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Pleasure Differences as a Result of Seeing an Action versus Own Acting

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***Abstract*—Actively playing a computer game will generate more pleasure than a corresponding passive experience, such as watching a movie or reading a book. This is what common knowledge tells us. It is however not fully consistent with our research on the human reward system, and we undertook the study described in this paper to have a closer look at the differences. In this study, test participants watched videos of actors playing games as well as actively played the games themselves. The study examined how the pleasure difference of the participant's own acting versus passively watching the actions of an actor changes with the participant's level of empathy, the sympathy toward the actor, and the level of emotion displayed by the actors. Among other results, the findings indicate that a higher pleasure resulting from own actions diminishes with a higher empathy rating, with equal pleasure at about the maximum rating of 80.**

I. Introduction

Time and again, many people wait in anticipation of movie blockbusters and throng to the cinemas to catch their heroes in action. In watching these movie characters performing actions, it has recently been suggested that our internal system of mirror neurons will mirror these actions onto ourselves, triggering in our neural system similar responses that would be triggered if we were to perform those actions ourselves [1, 2]. Thus, by seeing those movie heroes achieving all those amazing feats and experiences, the question of whether the movie goers would feel a similar level of pleasure if they were the ones to accomplish those feats and experiences themselves arises.

The pleasure differences in seeing an action versus own acting is a very interesting aspect of not only the movie industry, but also the gaming industry and the entertainment industry in general, and gives us a better psychological understanding of how the human mind works. This enhanced understanding of how our human mind works when it comes to pleasure would allow the level of gaming and entertainment to be greatly improved, thus enabling us to have a more rewarding experience. As our internal reward system is very closely linked to our learning system as well, the pleasure and reward differences, if any, will also give an indication of how different our learning can be in watching others as compared to us performing actions ourselves, which may have a profound significance for teaching/learning methodologies.

Neuroscientists have found that about 20% of the millions of neurons in our human mind have the ability to mirror the actions of others onto ourselves [3]. These neurons, aptly named "mirror neurons", allow us to replicate and learn skills simply by observing the actions of others [4]. Researchers have gone as far as to claim that perhaps more can be gained from observing rather than from doing [5].

In terms of pleasure generation in entertainment experiences, this leads us to hypothesize that there actually is no difference in the pleasure generated by own acting versus seeing a person acting if we can identify with the acting person. Indeed, given the lower effort/energy to be invested for a passive experience, a passive experience might even be preferred. There are, however, also other factors, such as additional secondary social rewards like bragging, which we can potentially not realize if we were not acting ourselves.

The goal of this paper is thus to study the factors that are relevant for a difference in pleasure for active acting versus passively watching someone else. Potential factors are the general level of empathy, the sympathy toward the acting person, the intensity of his/her emotional display, and the correspondence of motivation for the rewards/actions.

Mirror neurons are said to be closely linked to empathy [6]. Empathy, also termed as the ability to relate to others, is a measure of how well one is able to share and understand another's emotions and feelings. Thus, a person with higher empathy should have a lesser pleasure difference for self-action as compared to when watching others. As for the level of emotional display, a gene has been found (called CREB1) that influences the brain's reward level when observing another person's facial expression [7]. This suggests that depending on the person's expression while carrying out a task, we feel different levels of pleasure when watching the person. Mirror neurons have also been found to be able to help us discern the motivation for an action [8]. For example, when we perceive a person grasping a cup, our brain can identify if the person is about to take a sip out of the cup, or to remove the cup, and so on based on the context in which the action takes place. Similar to the concept of empathy, if we have the same motivations as the target of our observation, thus being more able to relate to the person, it is hypothesized that a higher level of pleasure should be felt. In this study, however, we will for now not look into motivation

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factors as this cannot easily be integrated with the test setting used.

II. Methods

Subjects: 36 volunteers within the age range of 20 to 25 years participated in the experiment, of which 20 were male and 16 female. Of these subjects, 11 were Malaysians, three were Indonesians, and the remaining 22 were Singaporeans, with all subjects being Chinese by race except for one Malay subject.

Task: Subjects were seated in front of a computer screen. The basic procedure of the experiment is that a subject will first watch an actor playing a short quiz game, before attempting the quiz game himself/herself. Each quiz game has three questions with multiple-choice answers. A score of two out of those three questions constitutes a win. Before watching the videos, subjects were informed that the outcome of the actor's game does not affect subject's score and that each game is unique, such that subjects do not need to get preoccupied with trying to memorize answers. The entire experiment was recorded via two different cameras, one to record the face of the subject, and the other to record all screen activities of the subject.

The video part of the experiment consists of four video sets, each with one or two videos, which the subject is required to watch. The video sets are as follows:

- Video set (a): T1 ("with emotion")
- Video set (b): T2 ("emotionless")
- Video set (c): P1, T3 ("nice")
- Video set (d): P2, T4 ("direct")

Each of videos T1, T2, T3, and T4 shows an actor playing a short quiz game. All videos had the actors winning with the same margin. Both videos T1 and T2 are acted by the same actor, actor 1, and are used to test the differences in pleasure felt when watching an observational target displaying different levels of display of emotion, with the actor showing obvious emotions such as smiling when getting a correct answer in Video T1, whereas in Video T2, the actor only stares straight ahead without any emotions shown.

Videos P1 and P2 are videos of two separate actors, actor 2 and actor 3 respectively, where the actors are each asked several questions such that subjects watching the videos can have an idea of the personality type of the individual actors. Actor 2 of Video P1 gives the impression of being a nice person, and gives politically correct answers to the various questions. On the other hand, actor 3 of Video P2 portrays a less approachable individual who gives very direct answers that may not be "music to the ears". These videos are screened just before the actors' respective quiz game video, videos T3 and T4, to see if the personality type of an actor can affect how much pleasure a subject feels when watching the actor play the game.

Experimental flow: The flow of the experiment is randomized to reduce the effect of learning, with the criteria that all video sets (a), (b), (c), and (d) must be watched exactly once.

Step 1) Video set (a), (b), (c), or (d)
Step 2) Video set (a), (b), (c), or (d)
Step 3) Game 1
Step 4) Video set (a), (b), (c), or (d)
Step 5) Video set (a), (b), (c), or (d)
Step 6) Game 2

After each step, the subject is asked to answer a questionnaire with answers on a scale of 1 to 7. For videos P1 and P2, three questions were asked:

- Q1: Compared to the person's (actor's) answers, how similar would your answers have been?
- Q2: Do you like/dislike the person in the video?
- Q3: How similar are you to the person in the video?

For videos T1, T2, T3, and T4, the question asked was:

- Q4: How rewarding was it to watch the person win/lose?

The measure of conscious pleasure is contrasted with the subconscious pleasure measured by electromyography (EMG). The EMG sensor was fit to measure movements of the zygomaticus major muscle, also known as the "smile muscle" often associated with happiness [9, 10]. These EMG readings, coupled with cross-verification from videos of each subject's face (to exclude unrelated movements, such as sneezing or rubbing of the face), give a measure of subconscious pleasure felt by the subject. To shield from any interference of smiling as a form social communication, subjects underwent the experiments individually and were left alone in the experiment room while carrying out each step of the experiment.

EMG readings for the duration of each video or game (duration varies from twenty seconds to one minute and nineteen seconds) were recorded and the average reading for each duration taken. This EMG value is taken as a value of pleasure, e.g., an EMG reading of 23.58 micro-volts is taken as a pleasure value 23.58 units of pleasure.

For the measurement of empathy, an online empathy test was used to calculate an empathy score within the range of 0 to 80 [11]. A score of 0 to 32 is considered as low (people with Asperger Syndrome or high-functioning Down Syndrome score about 20), whereas the range of 33 to 52 is considered as an average score (average for women is about 47, and about 42 for men), 53 to 63 is considered as above average, and the remaining scores of 64 to 80 are in the very high empathy range. This empathy test can be taken either before or after the actual experiment.

III. Results and Analysis

A. Watching versus Doing

To identify the overall relationship between the level of

pleasure felt when watching others as compared to when performing an own action, the averages of pleasure for watching Videos T1, T2, T3, and T4 were calculated and plotted against the averages of pleasure for playing games G1 and G2. The results of Fig. 1 show a linear relationship, with the pleasure for self action generally higher than the pleasure for when watching others.

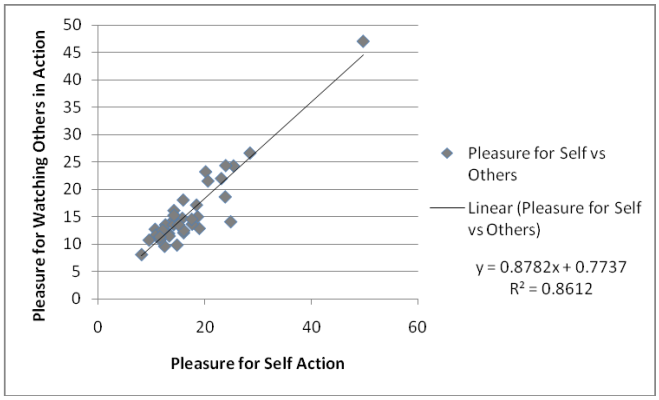

Fig. 1. Subconscious Pleasure for Self versus Others. In this graph, the average of pleasure obtained for self-played games G1 and G2 are plotted against the average of pleasure gained when watching the actors play in videos T1, T2, T3, and T4. With a trend line of gradient 0.8782, the results show a higher tendency towards a higher pleasure when playing as compared to when watching others play.

To obtain a further breakdown of how the pleasure differences differs across the pool of test subjects, a histogram was plotted (see Fig. 2). A large majority of about 80% of the subjects had pleasure differences within the range of 0 to 4.

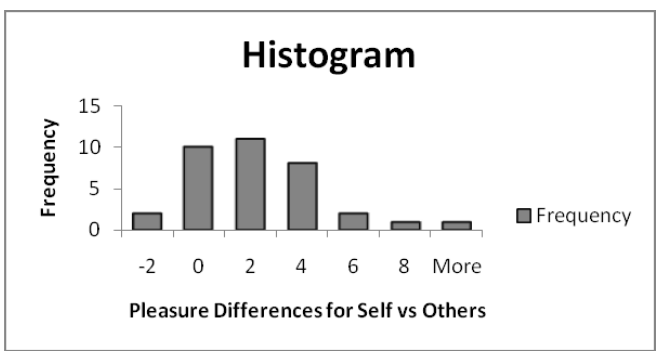

Fig. 2. Histogram for Subconscious Pleasure Differences between Self and Others. Values of the difference between the average of pleasure obtained for self-played games G1, G2 and the average of pleasure gained when watching the actors play in videos T1, T2, T3, and T4 are put into the histogram, with the results showing that about 80% of the subjects feel between 0-4 more pleasure when playing the games themselves as compared to when watching the actors play.

In line with the "common knowledge" that own acting provides more pleasure, the conscious level of pleasure for own acting is reported as much higher, relative to the passive experience, than the subconcious pleasure (compare trend lines of Fig. 1 and 3).

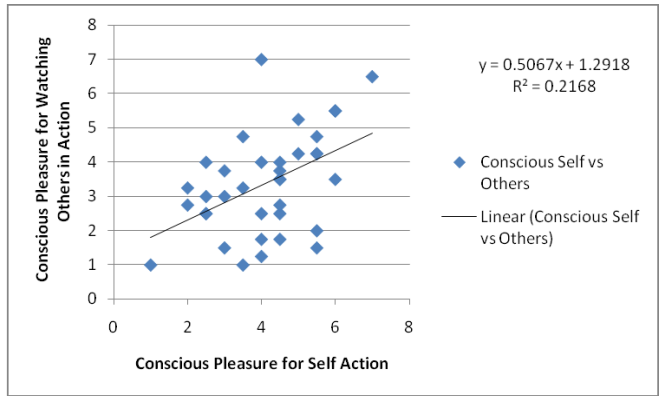

Fig. 3. Plot of Conscious Pleasure reported for Self Acting versus Others.

B. *Impact of Empathy*

The distribution of empathy levels across test subjects gives a normalised curve (see Fig. 4), suggesting that the pool of test subjects is a suitable population sample for tests relating to empathy.

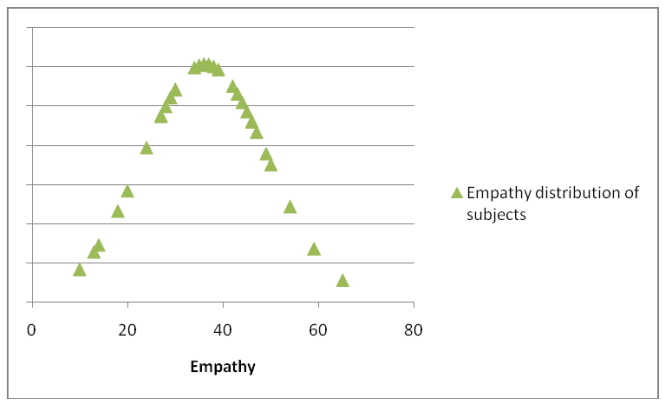

Fig. 4. Distribution of empathy levels of test subjects, with the average empathy at 36.22.

For the factor of empathy, the (subconscious) pleasure differences between the averages as used for Fig. 1 were calculated by subtracting the pleasure for watching from the pleasure for own acting. These values were then plotted against the respective subjects' empathy level. The hypothesis for the relationship between the pleasure differences for self versus others and empathy is that the higher a person's empathy, the lower the pleasure difference should be. The plotted points do not conform well to linearity, and attempts at trying to fit the points into other forms of curves including a logarithmic curve and polynomials of up to the power of six do not give any satisfactory trend line. The results in Fig. 5 show that the difference in pleasure for self action versus watching others does indeed decrease as empathy increases, dwindling towards zero difference between pleasure for self versus others as the empathy level reaches the maximum of 80.

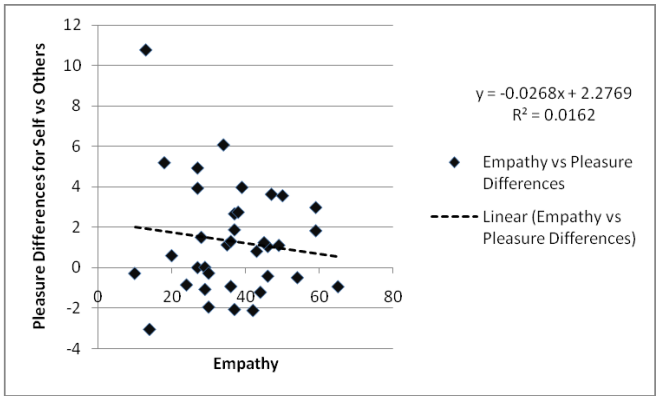

Fig. 5. Graph of Empathy versus the Difference between Subconscious Pleasure for Self versus Others. In this graph, the difference between the average of pleasure obtained for self-played games G1, G2 and the average of pleasure gained when watching the actors play in videos T1, T2, T3, and T4 are plotted against the empathy level for each test subject. The trend line slopes slightly downwards towards a value of zero pleasure differences for self versus others as empathy increases.

C. *Actor Sympathy and Pleasure Transfer*

By plotting graphs of pleasure when watching Video P1 versus pleasure when watching Video T3, and the same for Videos P2 and T4, Fig. 6 shows that the amount of pleasure felt when watching a person play a game is linearly related to the amount of pleasure felt in sympathy for the person (defining sympathy by the pleasure to watch the actor). An example of this would be game shows such as American Idol. Viewers tend to feel more for some finalists than others, and by Fig. 6, they will feel a higher sense of pleasure when a finalist of their choice wins. Given our test setup, it is however difficult to distinguish whether the test participants reacted stronger to the pleasure of actors that they like or simply prefer watching a video with a sympathetic actor.

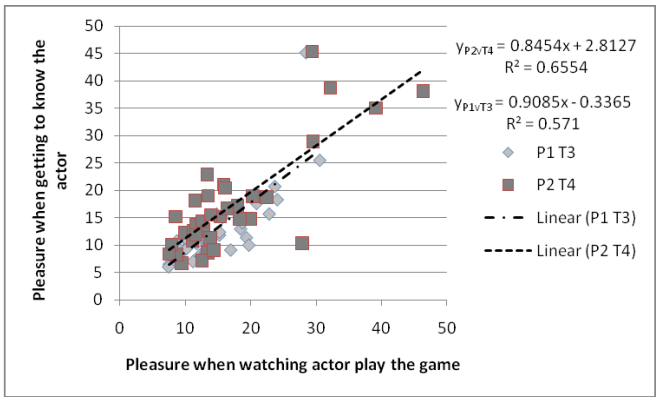

Fig. 6. Plots of Subconscious Pleasure for P1 versus T3, and P2 versus T4. Two separate plots of pleasure when watching Video P1 versus pleasure when watching Video T3 is superimposed with a similar plot for Video P2 versus Video T4. Both plots have very similar trends.

Fig. 7 shows the distribution of pleasure differences between watching Videos T3 and T4. The distribution gives a mean of -2.6, indicating that most subjects felt about 2.6 units of pleasure more when watching Video T4 than when watching Video T3.

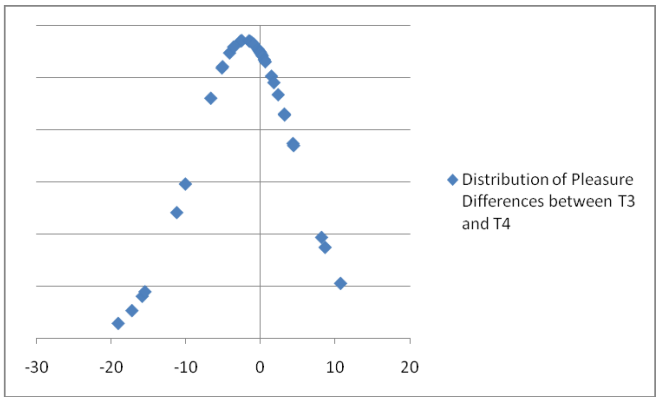

Fig. 7. Distribution of Subconscious Pleasure Differences between T3 and T4. Values of the difference between the pleasure obtained when watching Video T3 and the pleasure when watching Video T4 are plotted on a normalized scale. The distribution shows that the average difference in pleasure between watching Video T3 and T4 is about -2.6, meaning that subjects on average gain more pleasure from watching Video T4 than Video T3. The probability of a person feeling more pleasure when watching Video T4 than when watching Video T3 is about 0.6.

An interesting finding from comparing the conscious reward as reported by test subjects with their subconscious pleasures as measured by the EMG is that consciously, a large number of test subjects believe that they experience more reward when getting introduced to the polite and politically correct actor 2 of Video P1 (see Fig. 8) and that they are more similar to this actor (see Fig. 9). However, as shown in Fig. 7, the subconscious pleasure measurements show that a majority of the test subjects actually felt more pleasure in watching actor 3 of Video P2.

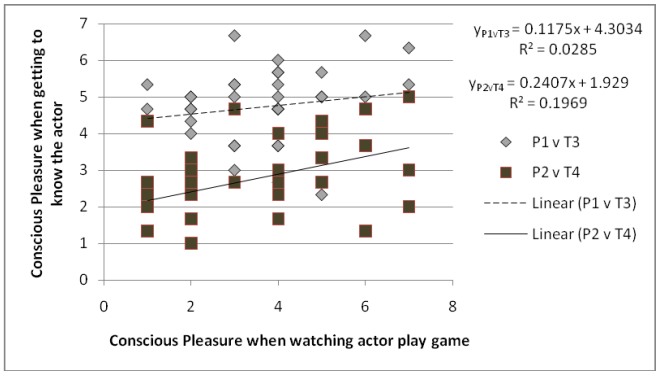

Fig. 8. Plots of Conscious Pleasure for P1 versus T3, and P2 versus T4. In contrast to Fig. 7 for subconscious pleasure, subjects reported themselves to have experienced more pleasure with Actor 2 rather than Actor 3.

Asked for an interpretation, a number of the test subjects replied that while they may not be all that similar to Actor 3, they feel pleasantly amused that there are people who dare to speak what others normally would not. (Note that such replies cannot be taken particularly seriously as sense-making processes in search for a conscious interpretation may be at work.)

Another finding from the questionnaires is that subjects with a higher empathy rating also gave more extreme

similarity scores with respect to the different actors (see Fig. 9).

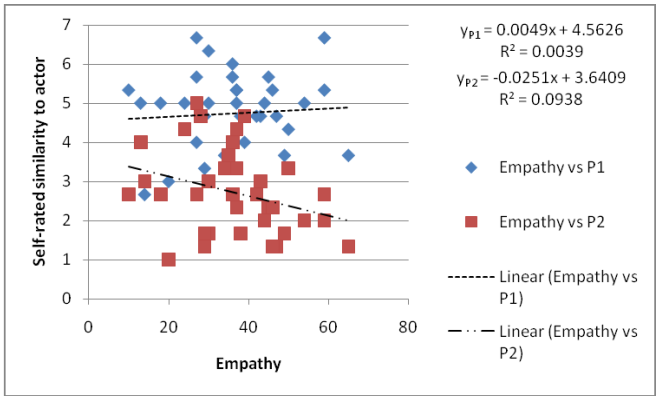

Fig. 9. Plots of Self-rated Similarity to Actor versus Empathy.

D. *Impact of Emotional Display*

An average pleasure difference of 2.4 for Videos T1 and T2 was found (see Fig. 10). This indicates that most subjects felt more pleasure watching Video T1, where the actor showed some level of expression, as compared to Video T2 where the actor had no obvious facial expressions.

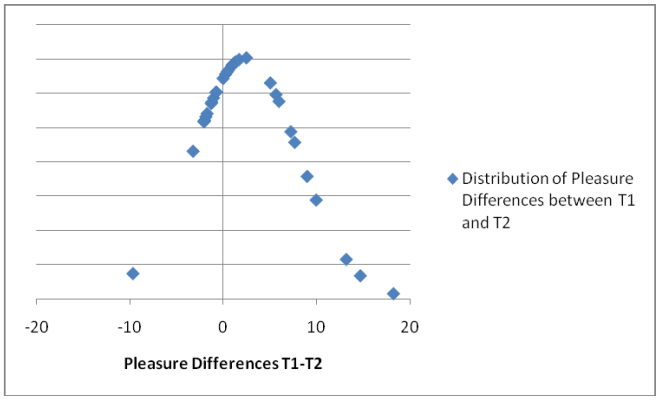

Fig. 10. Distribution of Subconscious Pleasure Differences between T1 and T2. Values of the difference between the pleasure obtained when watching Video T1 and the pleasure when watching Video T2 are plotted on a normalized scale. The distribution shows that the average difference in pleasure between watching Video T1 and T2 is about 2.4, and that the probability of a person feeling more pleasure when watching Video T1 than when watching Video T2 is about 0.7.

IV. Conclusion

Although trends and general results have been found, the limited number of test subjects does not allow formulating a more exact model. The study, however, showed some interesting trends, and future studies need to be undertaken to look into the relationships in more detail.

In summary, it is found that the experimental data follows our reasoning on the reward system: The higher the empathy level of a person and the stronger they connect to an actor performing the actions, the lesser the differences in pleasure for self acting versus pleasure from watching the actor performing the same actions, with basically no difference for very high levels of empathy. Higher levels of facial expressions were also found to have a strong impact, and indicate that the pleasure transfer does not work by simply analyzing actions and rewards, but that the actor serves as direct impersonation of the perceiver.

Some other methods of gauging pleasure such as heart rate and respiration rate were recorded during the experiment but the data not used due to those recordings being less accurate. This is because of the fact that both heart rate and respiration rate need time to pick up or fall, depending on the feelings of the test subject. Due to the short durations of some of the videos (as short as seconds), the heart may not have time to start pumping fast enough to register a significant difference in the recordings. Data analysis for this paper has been done mainly using the EMG readings. Among experiential, behavioral and physiological measures, the correlation between self-reported hedonic experience and facial behavior has been the strongest [12, 13].

While the experiments were able to show crucial aspects of how empathy and facial expression can be manipulated to tweak the way our mind registers pleasure, further studies into the specific factors are needed in order for a more concrete model to be formulated. This field of study holds much importance in the areas of game development, entertainment in general, as well as fields like learning, psychology and sociology. Given adequate player profiling techniques, a dynamically generated passive experience that adapts according to the user profile might be a viable alternative or serve as enhancement for active gaming experiences.

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