Lecture 10:

Human Pacman: a mobile, wide-area entertainment system based on physical, social, and ubiquitous computing 2004 Cheok et al

COMP 30025J

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Abstract

- Human Pacman played in real life with users attached to an AR interface
- Users play both Pacman and the ghost using a wireless lan
- The game aims to pioneer a new form of gaming anchors physicality, mobility, social interaction, and ubiquitous computing.

- Keywords: Collaboration , Physical interaction , Social computing , Wearable computer ,Tangible interaction , Ubiquitous computing

5 Conclusions

- Digital entertainment has lead to sedentary lifestyles
- Mobile Gaming paradigms could undo this (Remember Pokemon GO was 11 years after this paper)
- Using AR could lead to “Learning by Experience “ (we will examine this in great detail later on in the course
- Social gaming factor suggest in this experience of an interactive entertainment. (This has now been shown to be true by Pokemon GO)

1 Introduction

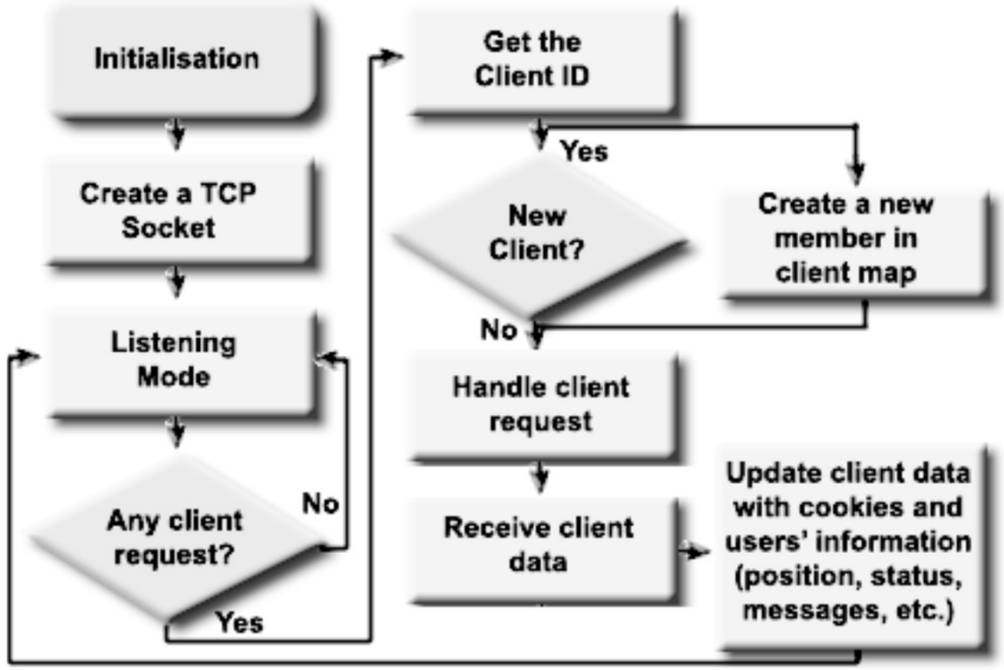
- The fantasy AR game allows for roleplaying as either as pacman or a ghost in the real world.
- Real world is matched with the Virtual world.
- The game happens in the real world , certain elements are Virtual and others are physical.
- The user must tap a real world ghost to capture them, but only if they have grabbed a magic pill embedded in a Bluetooth enabled device.

2 Background

- Discusses other social game experiences
- Arcade are becoming more interactive
- Examples given such as
  - Dance Dance Revolution & ParaParaParadise
- Academic examples such as AR quake are given

3 System design and game play

- Updates for the game aim to be within 10-21ms .
- This target is mirrored by latest developments such as the snapdragon 835 which aims for 16ms or lower time.
- Typical Client –Server model
- Pacman uses a wearable computer with his helper on a corresponding helper laptop
- Likewise Ghosts use a wearable computer with his helper on a corresponding helper laptop

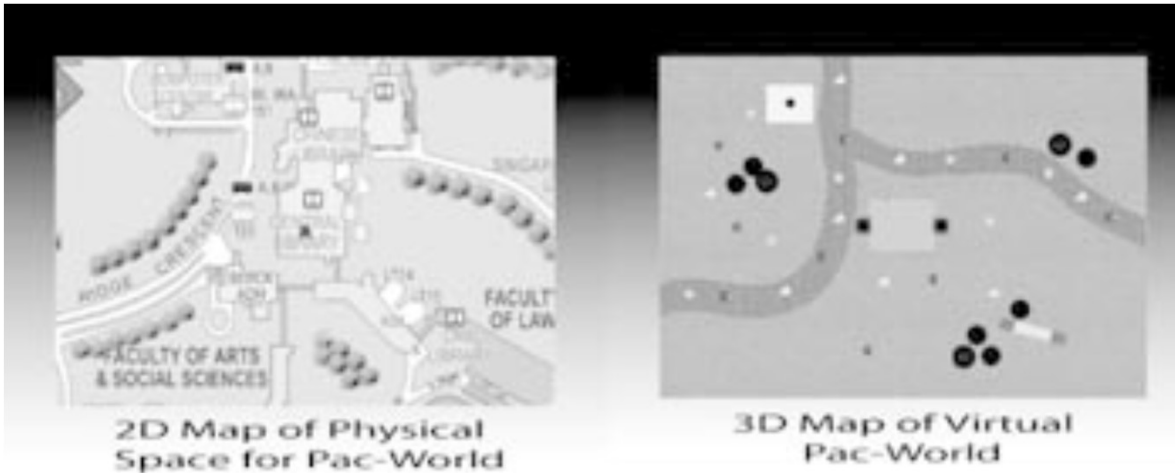


3.1 Main Concept

- Players are part of two opposing teams
- Two Pacmen and two helpers versus two Ghosts and two helpers
- The helpers are based on laptops viewing the virtual world in third person.
- The pacmen are trying to eat the cookies which are now virtual and placed in real world locations , the pacmen are tracked through a Dead reckoning module(includes GPS) and inertia sensors
- Based on the 1979 Namco Game

3.1 Main Concept cont.

- Using the devise are a real time link is established between the real physical play area and the virtual world
- The server uses the users position to evaluated if they are close enough to pick up a virtual cookie and removes it from the virtual world.



2D Map of Physical Space for Pac-World

3D Map of Virtual Pac-World

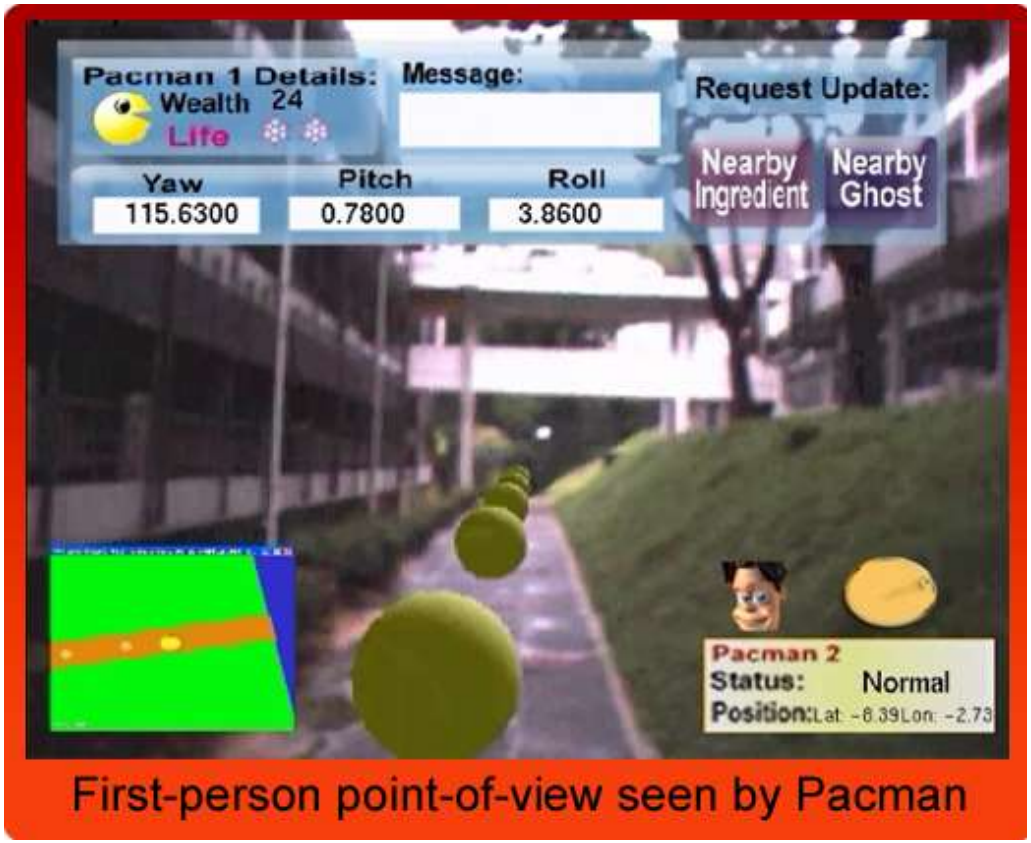
3.2 Pacman, Ghost, and Helper

- Pacmen move through the real world but using a AR(video see through) HMD can see the Virtual world at the same time
- The helpers are given full information about the experience
- The ghosts or pacmen when in attack mode, need to touch the shoulder of the opponent in the real world to devour them virtually.

3.3 Actual Game Play

- Pacmen collect cookies while ghosts only job is to attack the pacmen or run away from them if the pacmen are in attack mode
- The game play provides a novel environment to explore VR/AR games.
- Bluetooth enabled objects in the environment allow if the pacmen get close enough to let them change into attack mode

3.3 Actual Game play



4.1 Discussion

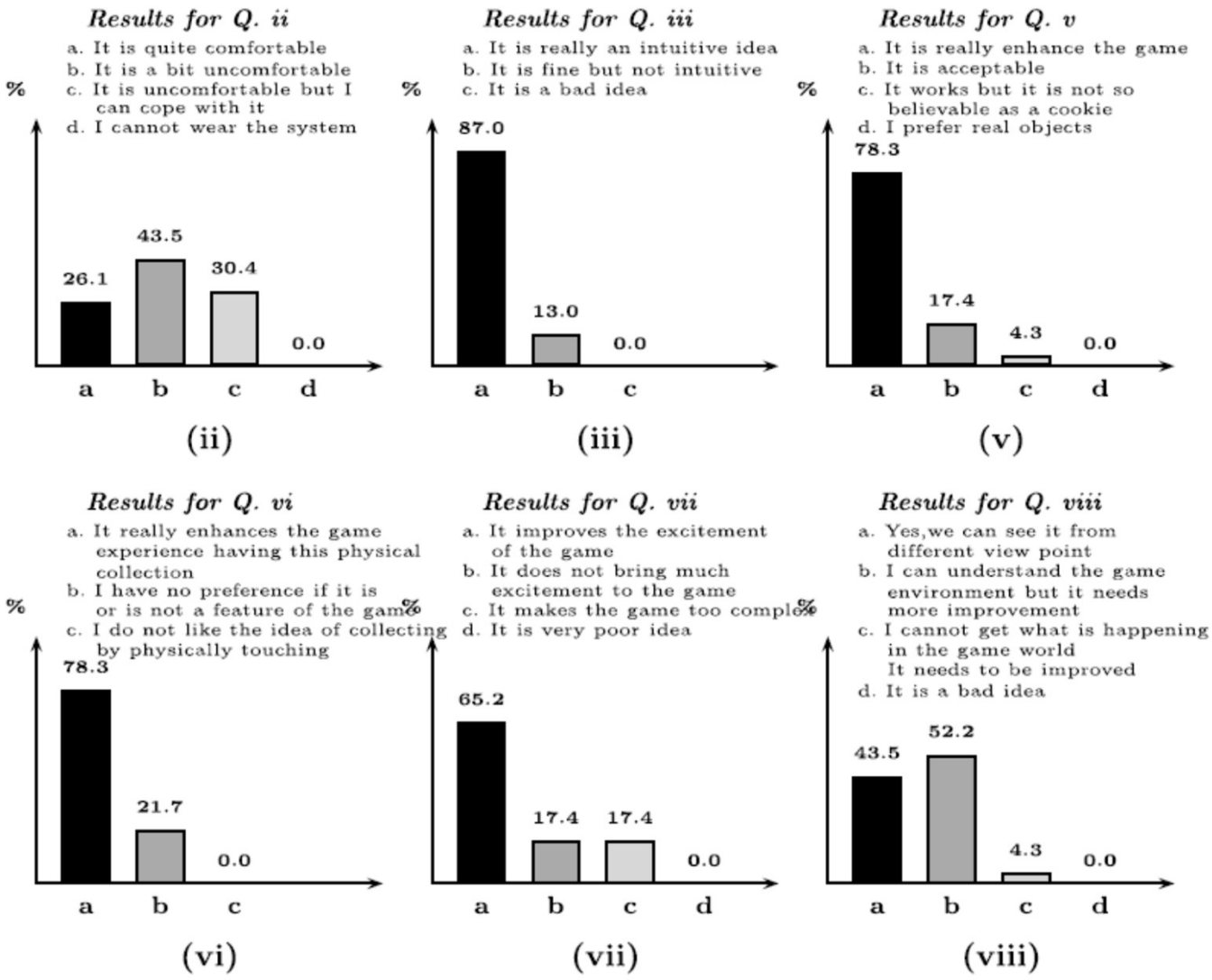
- What's a P value
- **"P Values**. The **P value**, or calculated probability, is the probability of finding the observed, or more extreme, results when the null hypothesis (H_0) of a study question is true – the **definition** of 'extreme' depends on how the hypothesis is being tested. "(1)
- So let say our P value is less than 0.05 that means to get a incorrect result , we would have to run our experiment 20 times. A P <0.01 would have to be run 100 times.

4.1 Discussion – User study

- Question 1: Human Pacman was much more liked over normal pacman.
  - P value was 0.000000672 in a t-test
- Question 4: More excitement playing in first person than third person.
  - P value was 0.000488 Two-condition Wilcoxon statistical test
- Question 11: Feelings of social interaction
  - No real difference between ghost and player but helper is perceived as having lesser social interaction p=0.0039
- Question 14:What are people willing spend ?
  - Similar to a standard amusement ride (values just averaged so no stastical test possible)

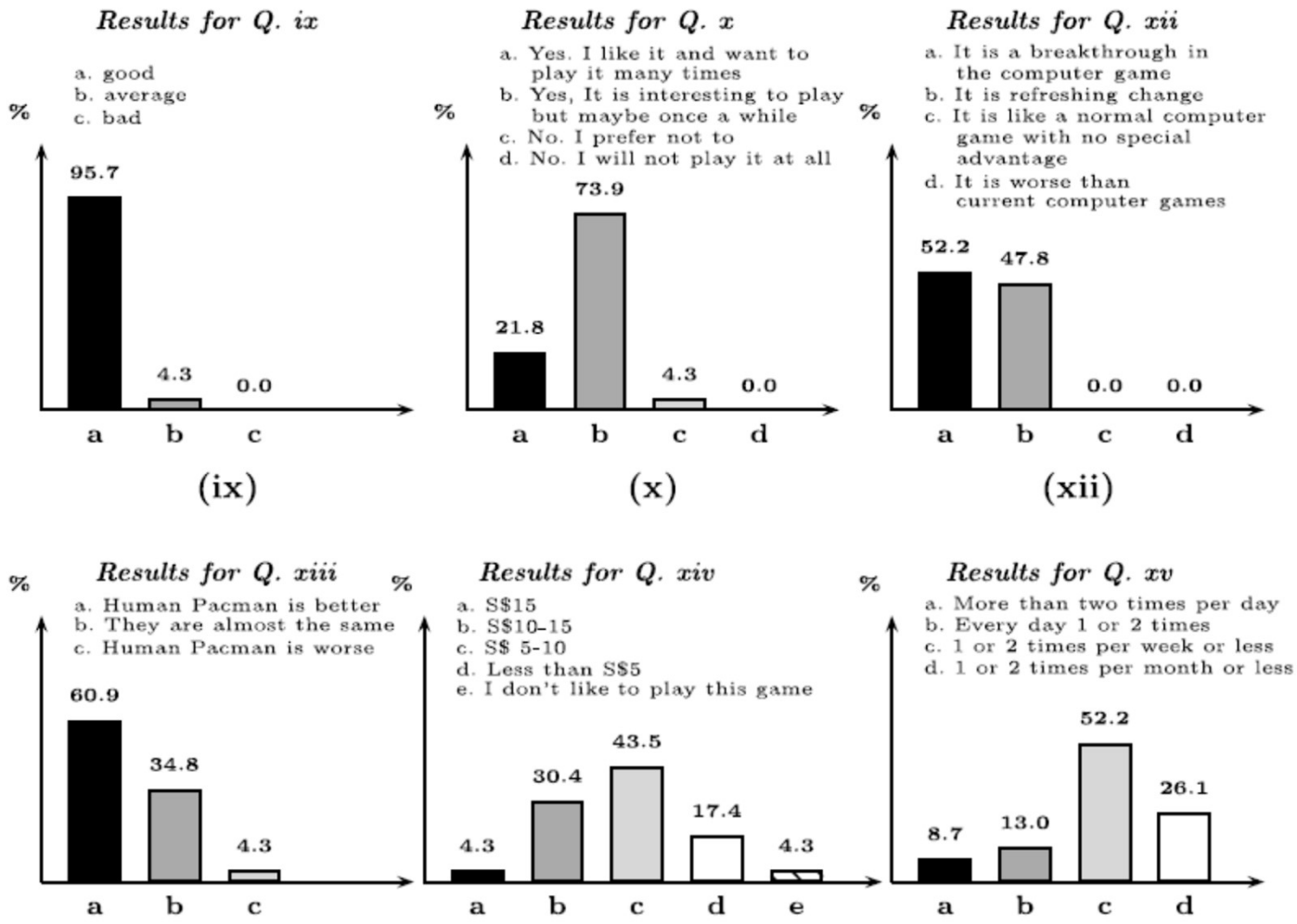
4 User study

- Q2: Comfort ?
- Q3: Intuitive ?
- Q5: How cookies are displayed in AR
- Q6: How cookies are displayed in Real life ?
- Q7: Collaboration between Pacman and Helper ?
- Q8:Does VR mode help understand game environment?



4 User study (results cont.)

- Q9: Capturing ?
- Q10:Do like playing ?
- Q12:Compared to other games?
- Q13: Compared to catch me game ?
- Q14: What would you pay for it ?
- Q15: How often you play games ?



4.2 Summary of findings and future work

- The cost of each set of wearable computer system is very high as they are lab prototypes
- The bulkiness and heaviness of the prototype wearable computer and HMD restricts the user to only walking, though the short response time of the system software does totally allow for quick movement, such as running
- An accurate and sensitive positioning system is needed to enhance the realism of the game
- The robustness of the system needs improvement

References

- Short amount of references based on the length of the paper
- References AR quake which will discussed earlier in the course.

Next week

- **“3D printing based on imaging data: Review of medical applications”** by Rengier· A. & Mehndiratta& H. von Tengg-Kobligk & C. M. Zechmann &R. Unterhinninghofen &H.-U. Kauczor&F. L. Giese

Mixed Reality Questions

- "How would evaluate a Mixed Reality user experience?"
  - Use **Milgram** to define problem
  - Use **Cheok et al** to cite user studies
  - Reference any other paper to cite components like sensors / displays to test.
- "How can a Mixed Reality HMD work and explain examples of its use?"
  - Optical See through / Video see through so **Milgram** and **Krevelen and R. Poelman**
  - Examples **Cheok et al** , Piekarski and **Thomas** , and tons of examples within **Krevelen and R. Poelman**

AR Reality Questions

- "How can you program a Augmented Reality application ?"
  - Examples
    - Piekarski & Thomas
    - Krevelen & Poelman
    - **Geiger et al**

Virtual Reality Questions

- "How can you create and use a Tele-presence environment ?"
  - Creating a real time Tele-presence system **, Prince et al** gives one example
  - **Cruiz-Neira et al** and **Campbell et al** for CAVE designs that allow telepresence
  - Alternative ways to view a Tele-presence environment **Olson et al** and **Surale and Shinde**
  - Use of game engines to create a environment **Lewis and Jacobson**