within a Simulated Environment

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Abstract

Territoriality is defined as the acquisition of land or resources, such as food or mates, and securing these resources from actual or perceived threat. Many animals show differences in the expression of territoriality based on sex and personality differences, this study examined the extent these factors mediate territoriality usage, and what form it expresses itself in human participants. First gender (as identified by self-report questionnaire) and personality (scores attained from the Big Five Inventory Questionnaire), were examined, and how this altered in game territorial behaviours. It was found that females tended to use more non-aggressive territorial behaviours than males, and displayed a greater number of overall territorial behaviours than males. These results are consistent with an evolutionary theory of territoriality, whereby females tend towards more passive territorial behaviours, as opposed to males who tend towards more aggressive territoriality. Surprisingly, males did not show this inverse relation of increased aggressive territorial behaviours within this simulation.

Secondly, power asymmetries were examined between avatars, based on predictions by Game Theory. It was found that participants assigned to smaller avatars displayed significantly more withdrawing behaviours in general, and in particular towards larger avatars, as compared to the individuals controlling larger avatars. Furthermore smaller avatars used more passive territorial behaviours than larger avatars. This is consistent with a Game Theory approach to territoriality.

Finally winner and loser effects were examined in how they mediate emotional word usage in a short storytelling activity. It was found that low survival time is the best predictor of negative emotional word usage, and as survival time increase, negative emotional word usage decreased.

Keywords: territoriality, gender, FFM, individual differences, game theory, LIWIC

Relationship Between Individual Differences and Human Territoriality, within a Simulated Environment

Territoriality can be defined as the application of offensive or defensive behaviours to secure a desirable resource, such as land, food, or mates (McCorriston, Harrower, Martin, & Oches, 2012). A number of species, both human and non-human, utilise these behaviours in order to optimise their individual fitness; that is, to improve their reproductive success (Miller et al., 2014; Thonhauser, Raveh, Hettyey, Beissmann, & Penn, 2013). Territorial behaviours will be elicited when an individual, or group of individuals, perceives a given resource, such as land or mates, as owned by themselves, and when this ownership is threatened, or perceived to be threatened, they will defend it by utilising a range of behaviours in an attempt to deter the potential threat (Bell, Greene, Fisher, & Baum, 2001). Territoriality is used primarily in response to incursion by an organism's own species, because individuals of the same species are competing for the same resources, such as the same food types, or mates of the same species, although it may also occur intraspecifically when two species share similar needs such as access to water, or territories in specific biomes (Connell, 1983; Wiens, Anthony, & Forsman, 2014).

Territoriality encompasses a wide range of behaviours that can be used to defend a given resource, such as vocal warnings, erecting body hairs, warning displays of aggression, such as the beating of a chest, or physically aggressive behaviours, such as physical confrontation, or even fights to the death (Alcock, 2001; Brown, Lawrence, & Robinson, 2005). Territoriality has been found to be highly advantageous to those species that employ it, and is a very efficient mechanism for increasing individual fitness by securing access to nutrients, and increasing reproductive success through attracting females to the desirable resource (resource defence territoriality; Gosling, 2014). Such behaviours can be costly however, in that if territorial conflicts escalate, they can lead to the demise of one, or both

individuals contesting the resource (Haynes, et al., 2014). This suggests that the benefits to fitness must be great, in order to outweigh the costs of performing such behaviours, which can lead to harm or even potential death. The extent to which animals utilise territorial behaviours can be determined by changes to both external environmental pressures (geographical surroundings) or through changes of internal environments (changes across the lifespan, such as puberty; Schoepf & Schradin, 2012). Territoriality usage is mediated primarily by food, such as quality, accessibility, or the rate to which it replenishes. It can, however, also be mediated by external factors, such as prevalence of predators and quantity and quality of mates (Maher & Lott, 2000). Continued usage of territorial behaviours, after a specific territory is claimed, is also likely to be mediated by ecological variants, such as the relative value of the territory, and the benefits gained from owning the territory as opposed to the potential damage received from defending the resource, or that may be incurred from attempting to claim an alternative territory (Maynard-Smith, 1982; Webb, Scott, Whiting, & Shine, 2015). Clearly then, territoriality can be seen as an efficient strategy to acquire resources, and can be mediated by a variety of factors. Before examining how territoriality can be mediated, animal territoriality as a whole must first be examined, and what forms these territorial behaviours take. This will then lead to an understanding of human territoriality.

Territorial behaviours have been repeatedly studied in non-human animals, where behaviours, such as differential vocal sounds, aggressive behaviours towards intruders, and even fights to the death between competitors can be observed (Piper, Walcott, Mager, & Spilker, 2008; Wilson et al., 2015). Animals often use a complex array of advertising to claim and defend a territory, through behaviours such as scent marking, warning gestures, aggressive facial expressions, and ritualised aggression which allows individual members of a species to compete for a resource, while reducing the likelihood of fatal damage to either contestant (Lane, Haughan, Evans, Tregenza, & House, 2016; Maynard-Smith, 1974). For example, big

cats will use scent markers, such as urine, in order to mark a claimed territory, or male song birds will engage in competitive warbling with other male songbirds in an attempt to deter the other male, and to attract a mate (Mennill, Ratcliffe, & Boag, 2002; Vogt, Zimmermann, Kölliker, & Breitenmoser, 2014).

The extent and forms which animals utilise territoriality varies widely between animals of different species, such as what if any territorial behaviours are used, whether the male or female competes for access to mates or land, and whether the territoriality display principally between members of the same species, or a multitude of species competing for the same resource (Hardy & Briffa, 2013). Animals use a multitude of assessments to determine whether or not to engage with a competitor. Such conflicts often follow a recognisable pattern of escalation, first starting with an individual marking their perceived territory, such as through scent markers or decorations. This is then followed by two competitors (often males) engaged in a range of warning behaviours. Such warning behaviours are devised in attempt to deter the competitor, by advertising the individual's relative prowess (such as a hyena raising its hairs to make it appear larger or more powerful than the competitor; Owens & Owens, 1978). If the interloper is not deterred by these warning behaviours, then the interactions escalate to a ritualised contest in which one or both contestants will flee, and thus concede the contest, or potentially perish (Batchelor & Briffa, 2010). An example of this is the hermit crab which uses its claws to signal its intent to attack if an interloper encroaches on its territory (Laidre & Johnstone, 2013). Simple gestures such as this can display the intent to attack the interloper, without the need to necessarily escalate behaviours towards conflict. The interloper can choose to leave the territory, without the need for physical confrontation, and so both the owner, and the interloper leave this territorial contest without the risk of harm to either individual.

It is clear that territoriality follows a set structure across a range of territorial contests, whereby an individual claims a territory, the owner attempts to deter any competitors with a

variety of defensive behaviours, and if neither competitor flees, this escalates into fighting behaviours (Huntingford, 2013). As such behaviours always follow a set pattern, a model such as Game Theory, is needed to explain these behaviours.

Game Theory

A useful theory for examining territoriality, and variations in territorial response is Game Theory, a model which explains what territorial behaviours will be utilised, and how an individual (usually unconsciously) will attempt to maximise their success in one-one territorial conflicts. Game Theory is a mathematical model, which predicts animal behaviour, assuming that animals make rational decisions on which behaviours to undertake, based on a series of assessment of own attributes, and their attributes relative to a competitor (Maynard-Smith, 1974). Game Theory suggests that individuals when confronted with a one-one territorial conflict will use a system of analysis and judgement in order to facilitate ritualised fighting (Maynard-Smith, 1979; Sandholm, 2012). Game Theory states that (usually unconsciously) the two competitors make assessments of themselves relative to their competitor, such as size and strength disparities or relative fitness, and then apply strategies to the situation based on these assessments, such as whether to engage with the competitor, or to flee and concede the resource (Myerson, 2013). The classic Game Theory proposes that in a conflict situation animals will either respond with a “hawk” or a “dove” disposition. The hawk disposition is where the animal will always attack the opponent, and if faced with a dove (one that always concedes the resource), the hawk will always win, and if faced with another hawk they will win the contest 50% of the time. If two doves meet, however, they will share the resource if it can be divided, otherwise they will receive nothing if the resource is indivisible. Animals when acting territoriality will inevitably use a combination of dove or hawk strategies when engaged in a territorial contest, and such an equilibrium of such strategies will spread among the population. Furthermore, all individuals within a population will alternate what strategies they

use in order to maximise their outcomes, and minimise their losses. This modification is likely to be a result of making assessments of their own fitness relative to their opponent, as well as taking into account past contest, and what behaviours were utilised in order to shape what behaviours they then choose to use in future territorial contests. This theory can be applied to animal contests, especially when these animals take into account assessment of fitness, such as own energy or health reserves, relative to their opponent (Maynard-Smith, 1982). This means that animals unconsciously use assessment of their own and opponent's fitness to reduce mortality in territorial contests, and increase likelihood of pay offs and rewards such as food resources (McNarma, 2013). By using the Game Theory approach to consider territorial conflict, it allows us to make predictions about behaviour. This, therefore, would predict that more powerful or healthy individuals would initiate more attacks against their opposition, and act more like "hawks", whereas less powerful, weaker individuals would act more like "doves" and display more non-aggressive behaviours, and more fleeing behaviours, when faced with a one-one territorial contest. The extent to which both of these strategies are utilised are prone to be driven by own fitness compared to opponents fitness, as well as which strategies have been used successfully in the past, or potentially more importantly which strategies have failed in contests in the past. This would also explain real-world animal territoriality, whereby male animals tend to be larger and more powerful than their female counterparts, and therefore this theory would predict increased male territorial aggression, and decreased female territorial aggression.

This theory accounts for many real world examples of territorial contests. One example is the study of cricket frog contests, whereby the individuals use temporal call changes in order to make size assessments of intruder species during territorial competitions (Burmeister, Ophir, Ryan, & Wilczynski, 2002). Furthermore studies, such as that conducted by Arnott and Elwood, (2009) have conducted meta analyses on a variety of animal species, and what

asymmetries are observed between the two competitors, and how these asymmetries lead to competition outcomes. It was concluded that animals, even if unconsciously take note of these asymmetries, and change their strategies in one-one contests in order to maximise outcomes, such as securing food, while minimising losses, such as fleeing from competitions then cannot win (Taylor & Elwood, 2003).

The Game Theory approach predicts winning and losing as natural consequences of territorial contests. So far, however, it has yielded minimal insight into subsequent behaviours of the agents after the completion of the territorial conflict. From these inevitable variances in winning and losing, those who initially lose, will tend towards increased instances of losing in the future (loser effects), and those who initially won are more likely to have more instances of future wins (winner effect; Kura, Broom, & Kandler, 2016; Mesterton-Gibbons, 1999). These winner and loser effects have been demonstrated to be sustained for an extended period of time, after the initial experience of winning or losing, and is suggested to be a result of alteration to neurotransmitter pathways, such as the 5-HT₁ receptor (serotonin receptors; Momohara, Minami, Kanai, & Nagayama, 2016). Serotonin is a neurotransmitter responsible for mood regulation, and is strongly linked to behaviours associated with the flight or fight response (behaviours such as arousal and eating; Cowen & Sherwood, 2013). Manipulation of this pathway, such as through learning, or artificial manipulation during lab studies, has been found to demonstrate extended differences in winner and loser effects, and in territorial behaviours. When this neurotransmitter pathway was inhibited, loser effects failed to occur; subsequently if animals were supplied with a chemical that bound strongly to the receptor sites, they showed no presence of the winner effects (Momohara et al., 2016). This suggests that this neural pathway is strongly tied to winner and loser effects. As well as territorial behaviour regulation, the 5-HT₁ receptor has also been strongly tied to mood regulation (Hairi & Holmes, 2006; Meneses & Liy-Salmeron, 2012; Young, 2007). While this pathway may be primarily

responsible for behavioural differences in animal research, it is likely that manipulation of this pathway in human research is likely to lead to subsequent mood differences, based on the presence of winner or loser effects manipulating this pathway.

Game Theory gives an insight into how territorial behaviour may differ based on situational differences, such as size differences between competitors in individual contests. Game Theory however, primarily accounts for survival and a selection of behaviours at an individual level. While due to the nature of survival of the fittest that these individuals adopting such strategies, are more prone to proliferating their genes, due to increases survival likelihood over those individuals that adapt maladaptive strategies, it largely fails to account for sexual selection theories, and how territoriality may not be used purely to increase one's own survival, but also used as an attempt for mate selection. Therefore, sex differences and territoriality must also be examined in conjunction with territoriality to examine both how different behavioural strategies are used in order to acquire resources, but also how the different sexes utilise territorial behaviours in order to increase reproductive success.

Sex Differences

Sex differences in territoriality have been repeatedly observed in a variety of animal species. In many species the male attracts females, through securing land and resources, whereas females choose the most suitable mate, based on his ability to provide resources pertaining to childrearing (Kelley & Endler, 2012). For example, a male bowerbird will create intricate structures, which they adorn with decorations, such as flowers and shiny objects they have scavenged, in order to impress a female. This ability demonstrates to a female that they are capable of securing territory, and providing a suitable environment for childrearing. The male therefore actively seeks to entice a female by securing land and is in direct competition with other males to secure a mate, whereas the female has her choice of mates, and is not in

direct competition with other females for mates. Due to this difference in mate selection, males tend to utilise more territorial behaviours, especially against intruding males, than females display (Bradbury, 2011; Pröhl, 2005).

Males therefore tend to show an increased ability to acquire and defend a resource in order to secure a mate, whereas a female does not need to display these aggressive territorial behaviours to acquire a mate. Females tend towards using more passive behaviours, when in the company of other females, in order to facilitate collective childrearing, and so females have a predisposition to be less aggressive towards other females (Tecot & Baden, 2015). This difference in female territoriality is likely to facilitate allomaternal care, in that if a group of females share a resource such as food, they can more easily achieve a common goal, such as childrearing, therefore all individuals benefit from pro-social behaviours in group living to facilitate childrearing (Burkart, Hrdy, & Van Schaik, 2009; Grinsted, Agnarsson, & Bilde, 2012). This does not necessarily mean they are intrinsically less territorial than males, just that how they express their territoriality alters based on the situational factors of group childrearing. These differences in sex territoriality may also be a result of size dimorphisms between the two genders, in that if males tend to be larger than females, they are the ones most likely to be utilising aggressive territoriality. In fact studies of the cichlid fish have found that when size disparities are no longer present between males and female, females are more territorial than males whereby contest times associated with females' territoriality were longer than with males (Odreitz & Sefc, 2015). This suggests that if size dimorphisms are removed between the two genders in some species, females become increasingly territorial, even in some ways more territorial than males. Due to this it is worth investigating size and power disparities in territorial contests in conjunction with gender in human research. If these size or power asymmetries are exaggerated, or removed, will this alter expression of territoriality between the genders?

Sex differences are especially pronounced in primates, and species with greater abilities for social communication, in which gender differences in behaviour are needed to facilitate living in larger social groups (Sterck, Watts, & van Schaik, 1997). For example, female baboons who form social relationships with other females baboons, have been shown to have greater life expectancy, increased access to resources such as food and water, as well as allomaternal care for their offspring, than those individuals who are socially isolated from other same sex members of the species (Archie, Tung, Clark, Altmann, & Alberts, 2014). This suggests behaviour patterns, such as territorial conflict, are mediated in order to facilitate social living. Males who socially bond to defend a territory have different payoffs to females however, in that male chimpanzees who co-operate to extend a territory benefit primarily from increased mating opportunities (Williams, Oehlert, Carlis, & Pusey, 2004). Because females tend to seek reproductive resources that are usually better achieved through co-operation, female aggressive territoriality is less common than male aggressive territorial behaviours (Manson et al., 1991). Females do tend to be highly territorial in terms of feeding sites and breeding sites, which are highly important for self-sustainability, and that of their infants, and so often form female conspecific territories with other females of their social group to defend these desired resources against other female non- bonded individuals (Clutton-Brock & Huchard, 2013; Stockley & Bro-Jørgensen, 2011). The evidence therefore suggests that females will still utilise both aggressive and non-aggressive forms of territoriality to defend reproductive resources, such as food, but suggests that the frequency of territorial behaviours, is likely to be less than that of males. Sex differences are then clear indicators of differences in the extent to which territoriality is used, and what forms this territoriality takes. As well as sex, a fixed factor that mediates animal territoriality, personality, has also been found to mediate animal territoriality.

Personality and Territorial Behaviour

Personality has been observed as an individual difference that can mediate the frequency, and the type of territorial behaviours that are utilised. Individual differences within a species can alter the likelihood of territorial conflict, cooperation with other individuals to retain a territory, and acquisition of resources, such as mates (Vrublevska et al., 2015). For example, great tits have been shown to consistently display individual variation in exploration, which may be characterised and recorded as a measure of their personality (Snijders, van Rooij, Henskens, van Oers, & Nagui, 2015). The differences in these exploration scores can predict vocal and spatial responses during an encounter with an intruder, both of which are responses to territorial infringement, and are warning behaviours, as an attempt to deter the interloper. Personality can also affect aggressive behaviours within a territorial conflict, such as crickets who scored higher in exploration, activity, and aggressiveness, all predicted usage of aggressive territoriality in one-one contests (Santostefano, Wilson, Araya-Ajoy, & Dingemanse, 2016). The individuals of species consistently behave with these slight variations to each other, and so can be viewed as synonymous to an animal's personality type (King & Figueredo, 1997). Individual personality differences in animals, such as their affinity towards novel stimuli, can alter the rate at which they utilise aggressive territorial behaviours (Réale, Reader, Sol, McDougall, & Dingemanse, 2007). Thus stable differences in an animal's personality mediate a variety of behaviours, most notably those related to territoriality, and territorial conflict. Researchers have sought to propose a model that can explain these personality differences, and account for all aspects of an individual's personality.

A variety of models have been suggested to categorise personality traits in both human and non-human animals, and one of the most commonly used models is the Five-Factor Model (FFM; McCrae & Costa, 1997). This model categorises diversity in personality onto five orthogonal traits of Openness to Experience, Conscientiousness, Extraversion, Agreeableness,

and Neuroticism. These personality traits have remained stable over various animal species, and over a variety of human cultures, suggesting they account for a large variety of individual differences, and how an individual's behaviour may be mediated by their personality type (McCrae & Terracciano, 2005; Konecna et al., 2008; Weiss et al., 2009). This model was originally developed to map stable personality traits of humans, and has repeatedly been validated, and therefore was applied to animal research in an attempt to assess non-human animal personality (Costa & McCrae, 2006; John, Naumann, & Soto, 2008; McCrae & Costa, 2003). In non-human animal research, observations of animal behaviours are used to examine various behaviours such as fear, hostility, dominance, submission, affection, sociability, and then these various observable behaviours are mapped onto the FFM (Freeman et al., 2013; Gosling & John, 1999).

As most research on territoriality has been conducted in relation to non-human animals, it is thus important to understand how much of the findings generalise to human territoriality. Non-human animals appear to consistently share many, if not all, of the factors derived from the FFM, and these personality differences mediate behaviours such as territoriality (Gosling & John, 1999). Chimpanzees have frequently been studied on how the FFM maps onto their behaviour. Traits, such as Neuroticism, have been characterised by observing behaviours such as impulsivity and erratic behaviours, Agreeableness by characteristics such as protectiveness, sensitivity, and affection, and conscientiousness includes behaviours such as low dominance (Latzman, Hopkins, Keebaugh, & Young, 2014). A number of studies have conducted similar research on various primates to see how the FFM can be applied to animal personality, and have found that Extraversion, Neuroticism and Agreeableness consistently map onto various primate species, and that while Conscientiousness and Openness to Experience do not always map onto animals as an orthogonal trait, several behaviours have been observed in animals that represent these traits, such as exploration, acting methodically when engaging in a task,

curiosity, and innovation, suggesting they still retain some elements of these various personality traits (Freeman & Gosling, 2010; Freeman et al., 2013; Kristiansen & Kuczaj, 2013; Weiss & King, 2015). While most species seem to fit within the FFM of personality, some species also possess another trait labelled Dominance (King & Figueredo, 1997). Such factor is derived from the Extraversion trait in human research, however in animal research the trait appears as its own higher order orthogonal trait. If Dominance is suggested as a higher order trait for some animals, but not for humans, it may be then that humans perform less territorially than some animal species, such as chimpanzees where dominance over other group members is a large component of their social living (King & Figueredo, 1997). While in some studies Dominance is categorised under its own higher order trait, in other studies it has also been categorised under the human trait of Extraversion, suggesting that Dominance can be accounted for purely by the Five Factor Personality Model (Patrick, Curtin, & Tellegen, 2002).

From this it is clear that the FFM can largely explain both human and animal personalities. As it has been established that the FFM is a good model to explain personality, it must therefore be considered how variations in FFM traits may link to differences in territorial behaviours, or in terms of the extent to which territoriality is used.

Extraversion is the primary trait that relates to the mediation of territoriality within animal research, primarily due to the fact that it encapsulates behaviours such as dominance (Weiss, King, & Hopkins, 2007). While many studies suggest Dominance as a separate higher order orthogonal trait, because this study will focus on human territoriality, Extraversion and Dominance will be examined interchangeably as a single trait. Extraversion and Dominance incorporate behaviours associated with engaging with the external world, and behaviours such as independence, decisiveness, and bullying behaviours (King & Figuerdo, 1997; King, Weiss, & Farmer, 2005; Pederson, King, & Landau, 2005). In contrast, lower scores on this trait shows behaviours tending towards timid, submissive, and fearful. Studies, largely conducted

on chimpanzees, have consistently found differences in Extraversion and Dominance, leading to differences in territorial behaviours, such as aggressive or submissive behaviours, approachability, and other pro or antisocial behaviours, dependent on whether they display high or low Extraversion and Dominance levels (King & Figuerdo, 1997; Pederson et al., 2005).

Neuroticism has been examined in animal research, over a variety of species, to examine how differing levels of such a trait, leads to various behaviours within these species (Gosling & John, 1999). This study used meta-analysis of nineteen studies, conducted on twelve different animal species to examine which of the FFM personality traits constantly appear through the different species. The studies included within this meta-analysis used a variety of methods to record animal behaviour, and consistently showed several features of the FFM that mapped onto animal behaviour. Animals that displayed higher levels of Neuroticism, showed an increased tendency towards a fight-flight response, than those that scored lower in Neuroticism. Further studies found that animals that are more cautious (one behaviour symptomatic of higher Neuroticism levels), tended to show increased activation of the Hypothalamic-Pituitary- Adrenal axis (HPA Axis) which is a critical hormonal pathway related to the flight or fight response (Baugh, van Oers, Naguib, & Hau, 2013). This research therefore suggests that personality differences can lead to an increased or decreased response of this pathway, and therefore this personality trait can mediate animal territorial responses (fight or flight). Neuroticism seems the main personality trait related to fight or flight, however other personality traits such as Agreeableness, are more related to other territorial behaviours, such as territorial conflict, and ritualised aggression.

Low levels of agreeableness have been found to be characteristic of hostility, aggressiveness, and fighting behaviours (King & Figuerdo, 1997; Pederson, et al., 2005). It is suggested that males will have an evolutionary tendency towards lower levels of agreeableness

to facilitate male-male competition through ritualised fighting for mates, or in competition for resources, such as food (Buss, 2009; Nettle, 2006). Because individuals with lower levels of agreeableness tend towards more aggressive behaviours, it is expected that this would be mirrored in their utilisation of territorial behaviours, in that they are more prone to ritualised fighting, rather than utilising an extended number of non-aggressive displays to secure their territory, or ward off intruders. While the previous research gives insight into animal territoriality, as mediated by personality, it still remains unclear if human behaviour is mediated by personality, and more importantly if humans act territorially, or if such behaviours can be mediated by personality.

While there is a wealth of evidence to suggest that animals display personality differences that mediate behaviour, especially territorial behaviour, these differences may not readily transfer to humans, where behaviour is often performed more based on logical decision making, than instinctive behaviour driven by one's personality. There is evidence however, that humans do vary their behaviour in association with their personality, and that several of these behaviours relate to potentially territorial behaviours, such as aggression and impulsivity (Barlett & Anderson, 2012; Bettencourt, Talley, Benjamin, & Valentine, 2006; Jones, Miller, & Lynam, 2011.) Both impulsivity and aggression are key characteristics of territoriality, in that individuals are more likely to initiate confrontations, and defend their perceived territories.

While human territorial acquisition may not be as overt as in non-human animal species, for example humans rarely fight to the death, or claim territory's using scent markings, it has still been observed that humans continue to utilise territoriality in order to settle disputes, guard resources from opponents, and acquire mates (Cashdan, 2013; Johnson & Toft, 2014). Animals tend to use territoriality more towards food and mate acquisition, whereas humans use territoriality to secure resources with a social value, such as larger offices and material objects. Behaviours such as placing name signs on office doors, or the concept of ownership of

property or land, and defending these against intruders are all forms of territorial behaviours that humans continue to employ, in display of their ownership of a resource (Brown, Lawrence, & Robinson, 2005). While these forms of territoriality may appear more subtle than those displayed by animals, this may be due to Westernised culture in which resources such as food or shelter is more prevalent. Territoriality, and the form in which it is expressed differs based on culture. Westernised society leads to territoriality towards social items and spaces, whereas, in contrast, in other societies territoriality may be expressed in other ways, or over different resources, such as prioritised towards land or food resources (Baker, 2003). This demonstrates that, like animals, external factors can mediate territoriality, and situational factors can increase or decrease the expression of territoriality utilised (Gat, 2000; Lagerloef, 2013).

As well as claiming office spaces, to denote territorial possession, a range of other territorial behaviours are performed, that can be noted as territorial, such as claiming a parking space, customisation of possessions, and claiming seating spaces in a public domain. For example, when leaving a parking space in a public parking area, individuals will act territorially towards their parking space, even when attempting to vacate the parking lot (Ruback & Juieng, 1997). If the individual feels their territory (in this case the parking space) is being intruded upon, such as by another individual honking their horn, they are likely to resist leaving the parking space. While the parking space is only temporarily occupied, and does not belong to the individual, while they are occupying the space with their car, this acts as a temporary ownership of this land, and so individuals may be prone to demonstrating territorial behaviours, when such space is impinged upon by others.

Other examples of human territoriality includes seat selection in public or semi-public domains. In situations such as student lecture theatres, individuals tend to select the same seating patterns continually, and rarely seek to displace other individuals from their respective

seating areas, suggesting a form of temporary territoriality (Costa, 2011). While occupation of these locations, such as seats in lecture halls, parking spaces, seating areas in a coffee shop, may be temporary, an individual will still respond with a variety of territorial behaviours, such as refusing to concede the territory, or using items to denote ownership of this territory, such as leaving personal items of clothing, or shopping bags. From the literature, it is clear that humans continue to utilise territoriality, and this expression of territoriality is context dependent, and can be increased or decreased dependent on if the situation necessitates. In the research on animal species it has been found that individual differences can consistently mediate territoriality, but it remains unclear if human territoriality can be mediated by individual differences, such as personality. Before predictions can be made about human personality and territoriality, it must be understood how human personality differences, lead to differences in behaviours that are associated with territoriality.

The Five Factor Model has also been repeatedly used in determining human personality traits, and how these personality traits affect individual behaviour (Back, Schmukle, & Egloff, 2009; Costa & McCrae, 1992, 2006; McCrae & Costa, 1997). Variations in personality have been found to affect overt behavioural differences, such as food production, mate recruitment, and conflict with other members of society (Gurven, von Rueden, Stieglitz, Kaplan, & Rodriguez, 2014). For example in small subsistence societies, higher levels of Extraversion and Openness to Experience have been found to show increased levels of aggression towards other males. These heightened levels of aggression are likely to lead to various behavioural differences, and increased aggression in all behaviours, especially in terms of territorial contests. Stable personality differences, such as high levels of Extraversion and low levels of Conscientiousness, lead to an increased likelihood towards risky behaviour such as tobacco and alcohol consumption, as well as increased number of daring sexual encounters (Hong, Paunonen, & Slade, 2008). From this it can be inferred that individuals who self-report higher

in such traits may be more prone to a variety of risky behaviours, or may act more impulsively in certain situations, such as territorial conflict scenarios.

Gender and personality also seem to have co-existed on an evolutionary tendency, in that females tended to show increased levels of agreeableness and lower levels of emotional stability than males (low emotional stability can be seen as synonymous with higher levels of Neuroticism; Budaev, 1999). This tendency towards certain personality characteristics is in keeping with evolutionary theories of personality differences between genders, in that females may show increased agreeableness to enable co-operation in communal living environments. Males also tended to show increased levels of dominance and aggression compared to females, which may be due to the evolutionary role of the male to secure food for their mates, and out-compete other males for access to mates, and therefore males are expected to be more aggressive and dominant than their female counterparts.

Research Aims

The literature above therefore defines territoriality as a measure used to claim a territory such as food, water, or mates, and its continued use is to defend it from interlopers. This Literature Review then examined how animal research gives insight into what behaviours a human may use if their resources are threatened, or become sparse, and the human research into territoriality concludes that humans do in fact continue to use territorial behaviours, just not necessarily as frequently, or as overtly, as animals utilise such behaviours. To examine human territoriality a theory was needed that could be used to predict usage of territorial behaviours in a given conflict. Game Theory was therefore used as a method of assessing whether consciously, or unconsciously, animals shape their behavioural styles in territorial setting to fit that of the surrounding population in order to maximise the gaining of resources, and likelihood of survival. Furthermore, Game Theory yields an insight into how winner and

loser effects can manipulate future territorial interactions, and potentially long term changes to behaviour and mood. Following this, factors that have been shown to affect animal territoriality were investigated, such as gender, personality, and power disparities to gain an insight into what factors may mediate human territoriality. As the research shows, there are many gaps in the research, such as can human territoriality be artificially manipulated, does it vary naturally based on an individual's personality characteristics, or gender, and do differences such as size and power disparities influence an individual's behaviour, similarly to that of animal's behaviour as predicted by Game Theory. Furthermore, will experiences within a territorial contest shape an individual's mood after the completion of a territorial contest?

The primary aim for this research project is to address the discrepancy in research between non-human and human territorial behaviour. Much research has been conducted on non-human territoriality, however very few experimental studies have addressed human territoriality, and what factors can mediate the extent to which they utilise territorial behaviour, or in what forms this territoriality will be expressed. The primary aim of the first experiment (Experiment 1) was to examine gender and personality differences as predictors of territorial behaviour within a simulated environment. Experiment 2 sought to examine if power asymmetries between contestants in a simulated environment mirrors that displayed by animals in a real-world territorial environment. The Game Theory approach was used, to assess if individuals shape their behaviour based on observable differences between individuals such as health and power asymmetries. Due to this theory, differences between competitors are expected, both in-game and post-game, based on whether the individual is controlling a more powerful, or a less powerful avatar. Finally, Experiment 3 focused on winner and loser effects from a territorial contest, and how success or failure within a territorial contest may lead to behaviour and mood changes for an extended period after the conclusion of the territorial contest.

General Methodology

The Simulated Environment

Perceived or actual territorial infringement in humans can lead to a range of simple territorial behaviours that utilise both verbal and non-verbal behaviours, such as physical aggression, or aggressive language in an attempt to cause the intruder to flee, or to eliminate the intruder as a potential threat (affective defence; Weinshenker & Siegel, 2002). These are primarily non-verbal however, and can be easily represented within a simulated environment, where such simplistic behaviours, such as striking an opponent, can be expressed through virtual avatars, so observations of territorial behaviours in humans can be made, without causing risk of injury or harm to participants.

One such example of a simulated environment, in which territorial interactions could be observed between virtual avatars, controlled by human participants, was devised by Descioli and Wilson (2011), and was therefore selected to be utilised during the current study. Participants could compete against other participants for resources needed to survive, such as food. Their health would deteriorate as the experiment progressed, and could be restored by consuming food, in this case berries from berry bushes. They could fight their opponents for berry bushes, which were either a small number of regularly high yielding green berry bushes, or a larger number of irregularly low yielding brown berry bushes, however, they could not survive the attrition to their health based on the resources collected from the brown resources alone, and would therefore, have to compete for the more desirable resources. The colour differentiation of the food resources was used so it was clearly apparent which was the more desirable resources, it was also explicitly stated in the onscreen instructions that the green resources were more desirable so there could be no confusion to the participants. (See Figure 1.0. below).

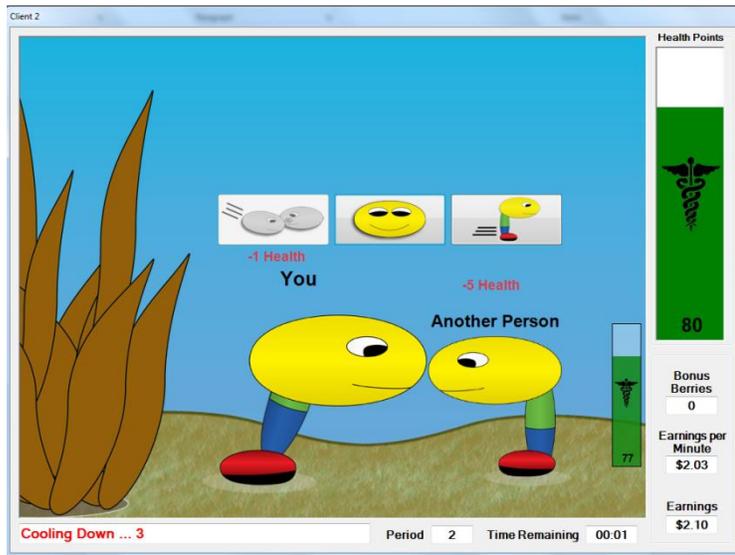


Figure 1.0. An example of an aggressive interaction between two avatars, within a brown berry bush.

The computer simulation allows participants to engage in territorial contests, without a risk of harm coming to the actual participants. Such individuals are able to control an avatar, and move the avatar around a savannah like environment, where they can interact with other participants in territorial contests. The in game avatars had health meters, scaled 0-100, and beginning at 90, which deteriorated as the game progressed (ten points per minute); such attrition can be viewed as the avatars metabolism. Avatars can increase their health by consuming berries from the berry bushes within the game, and as the avatars health increases, so does the overall score of the player, therefore their overall scores (as shown in cash earnings), can be viewed as how successfully an individual has navigated the territorial simulation.

If two avatars enter the same bush, then they are faced with an interaction screen which displays each avatars respective health, as well as a visual representation of how desirable the resource is that they are contesting for (green is highly desirable, brown is less desirable). Each participant then has three options to choose from: to smile at their foe which causes no harm or

gain to either avatar, to retreat from the interaction which conceded the resource to the other avatar, or to attack their opponent, which deals a slight health damage to the attacker, but a greater damage to the opponent. This screen will be resolved by one of the avatars leaving the berry bush, or one of the avatars health reaching zero, which will result in the demise of said avatar.

In the scenario the resources were randomly distributed, with a significantly lower proportion of desirable berry bushes, to undesirable ones (10 brown berry bushes/5 green berry bushes), thus increasing the likelihood of territorial behaviours being utilised to secure such resources (DeScioli & Wilson, 2011). The game lasted twenty minutes, however participants were not aware of the exact duration of the game to prevent end effects. Participants had a mini-map that appeared in the top corner of their computer screen to aid navigation of the territorial environment, however this did not display where other avatars were located in order to prevent intentional targeting of other players.

The simulation also had a separate monitor for the researcher, that was unseen by participants, which allows the researcher to observe the interactions of the participants, and track their location and interactions within the virtual simulation. The programme also automatically recorded these interactions between participants, and also recorded the interactions as a video, which monitored the movements of participants around the simulation, so that it could be replayed to the researcher, as well as having complete records of all interactions that occurred.

Personality Measures

The personality traits of the participants were recorded through using a 44-point Big Five Inventory Questionnaire prior to the commencement of the territorial contest (see Appendix E; John, Donahue, & Kentle, 1991). A series of statements were presented to the

participants to assess their various levels of: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience. Each statement referred to one of these aspects, and the participants rated how appropriate the statement; for example “Is easily distracted” related to themselves. Such judgement was based on a 5 point Likert scale ranging from “strongly agreed (5)” to “strongly disagreed (1)”. These scores were then averaged so that each participant had a score for each personality trait ranging from 1-5.

Procedure

Participants were asked to attend specific slots of between 8-12 participants. Each participant could only attend the study once, and so their data was compared against that of other participants. Each participant was randomly allocated to a computer which were spaced out around the testing area in order to reduce the likelihood of verbal interaction between participants. They were then asked to read through the information sheet (see Appendix C), and then if they were happy to proceed to fill out the consent form (see Appendix D) and then begin filling out the personality questionnaire (see Appendix E). They were given the opportunity to ask any questions before proceeding, and were made aware they were free to leave the study at any time without consequence of doing so.

After all the participants in the session had completed the questionnaire, they were then presented with the virtual environment. Each participant has a series of onscreen instructions which details how to navigate the virtual environment, and were given the opportunity to practice interacting with the software before the experiment commenced. The instructions explained how the aim of the game is to collect as many berries as possible, and that the overall health of the avatars, and the number of berries consumed, translates into the overall score of each participant. The score at the end can be viewed as synonymous to how effectively each individual navigated around the virtual environment, and how efficiently they

interacted with other avatars. Once the player had practiced navigating around a trial scenario, they were free to ask any more questions; once all questions were answered the experiment would begin. The experiment comprised of twenty game periods, each of which comprised of sixty seconds, so the game overall ran for twenty minutes however, the participants were unaware of the duration of the game to prevent end effects. If any avatar during this twenty minutes reached a health of zero then the avatar would expire and the participant would be asked to remain seated until the end of the experiment. After the twenty periods had elapsed, participants were shown their overall score (as represented by \$ earnings), and presented with a short questionnaire (see Appendix I) which documents the participants name, age, gender, and ethnicity (in order that the researcher could later match up the participants in game data, to their personality score information; See Appendix H).

After the virtual environment portion of the experiment concluded, participants were asked to open up a 'PowerPoint' document which contained the three storytelling OH cards (see Appendix G), and were given onscreen instructions detailing that they should write a short five minute story connecting these three ambiguous images. This part of the experiment was purely used for Experiment 3 (see page 54). These instructions guided the participants on what sort of information should be contained with the story such as "what [are] the characters feeling and thinking?". This guided the story in that it would elicit the use of more emotive words. When the five minutes had elapsed the participants were asked to save their stories, and were free to leave, or ask any remaining questions to researcher. All participants were presented with a debrief sheet (see Appendix H) as they left. This debrief detailed the true aims of the study as well as the expected findings and contact details of the researcher in case they had any further questions, or wished to withdraw their data from the study.

Research Ethics

A full ethics application, and risk assessment were completed prior to the commencement of testing (see Appendix A and B). This was approved by an independent board that deemed the study acceptable, and would cause no harm or distress to the participants, and fully complied with the ethical criteria for human testing as set by the British Psychological Association (BPS). The study was conducted at the University of Hull under the guidance of my supervisors Dr Mary-Ellen Large and Dr Paul Skarratt, and training regarding the use of software had been provided prior to the beginning of testing. For the first and final experiments, participants were able to give fully informed consent, with no element of deception, and met all BPS ethical guidelines. However, for the second experiment participants were deceived in the aims of the experiment to avoid demand characteristics; however, they gave their fully informed consent in terms of what is expected of them during the experiment, and in terms of time constraints. They were fully debriefed after the experiment in terms of the true aims of the experiment. Anonymity of the participants was maintained by removing any identifying features when analysing data or in and results within this publication, furthermore participants were made aware they could give a pseudonym or their student number to identify themselves, as long as they consistently used such name or identifier.

Experiment 1

Introduction

Many individual differences have been shown in animal research that mediate territorial behaviour, but no factors seem more prevalent or universal than differences in personality and gender (Gosling, 2014; Gosling & John, 1999; Kristiansen & Kucjaz, 2013; Pusey & Schroepfer-Walker, 2013). Most animal species tend to differ highly in the territorial responsibilities between the sexes (Lonsdorf et al., 2014). Males tend to be more outwardly

aggressive, usually having to compete for mates, land, or resources, primarily competing against other males of the same species in order to secure these resources. Females tend to be less outwardly aggressive, and especially in species that encourage communal living (such as apes and humans) and practice group childrearing. They often tend towards more passive territorial displays, to secure resources for their offspring, such as food (Sterck, Watts, & van Schaik, 1997). It is expected that there will be gender differences in humans as well.

Furthermore, animal research has shown that individual differences occur within the gender, and that various animals consistently behave in certain ways, which can be represented as the animal's personality. These differences have been shown to alter the extent to which they display territorial behaviours, and how these behaviours manifest. It remains unclear, however, to what extent humans manifest these individual personality differences, when confronted with a territorial environment, and so the first experiment will investigate these differences in gender and personality in territoriality.

Experiment 1: Personality and In-Game behaviour hypotheses

As the animal literature specifies, Dominance maps primarily onto Extraversion, as such a trait refers to behaviours such as assertiveness, suggesting an increase in overall number of territorial behaviours, and an increased use in aggressive territoriality specifically. Therefore individuals scoring higher in the Extraversion trait will use more overall territorial behaviours, and will use more aggressive territorial behaviours.

High Conscientiousness shows a predisposition towards planning and forethought, and show increased impulse regulation and are less prone to territorial displays. Therefore participants higher in conscientiousness will display fewer territorial behaviours, more non-aggressive territorial behaviours, fewer aggressive territorial behaviours, and more fleeing behaviours, than those who score lower on this trait.

Furthermore, individuals with higher Neuroticism scores have also been shown to lack impulse control, and are more prone to become irritated and aggressive from certain stimuli, and so are more likely to show more aggressive territorial behaviours. Furthermore, their behaviours are more erratic and they are likely to withdraw from more conflicts, due to their increased sensitivity to certain situations, such as that in animal behaviours where they display more timid and fearful responses to stimuli. Therefore, individuals higher in Neuroticism will use more aggressive behaviours, and more withdraws, than those lower in this trait.

Individuals with higher levels of Agreeableness tend towards more amicable and harmonious social situations, whereas those lower in such a trait tend towards self-interest and are unwilling to help others. Therefore those who score higher in this trait will display more non-aggressive territorial behaviours, and fewer aggressive territorial behaviours.

Experiment 1: Gender and In-Game behaviour hypotheses

In concordance with the current research in human and animal behaviour, as highlighted in the literature review, gender differences are expected in territorial behaviours. Females tend towards more passive territorial behaviours (such as smiling or withdrawing), whereas males tend towards more aggressive dominant behaviours (attacking/striking). Therefore, females will use more passive territorial behaviours, more fleeing behaviours, and fewer aggressive behaviours than males.

Method

Participants

The study participants were derived from undergraduate students from the University of Hull, recruited to participate in a study based within the Psychology department. Participants (n= 60) were (n=24) male (aged 18-44 M=21.46, SD=5.52) and (n=36) female

(aged 18-44 $M=20.64$, $SD=5.70$). The males self-reported ethnicities were 16.6% Black British, 75.06% White British, 4.17% Chinese, and 4.17% Mixed Race; and the females reported ethnicities were 67.73% White British, 13.86% Black British, 13.86% British Indian, and 4.55% Mixed Race. Participants were drawn on a volunteer basis and were rewarded with credits needed for their course, but were given no financial incentive to participate.

Materials

Gaming Questionnaire

In this experiment a Gaming Questionnaire (see Appendix F) was used so to ensure that if one gender significantly outperformed the other, gaming experience could be controlled for to ensure such differences were gender based, and not based on previous gaming experience. Such questionnaires have been used in previous studies to assess computer game usage (Gentile, Lynch, Linder, & Walsh, 2004). It was therefore used as a control measure, only if significant gender differences arose in overall performance, to ensure that gaming experience was not an extraneous variable leading to performance differences.

Procedure and Design

The procedure of Experiment 1 did not differ from that of the General Methodology, except that in this experiment, participants were asked to complete a gaming questionnaire to assess if their previous gaming experience would have any impact on their in game, or post-game experiences.

Participants were recruited on a volunteer basis from the University of Hull. The primary independent variable was gender, and so participation slots were separated based on gender, so that no confounding variables associated with being in the same room as different gendered individuals could account for differences in the results. Another naturally occurring

IV in this study was personality as measured by the BFI questionnaire. The dependent variables were number of hits displayed, number of smiles displayed, number of withdraws, and number of hits received, as well as avatar status at the end of the experiment (dead or alive), survival time, and overall game score.

Results

Personality as a Predictor of Territoriality

The participants completed the BFI personality test prior to the commencement of the study to investigate the differences in personality types between the two genders, and if these personality differences affected the two genders performance in any significant manner. The scores were attained by participants rating a series of questions on a Likert scale from 1-5. The answers that were given for each personality trait were then averaged so that direct comparisons could be made between different personality traits (some traits required more questions on the BFI, thus an average was needed). The mean personality scores of the two genders can be seen below in Table 1.0.

Table 1.0. Mean personality scores (SD) sorted on gender, on the Big Five Inventory.

* $p < 0.005$

Big Five Inventory	Gender	
	Male	Female
Extraversion	3.16 (0.85)	3.16 (0.81)
Agreeableness	3.68 (0.57)	3.87 (0.48)
Conscientiousness	3.27 (0.51)	3.49 (0.54)
Neuroticism	2.56 (0.69)*	3.11 (0.69)*
Openness to Experience	3.52 (0.65)	3.46 (0.65)

Because the male participants had a sample size of less than 30 ($n=24$), normality of the data set cannot be assumed under the assumptions of the Central Limit Theory. Therefore, first the data was tested for normality distributions of personality, before any assumptions can be made about their relevance.

All traits showed a significance level of higher than 0.05 on the Kolmogorov-Smirnov and the Shapiro-Wilk tests, and therefore it can be concluded that the data is normally distributed, so parametric tests could be utilised. There were no significant differences between the personality types of the two genders except for Neuroticism scores, in which females scored significantly higher Neuroticism scores than males $t(58) = -3.26$, $p = .002$. This is consistent with the literature review.

The first hypothesis regarding personality and territoriality specified that higher levels of Extraversion are a predictor for overall number of territorial interactions. A linear regression

was conducted to assess this, however there was little or no relationship between these two variables, $(F(1,58)=1.13, p=.29)$.

The second hypothesis relating to personality and territoriality was that individuals who scored higher on Extraversion would utilise more aggressive behaviours (hits) than those who scored lower on this trait. The linear regression concluded that there is no or little relationship between these two variables $(F(1,58)=1.06, p=.31)$.

Another linear regression was conducted to investigate the hypotheses that individuals with higher levels of Conscientiousness should utilise fewer overall territorial behaviours, utilise more smiles, and flee from more interactions than those who scored lower on this trait. Conscientiousness failed to account for number of territorial behaviours initiated $F(1,58)=.10, p=.75$, utilisation of smiles $F(1,58)=.04, p=.84$, and number of flees from other avatars $F(1,58)=1.31, p=.26$.

Finally, a linear regression was conducted to examine how Neuroticism will account for territorial behaviour differences. The hypotheses specified that higher Neuroticism scores should decrease impulse control, and therefore lead to increased aggressive interactions, and increase the likelihood of fleeing behaviours. Neuroticism failed to account for any differences in usage of in game hits towards other avatars $F(1,58)=.02, p=.88$, or in terms of number of fleeing behaviours (withdraws) utilised by the avatars $F(1,58)=1.31, p=.26$.

Gender as a Predictor of Territorial Behaviour

The main focus of the in game data was to examine if behavioural differences occurred based on gender, therefore the mean in game data is displayed below in Table 2.0., separated by gender.

Table 2.0. Mean scores (SD) of in game performance, separated by gender. * $p < 0.005$, ** $p < 0.01$.

Virtual Environment Scores/ Behaviours	Gender	
	Male	Female
Score (\$)	5.18 (11.28)	12.58 (12.07)
Smiles Delivered	14.92 (15.94)*	38.94 (41.94)*
Hits Delivered	13.75 (6.48)	11.75 (10.43)
Hits Received	13.75 (6.28)	11.75 (7.55)
Withdraws	12.79 (8.16)	13.19 (7.91)

Before investigating the territorial differences between males and females, it first needed to be examined if their actual success in the game (as measured by overall score) differed between the genders. The results from the gaming questionnaire demonstrated that males ($M=6.54$, $SD=3.41$) play MMORPG's more than females ($M=4.19$, $SD=2.24$) (corrected values reported due to a significant Levene's test) $t(36.15)=2.97$, $p=.005$, and that these individual game play session lasted longer for males ($M=8.83$, $SD=5.23$), than when females ($M=5.17$, $SD=3.97$) played computer games $t(58)=3.08$, $p=.003$. Even though males tended towards increased computer gameplay then females, males ($M=5.18$, $SD=11.28$) did not significantly differ in overall score to females ($M=12.58$, $SD=12.07$), $t(58)=9.52$, $p=.35$.

The first hypothesis was that females would utilise more smiles than males, and that inversely men would use more hits than females. An independent samples t-test displayed that females ($M=38.94$, $SD=41.94$) used significantly more smiles than males ($M=14.92$, $SD=15.94$), (corrected values reported due to a significant Levene's test) $t(48.36)=-3.12$, $p = .003$. Males, however, failed to show the inverse of this, in that males ($M=13.75$, $SD=6.48$) did not use significantly more hits than females ($M=11.75$, $SD=10.43$), (corrected values reported due to a significant Levene's test), $t(57.78)=-.92$, $p = .36$.

Finally, gender is examined to see if it mediated the number of withdraws from a contest participants would make. It was expected that females would significantly withdraw from a contest more than men; however there were no significant differences between the genders in terms of number of withdraws, $t(58) = -1.91$ $p=.85$.

From this it can be concluded that gender does in fact alter in game behaviour more so than personality traits, in that gender can influence types of behaviour performed, and how territorial an individual is.

Personality and Gender as a Predictor of Territorial Behaviour

As gender significantly predicted behaviours within a territorial environment, but personality did not in this case yield a significant predictor of territorial behaviour, finally the influence of personality on territorial behaviour was examined, however separated based on gender. This was done by separating the cases based on gender, and then running linear regressions similar to that of when examining gender alone on territorial behaviours. It was found that that personality traits as separated by gender could not predict score (males $F(5,18)=.49$, $p=.78$, females $F(5,30)=.81$, $p=.55$), smiles delivered (males $F(5,18)=.48$, $p=.79$, females $F(5,30)=.69$, $p=.64$), hits delivered (males $F(5,18)=.92$, $p=.49$, females $F(5,30)=.18$, $p=.97$), hits received

(males $F(5,18)=.44$, $p=.82$, females $F(5,30)=.38$, $p=.86$), or number of withdraws performed (males $F(5,18)=.52$, $p=.76$, females $F(5,30)=.42$, $p=.83$).

Discussion

The results gained from the study were mixed in its support of the hypotheses. The results demonstrated that no aspect of the FFM, as tested through the BFI questionnaire, showed any significant relationship between personality and usage of territorial behaviours. These results seem incongruous with results from animal studies that demonstrated a relationship between territoriality and personality factors such as dominance. There are a number of reasons why this may be the case, such as higher orthogonal personality traits, as determined by the FFM, may be too broad a measure to examine specific personality differences that may alter territorial behaviour. For future research then, it may be worthwhile looking at lower level factors contained within one of these orthogonal traits to investigate their link with territoriality. For example, Extraversion consists of a variety of traits such as dominance, assertiveness, and various other traits associated with territoriality. It may, therefore, be worthwhile investigating these lower level traits and how they alter specific game behaviours, as opposed to how the higher order traits as a whole may mediate various behaviours.

Furthermore, this study investigated how higher order traits, may affect later specific behaviours within a virtual territorial contest. It may be that, while personality differences did not affect game score, or number of behaviours utilised, it may alter what strategies participants applied when engaging within the contest. Future experiments may therefore use a qualitative aspect to the experiment after the completion of the territorial contest, in which participants describe what behaviours or strategies they adopted, and then use content analysis to assess if these strategies differ based on orthogonal personality trait differences as

determined by the FFM. Furthermore, this experiment only used a shortened version of the BFI, and so in further experiments, a more extensive personality questionnaire may be needed in order to ascertain more subtle personality differences, that may alter specific in game territorial behaviours.

While personality failed to yield significant differences into territorial behaviour, there were significant findings with regards to gender differences in territoriality. Females significantly tended towards non-aggressive territorial behaviours than males (significantly more smiles). This is consistent with the literature review whereby females tend towards less aggressive territorial responses (Vallortigara, 1992). It was predicted that males would show the inverse response to this, in that males would use significantly more aggressive behaviours than females, however this study did not find this to be a significant difference. One explanation for why there were no significant results for male behaviour is due to a shortage of male participants in the study, and that due to a lack of male participants ($n < 30$) the data was not powerful enough to lead to significant differences. Furthermore, males and females participated independently of each other, and much of the literature review details how territoriality is a behaviour commonly adopted in order to secure a mate. Due to the isolation of the gender, it may be that an approximation of real-world territorial conflict cannot be drawn from this experiment, and so behaviours may not represent that of real-world territorial conflict. Furthermore, due to the fact that the experiment is within a computer simulation, and there is no actual threat to the participants, or no survival based need to act territorially, their behaviour is unlikely to fully represent that of real world territorial interactions.

The results of this experiment therefore yield mixed results as to which individual differences can mediate behaviours within a territorial contest. The next experiment will, therefore, investigate different individual differences to assess their influence on territorial

behaviour, namely whether size differences and power asymmetries can influence territorial behaviour within a simulated environment.

Experiment 2

Introduction

In the first study, gender and personality differences were examined between participants. Such individual differences are randomly occurring, and therefore cannot be controlled by the researcher. The second experiment has therefore been used to artificially manipulate individual differences between participants. The second study was used to assess if size of the respective avatars and power asymmetries between interacting avatars, led to any significant differences in performance during territorial contests. Furthermore this makes the simulation more representative of real world territorial interactions, in that size and power disparities between contestants does occur in real world contests, and so is an important individual difference to study in human territoriality.

Game Theory was proposed as a model to explain why different animals apply different strategies to territorial conflicts (Maynard Smith, 1982; Alcock, 2001). This model suggests that animals will unconsciously make a cost-benefit analysis when entering a territorial confrontation, and assess attributes such as their own relative health to their competitor, size and power disparities between itself and the competitor, and the cost of protecting a resource, at the expense of injury, or having to relocate to a different territory. This second study, therefore, sets out to ascertain whether humans make these same cost-benefit analyses.

The avatars the players controlled were either small or large, which differed in their visual representation, furthermore the large avatars could inflict more damage to the opponent when engaged in a conflict, than the small avatars. Power differences between competitors is

commonly found within territorial conflicts, and is a known component of deciding the outcomes of territorial conflicts (Dawkins & Krebs, 1979; Maynard-Smith, 1982). The main aim of Experiment 2 is therefore to examine how power asymmetries affect in game territoriality, and if behaviours mirror that predicted by Game Theory.

Game Theory predicts that if all individuals within an environment have access to a desirable resource, or the costs of owning a resource outweigh the benefits, then territorial competition will not occur (Gill & Wolf, 1975). In the territorial scenario there will be a shortage of desirable resources, and the undesirable resources will be insufficient producers of resources, therefore it is expected territorial conflict will occur between the participants. Like in most territorial competitions, however, there will be size and power disparities between competing avatars, and so it is expected that different size avatars will utilise different strategies when engaging with the other avatars. The individual differences, therefore, that have been manipulated in this study is the size and power differences between the avatars, and how this will impact territorial behaviours utilised within a simulated environment. Furthermore this study will also investigate if gender, in conjunction with power asymmetries also affects territorial behaviour.

Experiment 2: Power asymmetries as a predictor of territorial behaviour

This study seeks to assess the size differences in avatar representation, as a reflection of Game Theory, and how these size differences, and power asymmetries of the avatars affects within simulation game play. It is predicted that larger avatars will utilise more aggressive behaviours than smaller avatars, and smaller player controlled avatars will use more non aggressive behaviours, such as smiles (especially towards larger avatars) and fleeing behaviours.

Experiment 2: Gender and power asymmetries as predictors of territorial behaviour

In many animal species, males tend to be the larger member, and so the experiment also investigated if avatar size and gender existed as co-variables as predictors of territorial behaviour. It may be that one gender's behaviour was significantly altered by power asymmetries, whereas the other may not, therefore avatar size was investigated as its own standalone variable, and in association with participants' genders. As females are usually the smaller of the genders, as specified by the literature review, the greatest change in behaviours is expected when females control larger avatars as compared to females that control smaller avatars. Therefore, females controlling larger avatars will show higher survival times, higher overall game scores, and increased survival status, compared to females controlling smaller avatars.

Method

Participants

The study participants (n=59) were undergraduate students from the University of Hull, recruited to participate in a study based within the Psychology Department. Participants were (n=29) male and (n=30) female with an age range of 18-40[SD= 3.99]. Participants were drawn on a volunteer basis and were rewarded with credits needed for their course, but were given no financial incentive to participate. The sample was divided into two independent groups, based on random allocation to a computer as they entered the testing room. The two samples differed in the size of the avatar they controlled while completing the experiment (small avatar n=30, large avatar n=29). The break down based on gender and size was female small (n=14), female large (n= 16), male small (n=16), male large (n=13).

Materials

The Simulated Environment

The method of the second study differed slightly to that specified in the General Methodology. In this study to ensure size and power asymmetries could be assessed, participants had control of different avatars. There were two types of avatar, participants were randomly assigned to either control a large avatar (strike power= 5), or a small avatar (Strike power= 3). These asymmetries in power of the avatar were visually represented on the screen based on the relative size differences of the avatars. The power differences, as well as the size differences of the avatar was used in order to examine if power asymmetries of avatars mirrored that seen in real-world animal territorial interactions.

Procedure and Design

This study differed to the General Methodology only in that participants were not asked to fill in a gaming questionnaire prior to the commencement of engaging with the virtual software. Participants were recruited on a volunteer basis from the University of Hull. An independent design was used so that participants would not detect the true aims of the study, or their in game performance improve due to practice effects. The main independent variable was the size of the avatar, and this was manipulated by the researcher by random allocation to one of two groups, either controlling a small or a large avatar. The dependent variable then was defined as a changes in behaviours both within game and post-game, based on avatar size. The main hypothesis was that larger avatar would utilise more aggressive behaviours, such as “striking” than smaller avatar, and smaller avatars would utilise more passive behaviours such as “smiling” or “fleeing”.

Results

Data for this experiment was taken from two data sources. Identical research methods were utilised, the first of which was collected by Kyle Ginn for his undergraduate thesis at the University of Hull (Ginn, 2015). The second data collection point was exclusively for this experiment. The raw data was used from the first data collection point, with no collaboration in terms of data analysis or study write up.

Avatar size as a predictor of Territoriality

The duration of the game was 20 minutes (1200 seconds). Participants were recorded on the duration of survival within the game (in seconds), their overall health at the end of the game, their game score (which can be seen as a representative of how effectively the participants navigated the territorial environment, measured in money earned (\$)), Avatar Status at the end of the experiment (Dead (1)/ Alive (2)), as well as the number of smiles and hits delivered (separated as delivered to small and large avatars, as well as a cumulative total). The mean scores (SD) are shown in Table 3.0.

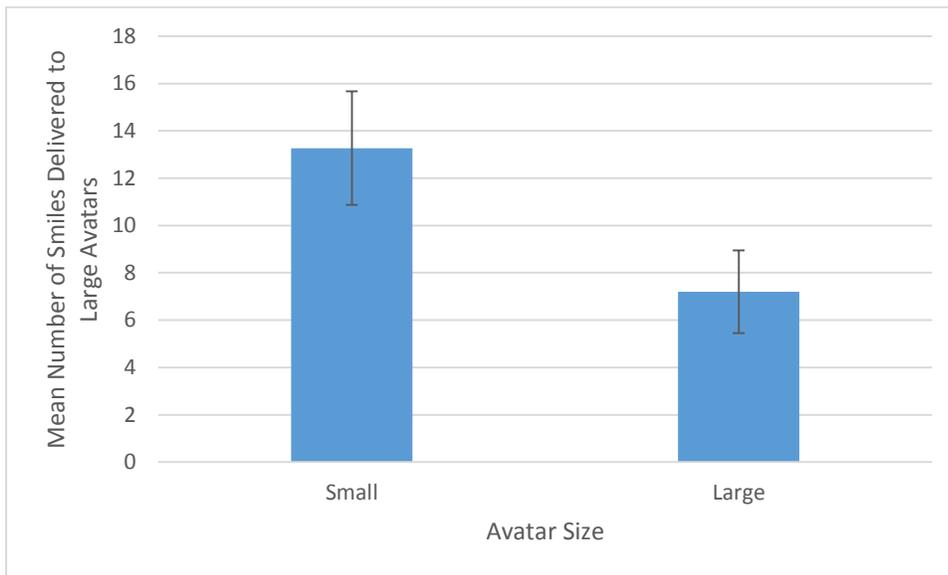
Table 3.0. Mean scores (SD) of in game performance, separated based on size of the avatar. *
 $p < 0.05$, ** $p = 0.05$.

Virtual Environment	Size	
	Small	Large
Scores (\$)	10.85 (12.83)*	18.97 (13.20)*
Survival Time (secs)	977.27 (324.92)	1081.14 (221.73)
Avatar Status (Dead(1)/Alive(2))	1.60 (0.45)	1.72 (0.46)
Hits to Small	4.93 (4.68)	6.72 (6.98)
Hits to Large	5.03 (5.04)	6.52 (8.02)
Smiles to Small	9.60 (7.67)	11.10 (16.27)
Smiles to Large	13.27 (13.13)**	7.21 (9.40)**
Total Hits	9.97 (7.35)	13.24 (11.09)
Total Smiles	22.87 (18.29)	18.31 (22.71)

An independent samples t-test was used to compare performance of the two conditions, for all variables, except for avatar status (which utilised a 2*2 chi square). Due to power asymmetries between avatar hit strength, it is expected that there would be differences in overall scores. This prediction is consistent with the original paper, as well as with Game Theory accounts of territorial disputes (Descioli & Wilson, 2011; Maynard-Smith, 1982). As shown in Table 3.0., this was the case, in that participants gained lower scores if they were controlling a small avatar ($M=10.85(\$)$, $SD=12.83$), than those who controlled larger avatars ($M=18.97(\$)$, $SD=13.20$). This difference ($M= -8.13$, $SD=3.39$, 95% CI= [-14.91 -1.34]) was statistically significant ($t(57)=-2.40$, $p=.02$).

The next hypothesis was that small avatars would use more non-aggressive behaviours towards larger avatars, than larger avatars. Figure 2.0. below shows how participants differed in the utilisation of non-aggressive territorial behaviours (smiles), in that small avatars smiled at large avatars ($M=13.27$, $SD=13.13$) more frequently than large avatars smiled at other large avatars ($M=7.21$, $SD=9.40$). This difference ($M= 6.06$, $SD=2.98$, 95% CI= [.09 12.03]) was statistically significant ($t(57)=2.03$, $p=.05$).

Figure 2.0. Mean use of smiles towards large avatars, as displayed by both small and large avatars (SE).



The other variables did not show any significant differences between the small avatars and large avatars including survival time (corrected value reported due to a significant Levene's test) ($t(51.33)=-1.44$, $p=.16$ (NS)), hits to small avatars (corrected value reported due to significant Levene's test) ($t(48.74)=-1.15$, $p=.26$ (NS)), hits to large avatars ($t(57)=-.85$, $p=.40$ (NS)), smiles to small avatars ($t(57)=-.46$, $p=.25$), overall usage of hits (corrected value reported due to significant Levene's test) ($t(57)=2.03$, $p=.19$ (NS)), and overall usage of smiles ($t(57)=.85$, $p=.40$ (NS)).

The Chi Square calculation to investigate the status of the avatar at the end of the experiment also failed to yield a significant difference between the two groups ($\chi^2(1) = 1.01$, $p = .23$ (NS)).

Next fleeing behaviours were examined as to whether small avatars are more prone to fleeing from conflicts than larger avatars. Table 4.0. shows the number of retreats from Small and Large avatars, separated based on size the size of the player's avatar.

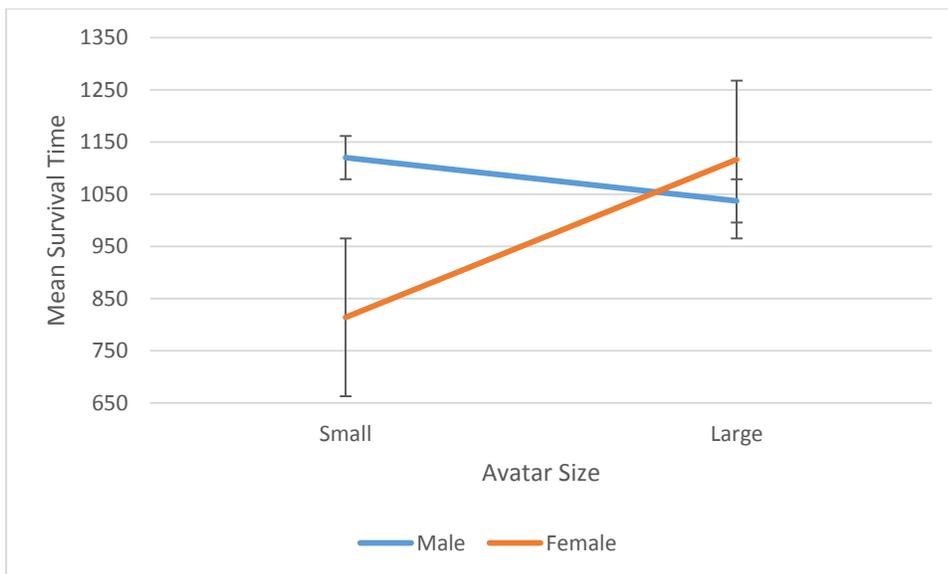
Table 4.0. Number of withdraws from contests based on avatar size. * $p < 0.005$. ** $p < 0.001$.

Opponent Size	Size	
	Small	Large
Opponent Small	75**	50
Opponent Large	124**	35
Total Withdrawals	199*	85*

A Chi Square was used to assess if own avatar size had an effect on withdrawing behaviour and this showed a significant result that Small Avatars would more frequently retreat from an interaction than large avatars ($\chi^2(1) = 10.80$, $p = .001$). It is expected that smaller avatars to flee significantly more from larger avatars than smaller avatars. A second Chi Square calculation was conducted, which also supports this hypothesis ($\chi^2(1) = 11.58$, $p = .0007$). Due to an incomplete data set, a chi square of fleeing data could only be ran on a portion of the sample size ($n = 19$). This was used as exploratory research, and in future experiments in this area will be examined in more detail, due to its promising data.

Finally 2*2 independent ANOVAs were conducted to examine the influence of avatar size and gender differences on territorial behaviour. The main finding was that gender and avatar size combined was a significant predictor of survival time (see Figure 3.0.). The main effect of gender was not a significant predictor $F(1,55)= 2.50, p=.10$. The main effect of avatar size was not significant as a predictor $F(1,55)=2.64, p=.11$. The interaction between the factors was significant however $F(1,55)=8.09, p=.006$. Bonferroni-corrected post-hoc tests ($p_{crit}=.025$) indicated that the interaction was driven by the fact that large female avatars survived significantly longer than small female avatars (equal variance not assumed) $t(18.03)=2.70, p=.015$. Males did not show an effect of avatar size on survival time $t(27)=1.02, p=.32$.

Figure 3.0. Interaction between gender and avatar size on survival time.



No other territorial behaviours were significantly predicted by gender and avatar size including avatar status $F(1,55)=2.37, p=.13$, overall score $F(1,55)=.02, p=.97$, hits delivered

$F(1,55)=1.16, p=.29$, or smiles delivered $F(1,55)=.87, p=.35$.

Discussion

The results show that one hypothesis was supported in that small avatars used significantly more smiles towards larger avatars than large avatars did towards other large avatars. This is consistent with a Game Theory approach to territoriality (Maynard-Smith & Price, 1973). This theory states that weaker individuals should behave more passive or pro-social towards individuals they perceive to be stronger, healthier, or more powerful than themselves. This finding is thus consistent with the existing literature, in that like animals, humans will adopt different strategies, based on the cues given to them about their opponent in a one-one contest. If their rival is stronger than themselves (increased health, or visible size/power disparities), then they will change their behaviours accordingly and adopt more passive behaviours, rather than initiating a physical contest that they cannot win.

Secondly, it was found that smaller avatars used a greater total number of withdrawals from interactions than did larger avatars, and that of those withdraws they were significantly more prone to withdrawing from contests from larger avatars than smaller avatars. This is an interesting finding, and supports the theories posed by Game Theory (Maynard Smith, 1982; weaker avatars will flee from stronger/ healthier avatars as opposed to engaging in an escalating contest). This is consistent with existing literature, in that like animals, humans make assessments of the relative fitness of their opponents, and modify their behaviours accordingly. If faced with an opponent that is stronger than oneself, the individual is more likely to flee the opponent, and concede the territory, rather than engage in a physical contest they are unlikely to win. The main issue with this conclusion, however, is that due to an incomplete data set, this analysis must be repeated in further studies, and due to a lack of power in the data cannot lead to any substantial conclusions.

These results suggest that participants changed their behaviour based on the size differences and power dissimilarities of the avatars in that smaller avatars acted more passively (through the utilisation of smiles) than larger avatars. The results from this study as a whole, do support Game theory. Based on Game theory it is expected that smaller avatars would use more non-aggressive territorial behaviours, in the case of this experiment utilising smiles, at stronger avatars (which was found), and using more evasive behaviours such as withdrawing from contests by fleeing, which was also found. The reason therefore the reverse was not found (e.g larger avatars changing behaviour to other large avatars) is that such behaviours would be based on other judgement behaviours (such as the value of the resource that is being contested, or the relative health differences between the two avatars) which the software used for this experiment could not detect. In order to make such conclusive judgements in terms of human usage of Game Theory, a different method or computer simulation would have to be accessed to assess such differences; however at the time these resource are not accessible.

While Game Theory suggests that winning or losing is an inevitable component to territorial contests, it remains unclear in human territoriality research, how success or failure in territorial competitions leads to subsequent behaviours in territorial contests, or in terms of mood regulation following a territorial encounter.

Experiment 3

Introduction

When engaging with a hostile scenario, such as that associated with territorial contest, individual's behaviours have been found to be modified after such engagement, which can therefore influence their behaviours in future territorial situations (Fawcett & Johnstone, 2010). Such long term behavioural changes are a result of winner or loser effects. Winner effects are defined as where past winning of competitions predicts likelihood of winning future

competitions (Kura, Broom, & Kandler, 2011). Whereas loser effects are the inverse of this, whereby a series of losses leads an individual to be less successful in future conflicts. These loser and winner effects therefore extend beyond the duration of the initial territorial conflict, and can elicit mood and behavioural differences. Furthermore, individual differences, such as hormone levels, can also influence receptiveness to winner and loser effects (Earley, Lu, Lee, Wong, & Hsu, 2013). They found that lower levels of male sex hormones increases the receptiveness to information from territorial contests, and therefore winner loser effects. Therefore, it may be that an individual's gender can increase or decrease the likelihood of winner and loser effects.

Winner and loser effects can therefore be seen as a form of learning, whereby previous experiences mediate behaviours in future incidents. Animal research has found that individual differences, such as age, personality, or number of exposures to contests, can influence how susceptible an individual is to winner and loser effects (Fawcett & Johnstone, 2010). Older individuals are more aware of their relative strength, and are likely to have engaged in a multitude of territorial encounters, and so winner or loser effects may only minimally alter their behavioural patterns. However, younger individuals are still learning their relative power, and so winning or losing competitions may significantly influence their future behaviours when engaging in contests (Lan & Hsu, 2011). Studies found that lower ranking crabs were found to have better memory for danger stimuli, such as predators, than more dominant crabs, however these differences only arose after the establishment of dominance hierarchies, suggesting differences in dominance levels can mediate subsequent behavioural changes (Kaczer, Pedetta, & Maldonado, 2007). This means that the effects of winning or losing territorial competitions, has been found to mediate animal behaviour in subsequent territorial situations.

Humans have also been shown to display winner and loser effects, and such effects can alter behaviour for a prolonged period of time (Rieger et al., 2014). Winner effects continue to mediate human behaviour, for example sportsmen who have recently won a sporting event, are more likely to win a subsequent game than those who have just lost a previous contest (Page & Coates, in press). This has also been replicated in other sporting events such as football, and such study found that as well as mediating behaviours, it can also influence mood, and lead to contest induced mood changes (Oliveira, Gouveia, & Oliveira, 2009).

One mechanism whereby winner effects and influence of mood can be linked is increased levels of serotonin, a neurotransmitter. Serotonin (5-HT) reduction has been found to induce negative moods and increase anxiety (van der Veen, Evers, Deutz, & Schmitt, 2007). Success in competitions, and reward mechanisms have been linked to increased serotonin levels, thus suggesting that winner effects can lead to mood elevation, as well as behavioural differences (Seymour, Daw, Roiser, Dayan, & Dolan, 2012). A decrease in serotonin however, can occur from losing a competition (loser effects), which can decrease mood, and increase negative mood and anxiety (Cooper, Grober, Nicholas, & Huhman, 2009).

These alterations in mood can translate into an individual's writing style, in that negative moods can increase the prevalence of negative associated words in their writing, such as words like injury, illness, or sad. (Tausczik & Pennebaker, 2016). Therefore, if participants engage in a writing or storytelling activity after exposure to competition, such as that found in territorial conflict, their writing style afterwards may be used as an indicator of their mood state, which is influenced by their success or failure within the territorial contest.

Therefore, in this experiment, data was collected and analysed from the two previous experiments (see General Methodology pp 25) where after the conclusion of the experiment, participants completed a short storytelling activity, which could then be used to assess their

mood states, based on their success or failure within the territorial simulation. Variables such as Score, Survival Time, and Avatar Status were all indicators of success or failure within the territorial contest. Separate analysis was conducted on this where winner and loser effects alone, as well as in conjunction with gender were taken from experiment 1. Analysis for winner and loser effects in association with power asymmetries of avatars was taken from Experiment 2. Finally an exploratory analysis was conducted which examined the two combined datasets.

The literature review specifies that winning and losing effects occur after engaging in a territorial contest, therefore individuals who have higher game success (higher overall score, higher survival time, and increases survival status) will utilise more positive emotional state words, and fewer negative emotional words, than those who score lower in these three measures of game success.

Furthermore, the literature suggests that gender differences will lead to differences in winner and loser effects, whereby it is expected that females will show stronger winner and loser effects than males. Therefore females with higher performance will use more positive emotional words, and fewer negative words, than those who score lower in performance.

The literature review suggests that individuals with the smaller avatars will see themselves as inferior and weaker than those who controlled the larger avatars, and therefore will alter their behaviours based on this self- assessment, and the assessment of other competitors. Therefore individuals who controlled small avatars will use more negative emotion, angry, anxiety, and sadness based words, than those controlling larger avatars.

Method

Participants

Participants were drawn from the two previous experiments (See pages 30 and 41). This story writing activity took place immediately after the conclusion of the territorial condition, and so no further ethical considerations, or testing slots were needed.

Materials

O-H Cards.

After the participants had finished the experiment within the virtual environment, they were given a task in which they were presented with three storytelling cards (see Figure 4.0.). These cards were selected from the standardised OH cards which are used as a story-telling prompts (OH Cards, 2013). All participants were asked to write a story that connected the three images, and to give as much detail and information regarding the events of the story, and were given five minutes to write such story. The instructions given to the participants were standardised, and appeared on screen, and utilised methods of Thematic Apperception Testing to guide the participants in what content to include within their stories connecting these ambiguous images (see Appendix G; Murray, 1943; Teglasi, 2010).

These stories were then examined for emotional word usage after the study had been conducted. Their stories were analysed using the LIWC2007 program for various types of words such as negative, angry, anxious, and sad words (Pennebaker, Booth & Francis, 2007; Pennebaker & King, 1999). The LIWC software houses a database of words, and categorizes these words for a number of details, such as word length, meaning of word, and psychological meaning of the word, as well as recording the number of instances such words are used. An

example of the storytelling cards used can be found in Figure 4.0 as well as the instructions presented in association with these cards (see appendix H).



Figure 4.0. Three OH story telling cards

Procedure and Design

In each experimental condition, participants first completed the territorial simulation (for methodology see General Method, or method section for Experiment 1 page 32, or Experiment 2 page 42). Following the conclusion of the territorial experiment, they were presented with a PowerPoint presentation slide, which displayed the three OH-cards (see Figure 4.0.) The presentation also had a series of instructions, which required them to write a short story that connect the three OH-cards. The participants were not informed as to the aim of this exercise until after the experiment concluded, when they were given their debrief sheets. Participants wrote their stories in the notes section of the PowerPoint slides. After participants had concluded writing these stories, they were then proofread by the experimenter in order to remove spelling mistakes, in order that the LIWIC software could correctly analyse the content of their stories. After participants had saved their stories, they were fully debriefed, given time to ask any questions, or withdraw their data if they so wished. They were then free to leave the testing area.

The independent variables for this experiment were gender, avatar size, and performance within the territorial scenario (Score, Survival Time, and Avatar Status). The

dependent variable was emotional word usage in a short story-telling exercise, with emotional word usage categorised by the LIWIC software.

Results

Territoriality as Predictor of Emotional Response

Data for territoriality as a predictor of emotional response was taken from Experiment 1. This was due to the fact that avatar size would not act as a confounding variable, and so the data would be more representative of territorial differences leading to alterations of emotional word usage, as opposed to power asymmetries leading to emotional word usage differences.

There were a number of territorial behaviours that could act as predictor values, such as overall game score, avatar status, and survival time. The mean emotional word usage scores are shown in Table 5.0.

Table 5.0. Mean emotional word usage (SD)

Emotive Word Usage	Mean (SD)
Affective	3.63 (1.90)
Positive Emotion	1.20 (1.27)
Negative Emotion	2.40 (1.46)
Anxiety	0.85 (0.90)
Anger	0.62 (0.91)
Sadness	0.53 (0.79)
Death	0.26 (0.64)
Positive feeling	0.20 (0.78)
Physical State	1.29 (1.53)
Body State	0.85 (1.21)

A multiple linear regression was used to investigate if performance affected post game emotional word usage. The variables investigated were overall game score, avatar status at end of game, and avatar survival time, and these variables were mapped onto usage of affective, positive emotion, negative emotion, anxiety, anger, sadness, death, religion, positive feeling, physical state, and body state based words, and found no variable significantly predicted word usage.

The lack of results relating to Multiple Linear Regression is likely due to a relatively small sample size, in that for an accurate representation of a multiple regression, a sample size (n=30) is needed for each IV inputted into the model. The dependent variables were therefore clumped into three main categories: positive words (positive emotion, positive feeling),

negative words (negative emotion, anxiety, anger, sadness), and neutral/ physical words (affective words, death words, physical state, and body state). The mean for each participant was taken in these categories, so that direct comparisons can be made between the three categories, as some categories incorporated more individual emotive word variables. The mean word usage is shown below (See Table 6.0.).

Table 6.0. Mean word usages of the emotive word categories (SD)

Emotive Word Categories	Mean (SD)
Positive	1.31 (1.52)
Negative	4.01 (2.53)
Neutral /Body	5.41 (2.95)

The multiple regression analysis was re-run using the new emotional word categories, however in game territorial behaviours continued to be insignificant predictors of emotional words usage in terms of positive category words $F(8,51)=.809$, $p=.598$, negative category words $F(8,51)=.601$, $p=.773$, or neutral category words $F(8,51)=.373$, $p=.930$.

Gender and performance as a measure of emotional word response

Secondly, gender was examined in conjunction with winner/ loser effects, and emotional word usage. Therefore each gender was analysed separately, using game score, avatar status, and survival time as predictors of performance. The mean emotional word usage, separated by gender is displayed below (see Table 7.0.).

Table 7.0. Mean (S.D) emotional word usage, separated by gender.

Emotional Word Categories	Mean (SD)	
	Male	Female
Positive Emotion	1.47 (1.52)	1.04 (1.07)
Negative Emotion	1.85 (1.22)	2.77 (1.50)
Anxiety	0.70 (0.86)	0.96 (0.92)
Positive Category	1.63 (1.94)	1.09 (1.14)
Negative Category	3.11 (2.27)	4.62 (2.55)
Neutral Category	5.35 (3.49)	5.46 (2.58)

A linear regression was used for both males and females to examine if game score, survival time, or avatar status could significantly predict emotional word usage.

The hypotheses from the literature review suggested that females would be more susceptible to winner and loser conditions, however game score, avatar status, or survival time, failed to predict emotional word usage in females for positive emotion $F(3,32) = .644$, $p=.59$, negative emotion $F(3,32) = .14$, $p=.94$, anxiety $F(3,32) = .43$, $p=.74$, positive category $F(3,32) = .47$, $p=.70$, negative category $F(3,32) = .76$, $p=.97$, or neutral category based words ($F(3,32) = .47$, $p=.70$). This was also the case for males in terms of success or failure within the simulation failing to predict positive emotion $F(3,20) = 1.74$, $p=.19$, negative emotion $F(3,20) = 1.60$, $p=.22$, anxiety $F(3,20) = 2.0$, $p=.15$, positive category $F(3,20) = 1.0$, $p=.42$, negative category $F(3,20) = 1.87$, $p=.17$, or neutral category based words ($F(3,20) = .18$, $p=.91$).

Avatar size as a predictor of Emotional Word Usage

Avatar size was also examined both as a stand-alone variable as a predictor of emotional word usage, and in conjunction with winner and loser effects. Table 8.0. below shows the mean emotional word usage, separated by avatar size.

Table 8.0. Mean (SD) usage of negative, anxious, angry, and sad words used in a short story, separated on avatar size.

LIWC	Size	
	Small (SD)	Large (SD)
Negative Emotions	2.74 (2.40)	1.82 (1.60)
Anxiety	0.77 (0.81)	0.65 (0.80)
Anger	1.38 (2.07)	1.00 (2.0)
Sadness	2.08 (2.39)	0.65 (0.80)

First an independent samples t-test was used to compare the differences in LIWC scores between the two avatar sizes, to see if avatar size alone lead to differences in emotional word usage. There was no significant difference in usage of negative emotional (corrected values reported due to significant Levene's test) ($t(50.65)=1.74$, $p=.089$ (NS)), anxiety ($t(57)=.053$, $p=.60$ (NS)), anger ($t(57)=.23$, $p=.48$ (NS)), or sadness ($t(57)=.87$, $p=.82$ ==39(NS)) based words between the two groups.

Then a linear regression was used, separated based on avatar size, to examine if individuals controlling small or larger avatars were more susceptible to winner or loser effects. Based on the literature review, it is expected that larger avatars who performed better (in terms of score, status, or survival time) would use significantly more positive emotional words, than

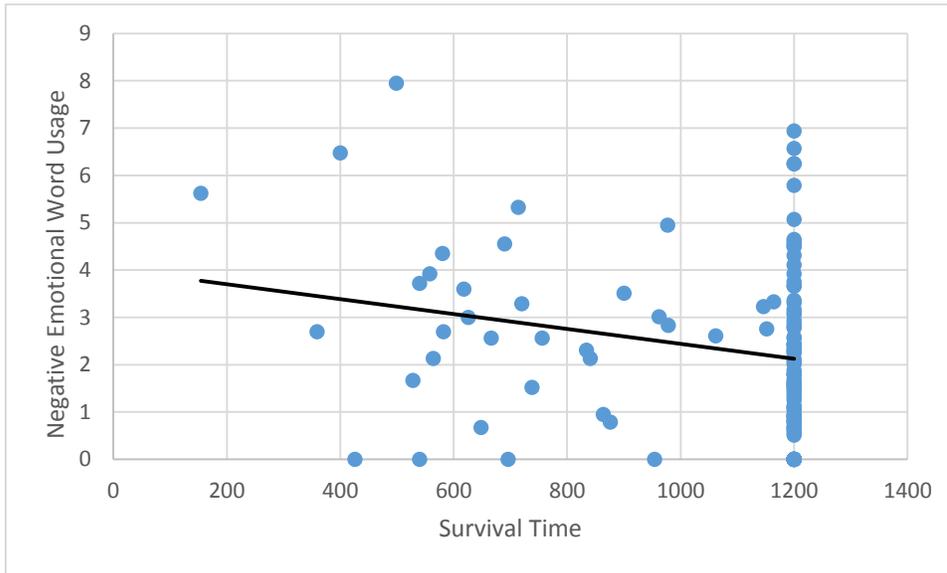
those who had performed less well. The inverse of this is also predicted, that smaller avatars who had performed poorer (lower score, lower survival time, and decreases survival status) would use more negative words, than those who had performed better.

Small avatar status in conjunction with territorial performance, failed to predict emotional word usage for Negative Emotion $F(3,26)= 2.54$, $p=.078$, Anxiety $F(3,26)=.51$, $p=.68$, Anger $F(3,26)= .12$, $p=.95$, and Sadness $F(3,26)= 1.21$, $p=.33$ based emotional words. Similarly for large avatar size, and performance there was no significance in prediction for Negative Emotion $F(3,25)= 1.18$, $p=.34$, Anxiety $F(3,25)= 1.13$, $p=.36$, Anger $F(3,26)= .83$, $p=.49$, or Sadness $F(3,25)= 2.52$, $p=.081$ based emotional words.

One possible reason for the lack of significant results may be due to the limited sample numbers in each study, in that to conduct a multiple linear model, each variable should ideally have at least ($n=30$) participants. Therefore an exploratory analysis was conducted, whereby the two data sets were combined, and then a multiple analysis run across the two groups to assess word usage after exposure to the territorial simulation.

Survival time was a significant predictor of use of negative emotion based word usage, in that as survival time increased, usage of negative words decreased $t(2,116)=-2.48$, $p=0.015$.

Figure 5.0. Survival time as a predictor of Negative Emotional word usage.



This is consistent with the original hypothesis that increased survival time (a measure of in game success), would decrease negative word usage. Survival time was also a significant predictor of sadness based word usage, in that as survival time increased, sadness word usage decreased $t(2,116)=-2.11, p=0.037$. In both graphs (see figure 5.0. & 6.0.) there is a significant number of data points at the 1200 mark, which signifies participants who completed the experiment, whereas the other data points represent individuals whose avatars perished prior to the completion of the experiment.

due to time restraints however, and in future studies it may be more reliable to examine more direct measures of emotion, or emotional changes, such as administering a mood questionnaire before and after the experiment. Furthermore, this study failed to examine if experiences in a territorial contest, leads to changes in subsequent territorial contests, and so in future experiments participants could later take part in a second territorial contest at a later date, and their performance compared to in game differences and outcomes in the first territorial conflict, to assess if their performance in the first study mediates their behaviours in the second territorial condition.

A second issue with this study was that many participants failed to include many emotional words at all. It may be then that the time allocation to compose the story was too short, and that if participants were given longer to compose the stories, there may be a greater wealth of data to analyse for emotive words. Due to time restrictions, participants were limited to five minutes to write the story, however many participants' stories were short in general, and specifically in terms of emotive words, therefore a different activity, or longer time for this activity is suggested in future research investigating mood after effects. This study did still yield an insight into winner and loser effects, and how experiences in a territorial contest, can alter emotional word usage after the territorial contest concluded.

General Discussion

Summary of Findings

The research conducted has focused on taking research on animal territoriality (which is extensive in its depths and variety) and applying it to studying human territoriality (where research remains limited). The literature review focused on how territoriality can be expressed in terms of subtle non-verbal interactions, such as baring teeth to show submission, or in a range of escalating behaviours that ultimately lead to fighting or even death of the competitors

(Georgiev, Klimczuk, Traficonte, & Maestriperi, 2013; Preuschoft, 2010). The research has investigated how individual differences, such as gender and personality, can modify these behaviours. It has also investigated how manipulation of power asymmetries can affect in game behavioural differences, and how success or failure within territorial conflict leads to emotional word usage differences in a post-experiment storytelling activity.

Consistent with the statement of purpose and the literature review, the first experiment investigated how an individual's gender and personality can mediate territoriality. The results showed that gender is the primary characteristic that mediates territoriality, and in what form these behaviours are displayed. Females tended to use more non-aggressive forms of territoriality (smiles), than males. These results correspond to the theories suggested by the literature review which speculated that these differences were due to differences in roles traditionally performed by the genders, in that females tended to group together for childrearing, and so it was advantageous to work together, and utilise more indirect aggression and less direct aggressive behaviours (Vaillancourt, 2013). It was a surprising finding, however, that the inverse of this was not found, in that males failed to display more aggressive territorial behaviours, than their female counterparts. This may be a result of a lack of size or power asymmetries in the first experiment, which are consistent with most gender differences in animal territoriality. In species where there are larger size disparities between the sexes, there tends to be increased dissimilarity in territorial behaviours, with the larger individual tending to be more territorial. When these size disparities are removed, aggressive territorial behaviour tends to become more similar, or even increased female aggression (Odreitz & Sefc, 2015).

In the second experiment more powerful avatars (represented by size and power asymmetries) performed significantly better in territorial conflicts, both in terms of securing resources, and defending against enemy intruders, as predicted by the literature review.

Participants that controlled weaker avatars used significantly more non-threatening territorial gestures (smiling) towards larger avatars, than individuals who controlled large avatars did towards avatars of the same size. This lends support towards the Game Theory approach to territorial conflict, in that individuals compete for valuable territories, and the more powerful individuals tend to claim favourable territories, and the weaker individuals have no reasonable likelihood of out competing a superior competitor, and so resort to non-aggressive forms of behaviour such as smiling or fleeing, rather than engaging in a competition they are unlikely to win (Lindström & Pampoulie, 2005). The experiment also found that weaker avatars tended towards smiling behaviours (towards all avatars), and an increased likelihood of retreating, than that displayed by larger avatars. This therefore supports the idea that territorial behaviours are based on Game Theory in that individuals make assessments of the asymmetries in power between the two competitors, and shape their behaviour and success, based on these size disparities (Cooke, Compton, Herre, & West, 1997). Furthermore, females controlling a small avatar survived significantly less than female participants controlling a large avatar, although this did not show an effect in male participants.

The final experiment focused on examining winner and loser effects, in the context of emotional word usage in a short storytelling activity. Consistent with the literature, the study predicted that those who were more successful in the territorial conflict would use more positive emotional words, whereas those who were less successful would use more negative emotional words. The main finding of the final experiment was that survival time (which is a primary indicator of success within a territorial context) was a significant predictor of sadness based word, and negative emotion based words. This is consistent with the aims from the statement of purpose, and consistent with the animal research from the literature review, that success in a competition, such as a territorial contest, has a lasting after effects on the individual based on their outcome from a territorial contest, in human cases leading to a

decrease in negative mood. The main issue with this, however, is that when the emotional words were re-categorised purely into positive, negative, and neutral body words, these differences in success, and emotional words usage disappeared. Furthermore, no differences were found in terms of gender, winner effects, and emotional word usage. The literature review predicted that females are more receptive to winner or loser experiences, and therefore it was predicted that females should show greater emotional word changes, as a result of success or failure within the territorial contests. The current research thus does yield evidence for experience within a territorial contest to having influence on post conflict mood ratings, however it fails to address how long these mood differences are maintained for and if this influences behaviour in futures contests. This was demonstrated in the final experience whereby survival time was a significant predictor of negative emotional word usage in the storytelling exercise. It is difficult however, to draw conclusive findings from this as no mood scoring was taken prior to the territorial contest, and so this would be implemented in future research. Furthermore it is interesting to find that while failure within a territorial contest did decrease mood rating, the inverse of this was not found. It may be that success in a territorial contest does not influence an individual's mood to such an extent as failing in one. Further research may be needed to examine this relationship, however it would appear consistent with animal research that greater learning and behaviour modification would occur from ones failures, rather than one's successes (Hsu, Earley, & Wolf, 2006).

Limitations and Further Directions

There were several limitations within this study, which may draw focus for potential future research. One shortcoming in this study is that the personality questionnaire utilised was only the short BFI questionnaire, and so it may be that a more extensive personality questionnaire is needed to identify subtle personality differences that manipulate territorial behaviours.

Furthermore, it may be that lower level traits within orthogonal personality traits, such as

focusing on assertiveness from the Extraversion trait, may be more useful as predictors of territorial behaviour, as opposed to focusing solely on higher order traits.

Another limitation to the study is that gender differences in territoriality focused on males exclusively competing against males and females competing against females. Future research may focus on multi-gender territoriality, especially if avatar customisation can be utilised so it is clear the gender of the opposing avatar. Also research suggests that males compete more aggressively in competition for mates, so a pre-experimental condition could include displaying attractive images to participants prior to experimentation, and observing if such individuals act more aggressively than those shown a neutral stimulus. Another limitation to this study is that, while it is a positive that the experiment can be conducted without risk to the participants, it may be that due to the safety of the experiment, the participants do not initiate a strong heightening of the Autonomic Nervous System (ANS) that would occur in real world territorial conflict (Jansen, Nguyen, Karpitskiy, Mettenleiter, & Loewy, 1995). This means that the results gained may not accurately represent flight or fight behavioural responses. Future experiments could potentially artificially stimulate the Sympathetic Nervous System (SNS: The portion of the ANS responsible for flight or fight), by displaying emotionally arousing stimuli before the experiment, or by having participants partake in exercise before the experiment to stimulate this neural pathway in a safe and observable manner.

Finally, mood after effects were examined when the experiment was completed; however, the quantity of emotional words used in the short stories was very limited and so in future experiments either a longer time should be allowed to write the story, or other methods should be used to examine the mood of participants, both before and after the experiment. This study does show, however, that humans do apply Game Theory methods towards territorial

conflicts, similarly to that of animals, and so it can be reasonably concluded that animal territoriality models can potentially map onto human territoriality simulations.

One further explanation as to why emotional word usage may change after the experiment is due to the Proteus Effect (Yee & Bailenson, 2007), in which the behaviour towards avatars may have been manipulated purely by differences in the size differences of the avatars, and not just based on the power differences between such avatars. While Game Theory does account for this difference between avatars, in that assessments of the other individuals strength are made based on these size disparities, it may be interesting in future research to examine if differences in behaviour occur, even when power differences between avatars are removed. This may mean that even, when different sized avatars are equally powerful, behaviours of participants may change purely due to differences in avatar representation, and not due to power asymmetries between the contestants.

Although further research may be needed to fully examine how individual differences, such as gender, personality, and power asymmetries, can influence human territoriality, the findings indicate that gender is especially prevalent in mediating human territoriality, and that human behaviour can be shaped both within a territorial confrontation based on these individual differences, but the effects of both individual differences, and experience to a territorial contest, can shape both human behaviour and emotion, subsequent to such experiences.

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Appendices

Appendix A: Ethics Form



If the project is classed “Exceptional” then the member of staff (or lead researcher) should place a signed copy in my pigeonhole AND email a copy to j.tipples@hull.ac.uk otherwise, all “normal” projects should be signed and submitted to the office (Gwyn Paffley)

Department of Psychology

Ethics Checklist for Research Projects Involving Human Participants

NAME OF STUDENT/ASSISTANT (Supervised projects only) Lee Parkin

NAME OF RESEARCH SUPERVISOR. Mary-Ellen Large, & Paul Skarratt.

TITLE OF PROJECT: The Relationship between Individual Differences and Human Territoriality, within a Simulated Environment.. . . .

NOTE This checklist should be completed by all individuals or research groups prior to beginning any research projects in which human participants will be employed. The checklist is intended to provide a general guide as to the ethical status of the project and whether or not a full application should be made to the Psychology Department Ethics Committee. It should be used in conjunction with the ethical guidelines published by the British Psychological Society. http://www.bps.org.uk/system/files/documents/code_of_ethics_and_conduct.pdf

Please complete all sections by ringing the appropriate answer.

1. RISKS

Do any aspects of the study pose a possible risk to participants' physical well-being (e.g. use of substances such as alcohol or extreme situations such as sleep deprivation)?	YES	NO
Are there any aspects of the study that participants might find humiliating, embarrassing, ego-threatening, in conflict with their values, or be otherwise emotionally upsetting?*	YES	NO
Are there any aspects of the study that might threaten participants' privacy (e.g. questions of a very personal nature; observation of individuals in situations which are not obviously 'public')?*	YES	NO
Does the study require access to confidential sources of information (e.g. medical records)?	YES	NO
Might conducting the study expose the researcher to any risks (e.g. collecting data in potentially dangerous environments)?	YES	NO
Could the intended participants for the study be expected to be more than usually emotionally vulnerable (e.g. medical patients, bereaved individuals)?	YES	NO
Will the study take place in a setting other than the University campus or residential buildings?	YES	NO
Will the intended participants of the study be individuals who are not members of the University community?	YES	NO

*Note: if the intended participants are of a different social, racial, cultural, age or sex group to the researcher(s) and there is any doubt about the possible impact of the planned procedures, then opinion should be sought from members of the relevant group.

2. DECEPTION

Does the study involve the use of (non-trivial) deception, either in the form of withholding essential information about the study or intentionally misinforming participants about aspects of the study?	YES	NO
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3. DEBRIEFING

Do the planned procedures include an opportunity for participants to ask questions and/or obtain general feedback about the study after they have concluded their part in it?*	YES	NO	N/A
If deception has been used, does the procedure include specific time for debriefing?	YES	NO	N/A

*Note: 'NA' would be appropriate for some purely observational studies.

4. INFORMED PARTICIPATION/CONSENT

Will participants in the study be given written information outlining: a) the general purpose of the study b) what participants will be expected to do c) individuals' right to refuse or withdraw participation with impunity?*	YES	NO	N/A
If the study involves physically unpleasant or emotionally upsetting procedures (e.g. viewing scenes of violence; working in loud noise), will participants be explicitly informed of this in writing?	YES	NO	N/A
Will all participants in the study be able to understand the information given and its implications for them?	YES	NO	N/A
Will participants have an opportunity to ask questions prior to agreeing to participate?*	YES	NO	N/A
Have appropriate authorities given their permission for participants to be recruited from or data collected on their			

premises (e.g. shop managers, head teachers, classroom lecturers)? (this is essential for all research that will take place outside university premises)	YES	NO	N/A
--	-----	----	-----

*Note: NA would be appropriate for some purely observational studies.

5. ANONYMITY AND CONFIDENTIALITY

Is participation in the study anonymous? (i.e. names are not recorded at any point in the procedure)	YES	NO	
If anonymity has been promised, do the general procedures ensure that individuals cannot be identified indirectly (e.g. via other information that is taken)?	YES	NO	N/A
Have participants been promised confidentiality?*	YES	NO	N/A
If confidentiality has been promised, do the procedures ensure that the information collected is truly confidential (e.g. questionnaire responses cannot be overseen by other participants; questionnaires are returned to the researcher in sealed envelopes)?	YES	NO	N/A
Will non-anonymous data be stored in a secure place which is inaccessible to people other than the researcher?	YES	NO	N/A
If participants' identities are being recorded, will the data be coded (to disguise identity) before computer data entry?	YES	NO	N/A

* Note: 'NA' would be appropriate for some purely observational studies.

6. DETERMINATION OF CLASSIFICATION

If any of the boxes below in section 6. require ticks, then the project should be classified as ‘Exceptional’. In this case either the problematic aspect(s) of the study must be altered, or, if this cannot be done without damage to the study, then the project will be given close scrutiny by the ethics committee

If you have answered ‘YES’ to any of the questions in Section 1 (risks), please tick the box on the right.*	
If you have answered ‘YES’ to the question in Section 2 (deception), please tick the box on the right.	
If you have answered ‘NO’ to any of the questions in Section 3 (debriefing), please tick the box on the right.	
If you have answered ‘NO’ to any of the questions in Section 4 (consent), please tick the box on the right.	
If you have answered ‘NO’ to any of the questions in Section 5 (confidentiality), please tick the box on the right.	
You are member of staff at the Department of Psychology, University of Hull and this a new line of research	

7. PROJECT CLASSIFICATION

Student projects: I have discussed the checklist with the student(s) and am satisfied that this project should be classified:

OR

Staff projects: I have completed the checklist and am satisfied that this project should be classified:

Normal

1. Project is approved and may proceed without further review
2. Please tick “Normal” on the front page top right

Exceptional

1. Complete details on next page,
2. Attach consent and debrief forms
3. Tick “EXCEPTIONAL”, on the front page, top right and see note below (in yellow)

Exceptional but simply change to pre-approved study

1. Complete details on next page,
2. Attach consent and debrief forms
3. Tick “EXCEPTIONAL”, on the front page, top right and see note below (in yellow)

Exceptional but only because the study is taking place outside the University or with non-University participants.

1. Complete details on next page,
2. Attach evidence of permission to conduct the research from relevant authorities (e.g. head teacher)
3. Attach consent and debrief forms
4. Tick “EXCEPTIONAL”, on the front page, top right and see note below (in yellow)

Researcher/Supervisor's Signature ME Large Date 07/10/2015

Students Signature* L. Parkin Date 06/10/15

If the project is classed “Exceptional” then the member of staff (or lead researcher) should place a signed copy in my pigeonhole AND email a copy to j.tipples@hull.ac.uk otherwise, all “normal” projects should be signed and submitted to the office (Gwyn Paffley)

*Supervised projects only

Appendix B: Risk Assessment

Name: Lee Parkin Supervisor: Mary-Ellen Large

Title of Project:

The relationship between Individual Differences and Human Territoriality, within a Simulated Environment

1. Where will the data be collected?

In the Department **Yes**

On the Campus _____

Outside _____ Please state location

2. Will any of the data collection take place outside of normal working hours?

Yes _____ **NO** Sometimes _____

If yes conditions and precautions to be taken

3. Who will be the subjects (e.g. Students, Patients)? **Students of the University of Hull**

4. Will Psychometric test material be used?

Yes No _____

5. Does any procedure being used involve drugs, chemicals, blood or abrasions of the skin?

Yes _____ **No**

If yes a COSHH assessment is required.

6. Please state test procedures to be used: Big Five Inventory personality test

7. Will this project involve the carrying or movement of equipment?

Yes _____ No

If yes please state what kind of equipment

8. Please state if there are any harmful effects in the test procedure or the administration of test materials for the subject or experimenter and what precautions will need to be taken

No harmful effects of the experiment or the materials used are expected to cause harm or distress to the participants.

9. State training or instruction received for all methods or procedures in this project

Instructions on how to operate the computer software have been supplied by my dissertation supervisor, no further training or instructions are needed.

Student signature _____ L. Parkin _____ Date

Supervisor signature _____ Date _____

A PROJECT SHOULD NOT COMMENCE UNTIL A RISK ASSESSMENT HAS BEEN CARRIED OUT

Appendix C: Information Sheet

Information sheet

The relationship between Individual Differences and Human Territoriality, within a Simulated Environment

Department of Psychology

University of Hull, UK

Researcher's names: Lee Parkin, Dr Mary-Ellen Large, & Paul Skarratt

Purpose of Study

You are invited to voluntarily participate in a study examining if there is a relationship between territorial behaviour, simulated in a computer game, and a number of individual differences, such as gender and personality. The study aims to improve our understanding of how variations in individual differences, affect human territorial behaviour that individuals display. This could lead to further research into the field of human territorial behaviour and result in the formulation of studies interested in how alternative individual differences also interact with territorial behaviour.

Procedures

It will take approximately 1 hour to participate in this study. You will be seated in front of a computer in a room with 9-11 other game players. You will first complete a personality questionnaire and a computer game usage questionnaire. Following this you will be presented with a virtual environment on the computer screen. After you have read the game instructions you will be given the opportunity to practice moving the avatar in the virtual environment, entering and exiting shrubs and picking berries. When the game commences your task is to pick as many berries, located in shrubs, as you can. During the game you may have to interact with other players who have either entered your shrub or are resident in a shrub you have just entered. You will have to make a decision whether to smile, defend your shrub by striking the other avatar or to leave the shrub and find another one. Striking avatars reduces health points, but also if you are struck by another avatar this will result in a greater reduction of your health points. The person with the greatest health points, and who collects the most berries wins the

game. You will then be presented with three images and asked to write a short 5 minute story based on the three story-telling cards presented to you.

How much of your time will participation involve?

The experiment should take approximately 1 hour to complete. However, we would like to remind you that participation in this study is voluntary and therefore you are free to choose whether or not to complete the study. You may stop the procedure and withdraw your results at any time, without penalty, and without having to give a reason.

Will your participation in the project remain confidential?

Any information concerning you and your participation in this study will be kept private and confidential. If information about you is published it will be in a coded form such that you cannot be recognized. Data for the study will be used in scientific reports, but no names or identifying information will be included in these reports. Therefore, if you choose to participate in this study your information will remain anonymous.

Payment

There is no payment for participation in this study.

Potential Risks and Benefits

The main risk associated with the questionnaires is possible discomfort when answering some of the personal questions. No other risks are known to the investigator at this time. You may benefit from this study by learning more about territorial behaviour in humans, and how individual differences may interact with this behaviour. At the end of the study you will be debriefed and we will answer all your questions.

What happens now?

If you are interested in taking part in the study, you are asked to complete and sign the consent form. You will then be given more specific instructions. Do not sign if you do not wish to take part. Please feel free to ask any questions that you may have, and once again we remind you that you may withdraw from the study at any time without penalty.

Contact for Further Information

The researcher will be happy to answer any questions that you might have about taking part in this study. If complaints or problems concerning this research project should arise, or you require any more information please contact me:

Lee Parkin - l.parkin@2015.hull.ac.uk

Or alternatively:

Dr Mary-Ellen Large – m.large@hull.ac.uk

Thank you for your effort in completing the study today.

Appendix D: Informed Consent Form

The relationship between Individual Differences and Human Territoriality, within a Simulated Environment Department of Psychology

University of Hull, UK

Investigators: Lee Parkin, Dr Mary-Ellen Large, & Paul Skarratt.

The participant should complete the whole of this sheet himself/herself. Please cross out as necessary

- * Have you read and understood the participant information sheet YES/NO
- * Have you had the opportunity to ask questions and discuss the study YES/NO
- * Have all the questions been answered satisfactorily YES/NO
- * Have you received enough information about the study YES/NO
- * Do you understand that you are free to withdraw from the study at any time without having to give a reason YES/NO
- * Do you agree to take part in the study YES/NO

This study has been explained to me to my satisfaction, and I agree to take part. I understand that I am free to withdraw at any time without penalty, and without having to give a reason:

Signature of the Participant.

Date.

Name (in block capitals)

I have explained the study to the above participant and he/she has agreed to take part.

Signature of researcher

Date.

Thank you for your effort in completing the study today.

Appendix E: Big Five Inventory Questionnaire**How I am in general (BFI)**

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please write a number next to each statement to indicate the extent to which **you agree or disagree with that statement.**

1	2	3	4	5
Disagree	Disagree	Neither agree	Agree	Agree
Strongly	a little	nor disagree	a little	strongly

I am someone who...

1. _____ Is talkative
2. _____ Tends to find fault with others
3. _____ Does a thorough job
4. _____ Is depressed, blue
5. _____ Is original, comes up with new ideas
6. _____ Is reserved
7. _____ Is helpful and unselfish with others
8. _____ Can be somewhat careless
9. _____ Is relaxed, handles stress well.
10. _____ Is curious about many different things
11. _____ Is full of energy
12. _____ Starts quarrels with others
13. _____ Is a reliable worker
14. _____ Can be tense
15. _____ Is ingenious, a deep thinker
16. _____ Generates a lot of enthusiasm
17. _____ Has a forgiving nature
18. _____ Tends to be disorganized
19. _____ Worries a lot

20. _____ Has an active imagination
21. _____ Tends to be quiet
22. _____ Is generally trusting
23. _____ Tends to be lazy
24. _____ Is emotionally stable, not easily upset
25. _____ Is inventive
26. _____ Has an assertive personality
27. _____ Can be cold and aloof
28. _____ Perseveres until the task is finished
29. _____ Can be moody
30. _____ Values artistic, aesthetic experiences
31. _____ Is sometimes shy, inhibited
32. _____ Is considerate and kind to almost everyone
33. _____ Does things efficiently
34. _____ Remains calm in tense situations
35. _____ Prefers work that is routine
36. _____ Is outgoing, sociable
37. _____ Is sometimes rude to others
38. _____ Makes plans and follows through with them
39. _____ Gets nervous easily
40. _____ Likes to reflect, play with ideas
41. _____ Has few artistic interests
42. _____ Likes to cooperate with others
43. _____ Is easily distracted
44. _____ Is sophisticated in art, music, or literature

Appendix F: Gaming Questionnaire**Gaming Questionnaire**

The study you are about to participate in involves playing a game in which you interact with other participants in a simulated environment. Due to this, it is important to know about your computer gaming habits, in particular those relating to MORPG's (Multiplayer Online Role Playing Games). Examples of such games include: Runescape, EVE, World of Warcraft, Age of Conan etc. Please list your three most common played MORPG's and circle the answer which relates closest to the time frame you play such games. If you do not play, or have never played an MORPG, then please circle the "Never" and "0 hours options" to show you have filled out the questionnaire.

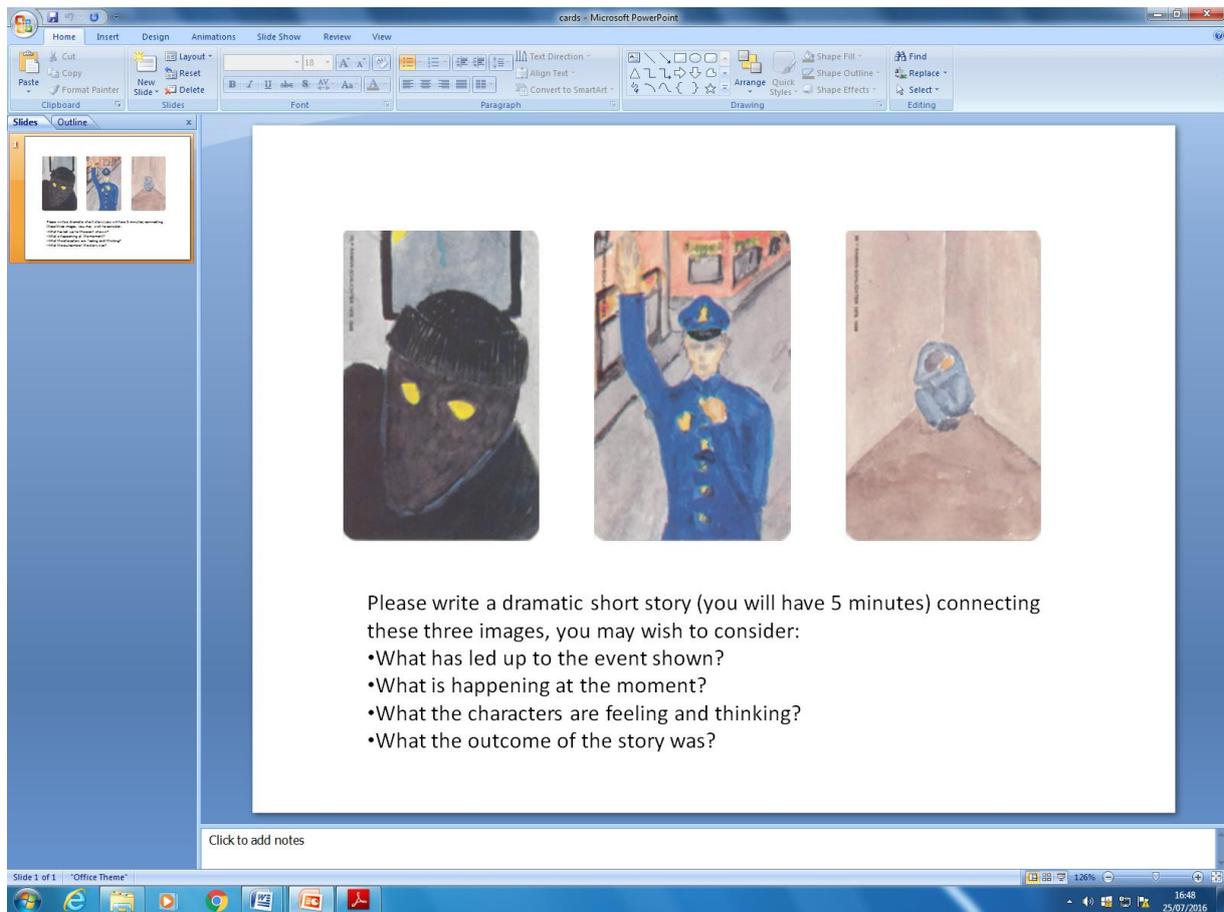
Please select the answer below that most applies to your usage of MORPG's (Multiplayer Online Role Playing Games).

Game Name	Never	Rarely	Monthly	Weekly	Daily
1.	1	2	3	4	5
2.	1	2	3	4	5
3.	1	2	3	4	5

Please now select the answer that most applies to the duration spent playing each game at each sitting.

Game Name	0 hours	1-30 mins	31 min- 1 hour	1-2 hours	2-5 hours	5-8 hours	8 hours+
1.	1	2	3	4	5	6	7
2.	1	2	3	4	5	6	7
3.	1	2	3	4	5	6	7

Appendix G: OH-Cards



cards - Microsoft PowerPoint

Home Insert Design Animations Slide Show Review View

Clipboard Paste Cut Copy Paste Format Painter New Slide Delete Slides Layout Reset Slides Font Paragraph Drawing Shape Fill Shape Outline Shape Effects Find Replace Select Editing

Slides Outline



Please write a dramatic short story (you will have 5 minutes) connecting these three images, you may wish to consider:

- What has led up to the event shown?
- What is happening at the moment?
- What the characters are feeling and thinking?
- What the outcome of the story was?

Click to add notes

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Appendix H: Debrief**Debriefing information**

The Relationship between Individual Differences and Human Territoriality, within a Simulated Environment

This research is being conducted by Lee Parkin in the Department of Psychology, University of Hull, UK.

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Background and Research Question:

Territoriality refers to any behaviour displayed by an animal that has the explicit purpose of winning, maintaining or defending a territory. It encompasses a variety of behaviours, including aggression towards rivals, and territorial adornment to attract a mate. Common introspection suggests that humans too display territoriality in a variety of settings, whether in public space, semi-private space (e.g., work), or private space (home). As do other animals, humans mark the boundaries of their territories, using fences and walls around their homes, or position personal items on desks at work. Furthermore, humans also defend their territories in anticipation of territorial infringement, placing locks on doors, and can act aggressively when territory is perceived to be infringed. A recent study by DeScioli and Wilson's (2011) investigated territoriality in humans. They designed a virtual environment in which several participants could explore and forage in the form of computer avatars. Participants were tasked with accumulating resources to maximise the health of their avatars, and these were obtained by discovering shrubs that varied in terms of their profitability. A good territory, therefore, was a shrub that contained a high number of berries that were frequently replenished, thus yielding a health return. More common, however, were slower-replenishing shrubs that gave small health returns due to fewer berries. As participants' health scores continually depleted over time, with their final health score translated into cash earnings, each faced a decision to either fight or flee upon discovering a territory that was occupied by another player. This scenario therefore provided a coarse analogue to the type of scenarios

faced by nonhuman territorial animals. Results showed that participants' behavioural patterns conformed remarkably well to those of other territorial species, with fight-or-flight decisions sensitive to resource distribution, estimates of opponents' fitness, and the observation that territory-holders win a higher proportion of disputes than do their challengers. The aim of the proposed study is to examine whether individual differences, such as age, computer game usage, or personality differences affect human territorial behaviour.

Method and Design:

Participants:

80 adults, recruited from the University of Hull will participate in this study. Participants will play DeScioli and Wilson's (2011) virtual reality game in groups of ten per session. The participants will also carry out a questionnaire, testing factors such as personality (Extraversion, Neuroticism, Agreeableness, Conscientiousness and Openness to Experience), age, or previous gaming experience. Data from the game will be analysed using standard regression with the factors being number of disputes, percentage of wins in territorial disputes, and number of strikes by resident/intruder. This data will then be used alongside the data collected via questionnaire to establish any relationships or correlations that may be present.

Expected Results:

The Literature Review suggests that female participants should use more passive territorial behaviour than men, however there will be no difference in overall territoriality. Individuals with higher Neuroticism scores will tend to flee more contests than those who score lower on the trait. Those who score higher on Extraversion, and lower on Agreeableness will tend to use more aggressive behaviours (Hits), and fewer passive behaviours (smiles).

If we find no differences between the groups then this suggests that individual differences do not interact with territorial behaviour. The results of the study will help us devise new experiments that look into human territorial behaviour and its relationship with other psychological factors.

Thank you for participating in this experiment.

Appendix I: Post- Game Questionnaire

Questionnaire

<p>1) What is your sex?</p> <input type="text"/>	<p>2) What is your age?</p> <input type="text" value="18"/>	<p>6) Please describe in as much detail as possible how you made your decisions in the electronic environment. Did you use a strategy of some kind?</p> <input type="text"/>
<p>3) What is your race/ethnicity?</p> <input type="text"/>		<p>7) How do you think the other people in your group made their decisions?</p> <input type="text"/>
<p>4) Were the instructions and the electronic environment easy to understand? If not, what was unclear and what could have helped you better understand?</p> <input type="text"/>		<p>In the space below, please provide any comments you might have about your experience in this study.</p> <input type="text"/>
<p>5) Is there something that you would like to be able to do in the electronic environment that you couldn't do in the current design?</p> <input type="text"/>		
<p>Type "Prefer not to answer" if you do not want to answer a question.</p>		<input type="button" value="Finished"/>