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# Exploring Moral Actions Using Immersive Virtual Reality



**eventLAB**

**Entorns virtuals en neurociències i tecnologia**

*Entornos virtuales en neurociencias y tecnología*

Experimental virtual environments for neuroscience

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**Final Report**  
October 1st, 2016

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## 1. Introduction

In the final period the implementation of the scenario has been completed, and the experiment has been run. Data has been collected and at the time of writing partially analysed with results given below.

The design of the experiment was given in Report 3, but for convenience we provide the major points here. There are two experimental scenarios that we refer to as Bar and Obedience. Participants first experience the Bar, and 1 week later the Obedience.



**Figure 1 - The Bar Scenario - the participant is embodied in the red shirted character with raised hands in phase 1 and then in phase 2 as the woman or the rightmost character in the image.**

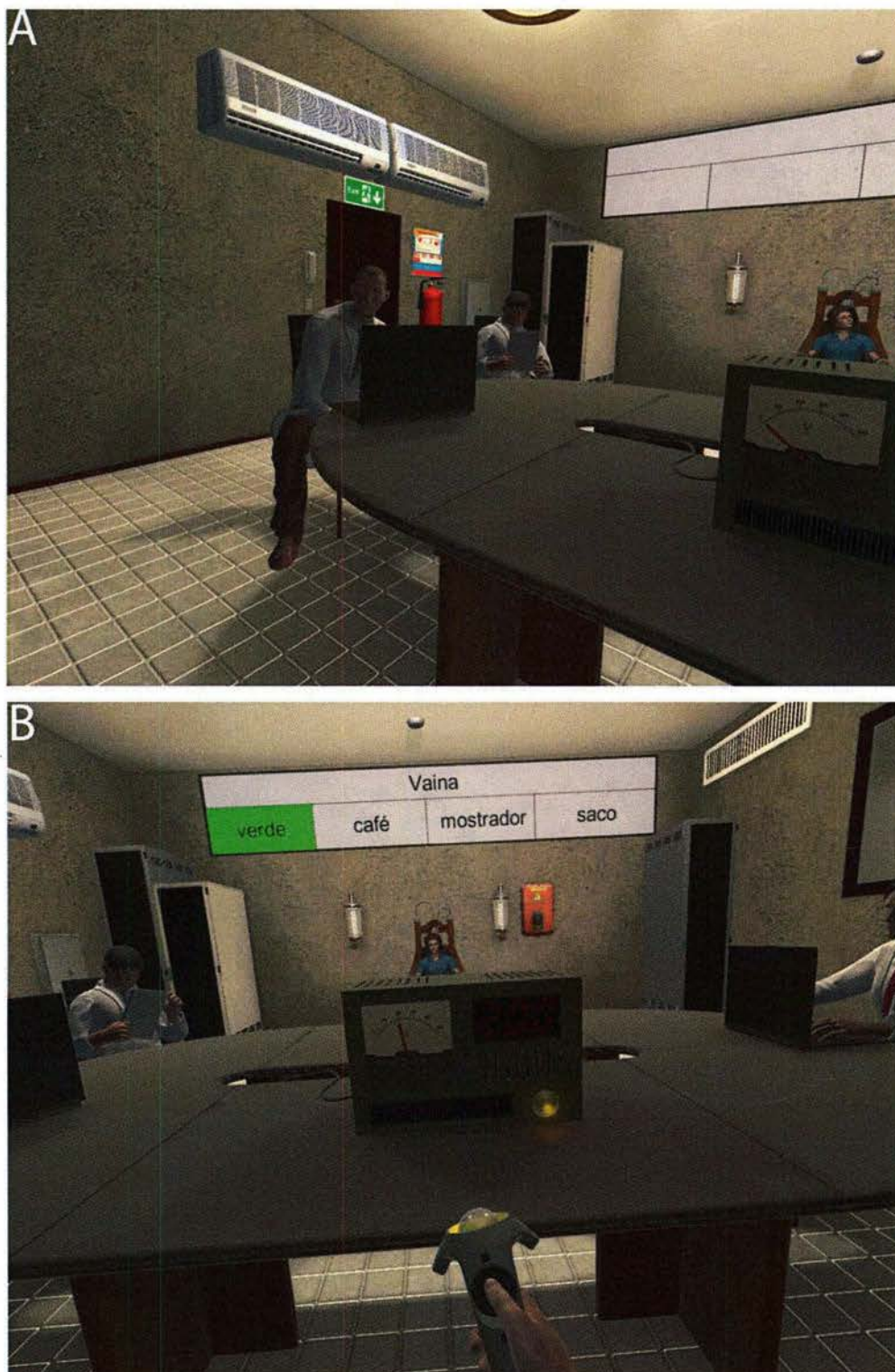
The Bar experimental scenario is in the context of sexual harassment and has two phases, all in immersive virtual reality. In phase 1 a group of men are sitting around a table in an open-air bar (Figure 1). The participant is seated amongst the group, and introduces himself to them. The participant is throughout this phase embodied in the body of a man amongst the group. He can see his life-sized virtual body when looking down towards himself, and also in a reflection in a window of the bar. His real movements are mapped to movements of the virtual body through real-time motion capture. The group are talking about mundane matters, and eventually move on to complaints about women. Sitting across from the men is a lone woman. One of the men invites the woman to join them and when she refuses and ignores the group of men, he continues to insist, becoming increasingly aggressive. Eventually one of the men stands up and walks aggressively towards the woman, and the scenario ends.

In phase 2 of the experiment the participant relives the whole scenario but in one of two conditions: embodied as another member of the group or embodied as the woman.

There are altogether three conditions in the experiments (1) Group: In the second phase the participant is embodied in the group of men (2) Woman: In the second phase the participant is embodied as the woman. (3) Control: the participants experienced the Bar scenario once only, and there were no other virtual characters there at all. There are 20 participants in each group recruited from the Mundet campus of University of Barcelona. All participants gave written and informed consent.

Our hypothesis was that those in the Woman group would experience greater empathy to women in that situation compared to the other two groups.





**Figure 2 - The Milgram Obedience Scenario - (A) The virtual character to the left gives the participant instructions for the experiment. The Learner is seen on the other side of the room. (B) The participant increases the shock level shown on the machine and the Learner is the other side of the table while the virtual experimenters are looking on.**

In order to test this all participants experienced the Obedience scenario. This was a variant of the Stanley Milgram Obedience experiments (Milgram, 1974) (in virtual reality of course). In this situation participants were seated in a room with four virtual characters. Three of these played the role of the experimenters, who instructed the participant to engage in a memory training experiment with the fourth virtual character a woman, who we refer to as the Learner.

The three men were the same characters they had seen in the previous experiment (the Bar). The woman was the same as the one from the Bar scenario. The setup of the experiment was that the woman Learner was supposed to have learned some word pair associations and the participant was to deliver the questions in the same format as the original Stanley Milgram experiment. Each time that the Learner answered incorrectly the participant was required to administer an electric shock. As the number of incorrect responses increased so did the voltage of the shocks. After a certain point the Learner virtual character started to complain about the pain of the shocks and eventually asked to be let out of the experiment. If the participant wanted to stop or was hesitant to give the shock the three virtual experimenters encouraged him to continue. There was also a safety signal where if the participant spoke directly to the real experimenter who was observing everything, then the experiment would be immediately stopped. There were a total of 20 incorrect answers and if the participant administered a shock corresponding to each the voltage would have reached lethal (following the design of the original Stanley Milgram experiments).

Our major response variable was the number of shocks that participants would administer. Operationalising our hypothesis we expected that those in Phase 2 in the Woman group would tend to give less shocks than those in the other two groups.

## **2. Results**

### **2.1 Participants**

At the time of writing the data has been compiled for  $n = 46$  participants distributed in the three experimental conditions: 13 Controls, 16 in Group, and 17 in Woman. Data for the remaining 14 participants is being compiled. Hence the following findings are preliminary.

### **2.2 Body Ownership**

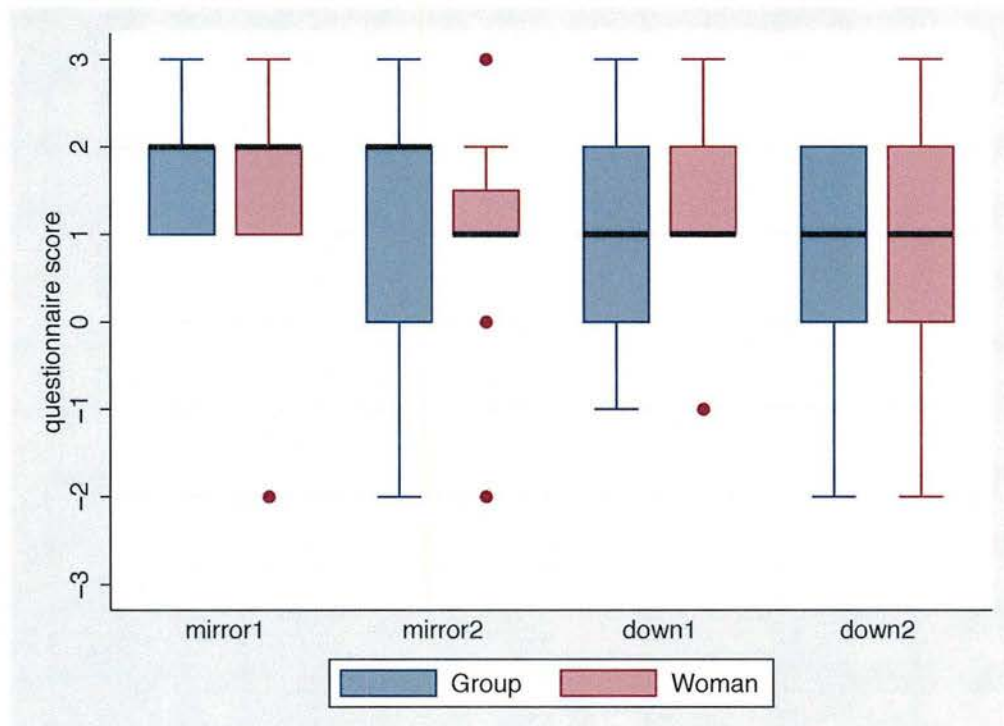
An important response variable in Experiment Bar was the extent to which participants had the perceptual illusion that the virtual body that they embodied was their body. For this purpose we had administered the following questions immediately after each virtual exposure:

**mirror:** I had the feeling that the virtual body I saw when I looked towards the mirror was my body.

**down:** I had the feeling that the virtual body I saw when I looked down was my body.

Each of these were scored on a -3 to +3 scale, where -3 signifies complete disagreement and 3 complete agreement. These questions were given after Phase 1 and Phase 2 where mirror1 is the score after phase 1, mirror2 after phase 2 and similarly for down.





**Figure 3 - Box plots of body ownership by phase 1 and 2 and condition. The horizontal thick lines are the medians, the boxes are the interquartile ranges (IQR), the whiskers extend from  $\max(\text{median} - 1.5 \cdot \text{IQR}, \text{smallest value})$  to  $\min(\text{median} + 1.5 \cdot \text{IQR}, \text{largest value})$ . Scores outside this range are shown individually.**

Figure 3 shows the box plots of the two questionnaire scores by phase and condition. It is clear that overall the body ownership scores were high (for example, all the interquartile ranges are above the 0 score, and all the medians are 1 or 2 out of the maximum score of 3). Most important, and in line with other findings, the level of subjective body ownership does not differ whether the participants are embodied in the male or female body, and also do not vary between the two phases.

### 2.3 Presence

Presence is the illusion of being in the virtual place (Place Illusion, PI), and also the extent to which the situation and events seemed to be really happening (Plausibility Illusion, Psi). This is covered in the questionnaire by two variables:

**PI:** I had the sensation to be on the terrace.

**Psi:** I had the sensation that the conversation was really happening.

As before the responses were on the scale -3 (complete disagreement) to +3 (complete agreement) and the questions were administered after each phase.

Figure 4 shows the results for PI. As before it is clear that the place illusion was high under all conditions and phases, and not different between the phases. Figure 5 shows the similar results for Psi.

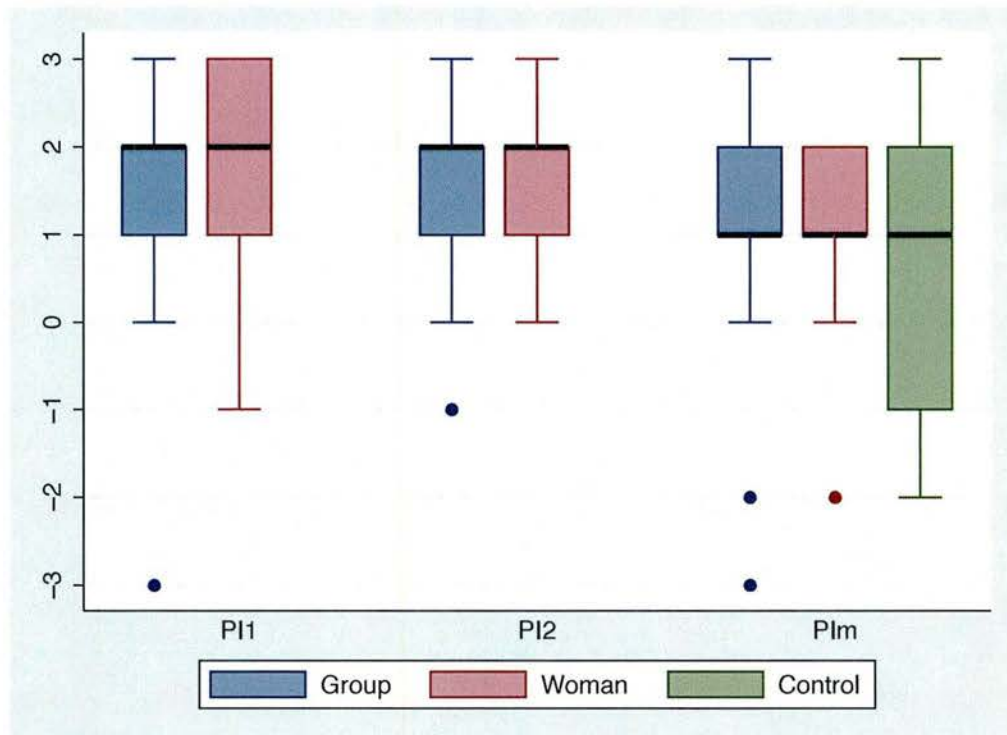


Figure 4 - Box plots of PI by phase 1 and 2 and condition. PIm refers to PI during the Obedience (Milgram) experiment.

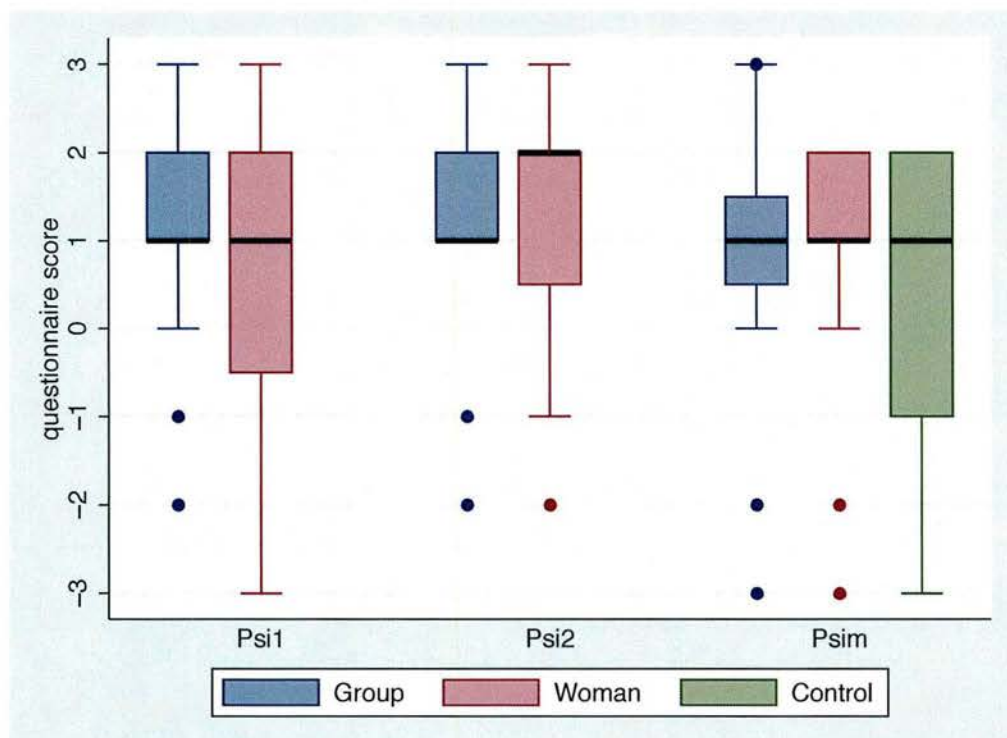
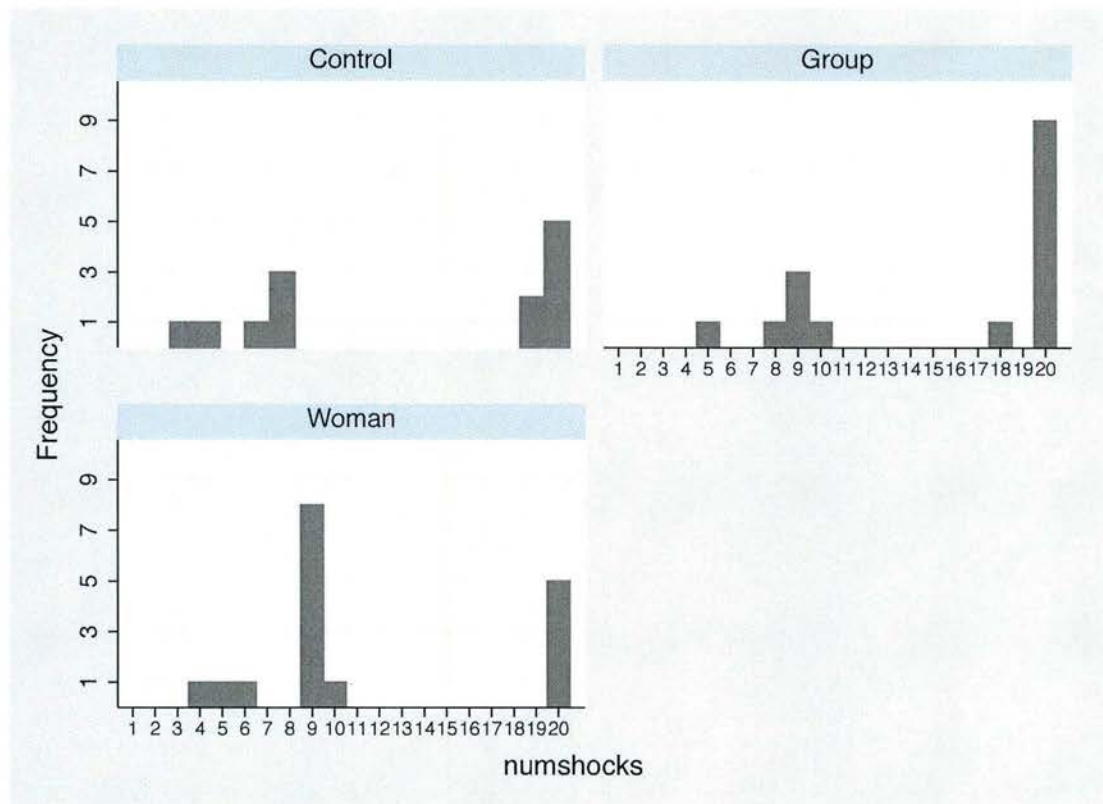


Figure 5 - Box plots of Psi by phase 1 and 2 and condition. Psim refers to Psi during the Obedience (Milgram) experiment.

## 2.4 Number of Shocks

Here we consider the number of shocks that participants administered during the Obedience experiment. Recall that this is the main response variable.



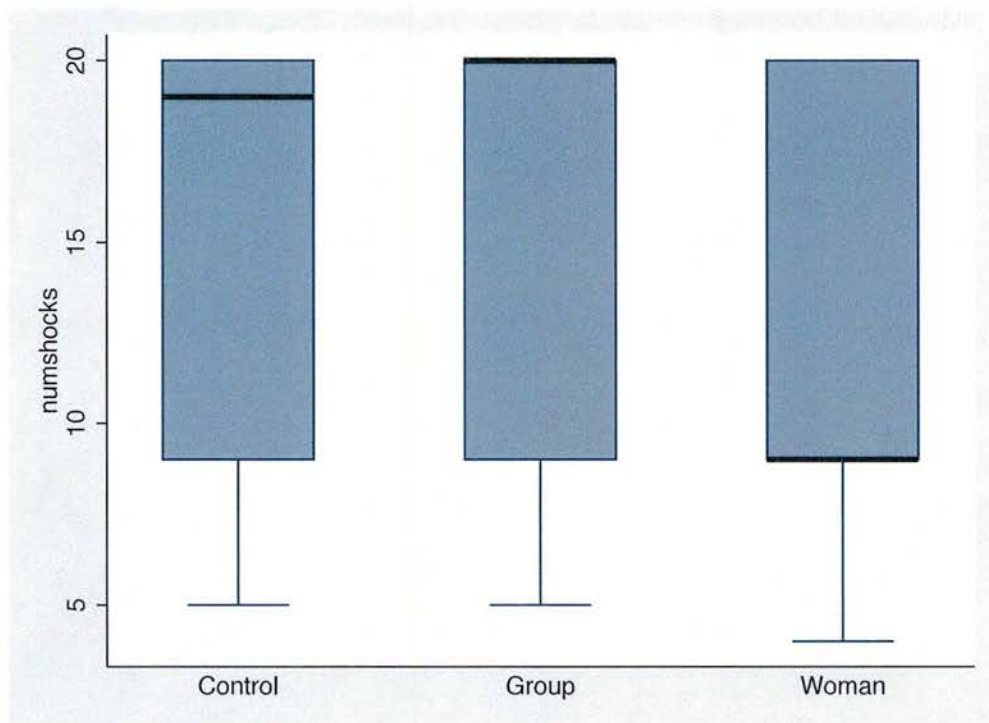
**Figure 6 - Histograms of number of shocks by condition.**

Figure 6 shows the histograms of the number of shocks across the three conditions. What is most striking is the different pattern between Group and Woman. There were double the number of people who gave a high number of shocks (18 out of 20) in the Group condition compared to the Woman condition. Those in the Woman condition were most likely to stop at shock number 9. After shock 8 the woman (Learner) exclaims “Let me out of here!”, and one of the virtual experimenter responds “Don't pay attention to her, she accepted our conditions and women are always complaining”. The Learner then shouts “I won't answer anymore!”, and the experimenter says “If she doesn't answer this counts as an error”. After shock 9 the Learner fails to give an answer, in line with what she had threatened. For those in the Woman group this dialogue seems to have been a critical point where the majority decided to terminate the experiment.

Figure 7 shows the medians and interquartile ranges of the number of shocks, showing that those in the Woman condition tended to give less shocks than the other two conditions. Here we use a non-parametric approach since the distribution of the number of shocks is far from normal within each condition.

A quantile regression analysis (Koenker, 2005) of the median by condition shows that the number of shocks given in Woman condition is significantly lower than the others ( $P = 0.012$ ), supporting the original hypotheses.





**Figure 7 - Box plot of the numbers of shocks by condition.**

### 3. Further Work

Overall we conclude that the Bar experiment successfully induced body ownership and presence, and when participants were embodied as the victimised woman in phase 2 then in the Obedience experiment they were likely to administer less shocks.

Far more data was collected than has been analysed here. For example, the questionnaires were more extensive, we also recorded waiting times between the moment that the Learner gave the incorrect answer and administration of the shock. In a previous virtual reality Milgram paradigm these time responses were critical in understanding the responses (Slater et al., 2006). Moreover there is data from more participants to include. Further more we have ECG data from which we will derive heart rate and heart rate variability - also variables that were used in the earlier study.

Our immediate objective is to complete the data set and then write up the results as a paper for submission to a high impact journal (depending of course on the final results).

### 4. Conclusions

The original proposal set out the problem to be addressed by this research as follows:

“You are with a group of compatriots who unexpectedly start to engage in an immoral act - for example, robbing and attacking a defenceless and innocent person. To maintain identity with your group you should go along with this attack, but on the other hand this clearly violates your moral code and society’s moral and legal codes. Do you maintain your status in the group, or walk away and yourself alert the authorities?...

“The fundamental goal of the research is to carry out a feasibility study that addresses some of the moral issues discussed above but using the technique of virtual body ownership. The particular research question to be studied is whether multiple different experiences from different viewpoints,

of a situation involving a moral dilemma, might lead to improved prosocial responses when confronted by another, but structurally similar moral dilemma later in time.”

The conclusion from our initial study suggests that being embodied in the viewpoint of the victim helps to override the pressure to conform to the group. Indeed those in the Group condition did not differ from Controls in the number of shocks they gave in the Milgram Obedience experiment. It should be recalled that this is in spite of the fact that those in the Group condition witnessed exactly the same sequence of events twice as those in the Woman condition. The only difference between the two conditions is that of the embodiment in the position of the victim, or as one of the group.

Overall the results support the idea that this method could be used in a training situation to overcome group camaraderie leading to pressure to carry out an immoral act.

## References

- Koenker, R. (2005). *Quantile regression*: Cambridge university press.
- Milgram, S. (1974). Obedience to Authority.
- Slater, M., Antley, A., Davison, A., Swapp, D., Guger, C., Barker, C., et al. (2006). A virtual reprise of the Stanley milgram obedience experiments. *PLoS ONE*, 1, e39.  
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Final Financial Report	ONRG FUNDING	Spent	Yet to be spent
Personnel	65,187.66 \$	64,223.76 \$	963.90 \$
Fringe Benefits			
Travel			
Equipment			
Supplies	2,550.00 \$	2,336.92 \$	183.08 \$
Other (Overheads)	11,953.73 \$	11,751.32 \$	202,41 \$
Total Costs	79,691.39 \$	78,341.99 \$	1,349.40 \$