Identifying Viable Hologram Gestures from Movies

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ABSTRACT

UPDATED—May 10, 2020. This study aims to determine the most intuitive gesture sets from movies depicting the use of holograms. It utilizes virtual reality to allow participants to interact with multiple scenarios in a virtual world designed to test hologram gestures from select movies. This study will determine whether each of the movies have gestures intuitive enough in nature to warrant future study, or if they are not potentially viable gestures. The results show that Iron Man and Prometheus are movies that have a potential for future study as a result of their low error rate and fast time for users to complete the scenarios. This will require future study with additional participants to gauge the full extent of their intuitiveness, but this serves as a good baseline for what has potential and what does not.

Author Keywords

Gestures; hologram; augmented reality;preference study

CCS Concepts

•**Human-centered computing** → *Gestural input;* **Human computer interaction (HCI);** *Haptic devices;* User studies;

INTRODUCTION

For years, science fiction movies have used their platform to represent technology out of our current reach. They can anticipate trends in the direction technology is moving and put it into movie form using special effects. The lack of limitations filmmakers have affords them the ability to develop the look and feel of a technology before it is feasible to make in reality. Due to the ability for movies to influence the public, these science fiction movies can then shape the public's perception of the technology and leave a lasting impact on what the expected look and feel of that technology is. This can help in the development of new technologies from a technical standpoint, using that look and feel to model the new technologies after, which will in turn generate new technological futures for the movie industry to base their movies on. This consistent cycle of movies inspiring technology and technology inspiring movies is an integral part in shaping the future of tech [6].

One of the biggest technologies movie makers have been implementing in recent years is the look and feel of the future to holograms and their manipulation by a user. Holograms have been represented for years in movies in both a virtual reality and augmented reality and have been shown to be manipulated through a variety of gestures. In a previous study of the representation of technology in recent movies, it was found that holograms were the most used technology in the scenes studied. There was also a large variety of gestures used in the scenes, paving the way for a research study based on preference of gestures among users [3].

There is a distinct lack of research in the area of hologram gestures, and no public studies have been done on the viability of movie gestures. There are previous studies on holo lens such as the paper by Markus Funk Et al.[2] that describes the hologram gesture problem in relation to difficulty to program properly, but this does not cover what the users feel are intuitive. However, researchers have found that holograms are one of the most prevalent representation of tech in modern science fiction movies [3]. With how prevalent holograms are in popular culture, this is an avenue that should be explored to see how users feel about using those gestures in reality.

Motivation

The technology for holographic technology is already on the way, and it is coming fast. We need to be ready for the technology to catch up by determining which gestures are a viable test candidate for future use. The most intuitive way of deriving gestures is to pull them from popular culture i.e. movies as many people would have the baseline knowledge required to know what the gestures are doing prior to having it explained to them. This seems to be a great starting point for the development of new gestures off of a baseline from movie gestures.

We also felt as if we had a more unique angle to the problem, as too many of the already limited studies are on the physical programming and more theoretical, but not enough of them focus on user experience when using the gestures, and what the users would want to use as their gestures. If the gesture is easy to program but users dislike it, then it's not worth the work to be researching and implementing that gesture in the first place. We believe that doing this research will save valuable time by showing others which gestures are worth looking into and which ones are too complicated or non intuitive for the users.

Related Work

The field of research into hologram gestures is somewhat lacking at the moment, especially research into user intuitiveness

specifically. Most of the existing studies on this topic stem from determining the best gestures from a technical standpoint [4][5][2][9][1][7][3][8]. The only study that we found that contained some aspect of how natural the gestures are for the users, but it is still viewed through the lens of a software developer instead of a user [2]. None of these attempt to leverage the gestures of existing popular culture or movies, which is where a large number of natural feeling gestures can be found. The paper on interactive holographic display based on finger gestures[5] in particular gives great insight as to how these gestures should be implemented, but it is through the lens of physics and mathematics rather than how people will interact with these gestures.

Figure 1. Hologram manipulation gestures demonstrated in Iron Man (2008), Her(2013), and Prometheus(2012).

METHODOLOGY

The simulated environment that we created was through the use of Unity and an Oculus Rift headset. The Oculus Rift is a full VR headset that allows us to create a very specific virtual world for the user to interact with. Using this, we leveraged the Wizard of Oz approach in order to give us more mobility with our objects being manipulated as an automated system would be less precise and could potentially complete the gesture when the user did not mean to. The Oculus Rift will allow us to gather the most accurate hand movements for the participants, as well as increased immersion in the simulation.

There are multiple sections to the problems regarding hologram gestures being used in reality that we aim to test:
- How intuitive are the gestures to users
- How easy to use the gestures are

Our goal is to use a Wizard of Oz type experiment to perform a preference study on each of the gestures.

We started this by designing a simple program for an Oculus Rift which mimicked the basic movement of objects displayed in three movies, whose scenes are shown in figure 1:
- Iron Man (2008)
- Her (2013)
- Prometheus (2012)

This provides us the largest assortment of gesture types for holographic display technology, and will allow us to test multiple methods of interaction. We will be doing an elicitation study as well as a preference study with a repeated measures design for the experiment. We will also be using a Wizard of Oz style design since the programming will be more time efficient and we are not intending to test the precision of the code itself, just the preference of the gestures. This study will be a remote through video conference due to COVID-19 concerns.

The way that we will determine how a set of gestures from a particular movie is intuitive is through the following criteria:
- 3 or less average guesses to determine what the gesture is
- 15 or less seconds to intuitively determine what the gesture is
- At minimum a 3 out of 5 on the user exit survey, preferably a 4 out of 5

The criteria was kept intentionally loose because the goal of this study is to determine which of the gesture sets warrant further study, and our main goal was to determine which gesture sets were significantly worse than the criteria. This particular set of criteria is designed to ensure that the user opinion with

a gesture being natural feeling and the data gathered from the experiment matches up with each other.

During each task, we will record the time and guess attempts to complete the first prompt, where they are given a referent and try to determine the best way of doing it until they guess the movie gesture. This will serve as our quantitative data and will be used to test how well they intuitively know these gestures from their exposure to pop culture and movies. The participants will also be asked a few short questions regarding their personal satisfaction using each of the gesture sets, which is important because human emotions play a large part in how they want to interact with technology. The ending survey will also include questions on VR experience and their level of exposure to movies is. Upon a participant beginning the experiment they will be provided with the following information prior to the testing of each gesture set:
- How to operate the device (only on the initial test, not on subsequent)
- A referent for this particular scenario

Subjects will be given 30 seconds to orient themselves upon being loaded into the scenario to remove potential visual confusion upon startup. An example of a task from Prometheus would involve moving a sphere similar to how it happens in the movie. We will tell them a referent, "move the sphere closer to you," and will see how long and how many attempts it takes to grab the sphere and pull it in.

We will then show them the movie scene that we were testing, so they know exactly what we were looking to elicit, and we will then let them play around with the motion for another 30 seconds. After this, they will be given a questionnaire on there thoughts on the gesture as well as their prior experience with VR and exposure to movies.

All directions will have a specified endpoint ("move the sphere to here") so that the Wizard of Oz works seamlessly.

Iron Man (2008):
- Point at the sphere to select it.
- Pull the sphere out of the rectangle.
- Enlarge the sphere into the size of a ball.
- Make the sphere larger than the player by raising hands into the air.
- Shrink the sphere back down into tiny ball clapping hands together.
- Move the sphere to the right.

Her (2013)
- Perform a gesture to move into first person view of the purple human.

Prometheus (2012)
- Gesture towards one of the rotating planets to select it.
- Move the planet around and inspect it.
- Rotate the sphere around by moving the palm of your hand in different directions.

- Push the sphere upwards to allow it to enter back into orbit.

These commands will result in the prompt pressing the appropriate keys to make the graphics move when the appropriate gesture is given, testing how intuitive these gestures are. Following this, the users will be shown the movie scene that the gesture is meant to mimic and given a chance to use the gestures some more for another 30 seconds.

The participants will then be given an exit survey, asking them to rate each of the gestures' feel on a scale of 1 to 5. They will also be asked context questions about their prior exposure to movies in general, the movies in question, their experience with virtual reality technology, and their exposure to augmented reality technology. These will be asked to take into account legacy bias.

RESULTS AND IMPLICATIONS

Experiment Raw Results
This experiment was conducted with N = 9 as a result of COVID The experiment results are as follows for each movie:
Iron Man:
- Average Time/Gesture: 7.59 seconds
- Average Errors/Gesture: 1.48
Her:
- Average Time/Gesture: 43 seconds
-Average Errors/Gesture: 8.11
Prometheus:
-Average Time/Gesture: 3.72 seconds
- Average Errors/Gesture: 0.47

Graphs to show the difference between the data of these particular movies are shown in Figure 2 and Figure 3
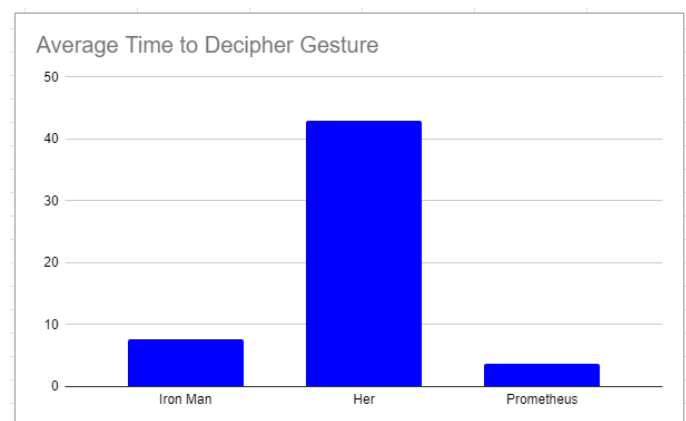

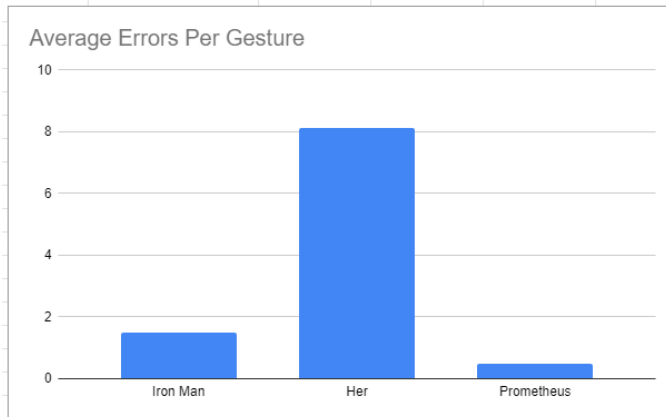**Figure 2. Average time users took to decipher the gestures**

Figure 2. Average number of errors users had when deciphering the gestures

Exit Survey Raw Results
Average *Iron Man* gesture feel (1-5): 3.77
Average *Prometheus* gesture feel (1-5): 4.55
Average *Her* gesture feel (1-5): 2
Average movies/mo: 6.77
Percentage who has seen *Iron Man*: 88.8%
Percentage who has seen *Prometheus*: 44.4%
Percentage who has seen *Her*: 11.1%
VR Users: 66.6%
AR Users: 11.1%

Result Analysis
Iron man and Prometheus well within the threshold to be intuitive to users, as they both scored highly in both user opinion and empirical results after each trial. After conducting an ANOVA analysis on the results (Figure 4.), it was found that *Her* is significantly worse than *Iron Man* and *Prometheus* at $p < .05$ and F-ratio of 79.34.

	ANOVA Results		
	Iron Man	Her	Prometheus
N	9	9	9
∑X	205	387	131
Mean	7.55	44.11	4.33
∑X2	7.59	43	3.72
Std.Dev.	3.6	23.19	2.48
	SS	df	MS
Between-treatments	11325.41	2	5662.7
Within-treatments	4853.204	68	71.37
Total	16178.61	70	
	F-ratio value 79.34 , p value < .00001		

Figure 4. ANOVA results and data summary

What this means is that not only did *Her* score significantly worse than our benchmark in every metric, it also has a statistically significant difference between itself and the other two movies. This results in the gestures from *Her* being empirically worse than *Iron Man* and *Prometheus*, and this is backed up by an extremely low rating of a 2/5 from the exit survey for *Her* as well.

As a result of sample size, this cannot be concluded for the whole of society, but it gives us an indication that *Iron Man* and *Prometheus* warrant further study in real life implementation of their hologram technology. It is also a good indication that the movie *Her* would not be a good option for real life implementation as a result of poor performance on all metrics and an overall frustrating experience for users to determine which gesture that movie is using even after being told what the gesture is afterwards.

Limitations and Challenges
As a result of a specific pool of students participating in this study as a result of COVID-19, there is a chance that their existing legacy bias with the use of an Oculus Rift could have impacted their performance either positively or negatively. Due to similar reasons, we also have all individuals from the same demographic, and interactions that they might find natural or intuitive may not be indicative of the whole of society. This is a result of the demographic being tested of 20s college students is generally more in tune with popular culture and new technology, so it may come as less of a shock to them to learn how gesturing works in a simulated environment.

While we did not find any significant correlation between the participant having watched the movie beforehand and their overall performance for each gesture set, the sample size is insufficient to rule out some form of bias as a result of the movie being previously viewed. Through further analysis it could be determined if a movie such as Iron Man, which almost every participant had viewed before this experiment is actually intuitive or if they viewers simply remembered how Tony Stark manipulated the hologram within that movie. Similar questions may apply in the inverse, where if more people had watched the movie "Her", maybe that would feel more intuitive to the user because they see the gesture in action and then are aware of what that gesture is attempting to accomplish before having to start guessing what It could be.

Another slight limitation is taking into account the relative difficulty present in the scenes of different movies. For example, moving an object from the Iron Man simulation may be more difficult than Prometheus. This is due to Iron Man having to use specific gestures to move the object, while Prometheus has the orb attach to the palm of the user, meaning that they may have different interpretations of how "smooth" the gestures felt as a result of this and could influence their opinion.

Future Work
Building off of the limitations outlined above, in the future will will include a larger number of participants from much more diverse backgrounds, and include a larger set of gestures. This will allow future research to fully determine which gestures from movies should be implemented in reality and

which should be ignored as implausible. Our somewhat simple simulation could become more advanced as well with high level graphics giving the user more of a feel of the scene itself, which could change how they perceive the scene and gestures as a result. The participant being more immersed in the simulation would allow researchers to see how the gestures work with real people in the actual world created by these movies. While the current boiled down representation can give us a basic idea of which ones have merit, this upgrade would allow more conclusive results and give more insights as to how these gestures should be implemented in the future as the technology advances. On top of this, more resources could be put in to implement basic gesture recognition that will turn this away from the Wizard of Oz style experiment and help gather precision metrics on the gestures, testing to see if the gestures will get more frustrating when having to actually track the motion of your arms. Expanding the participant pool would also have a great effect on the validity of the results, as we can get a much better idea of which ones are truly natural or which ones are impacted by legacy bias by including a pool of participants that are of all different ages and cultures.

CONCLUSION

Of the movies we tested, it was found that *Iron Man* and *Prometheus*' gestures are intuitive enough to warrant further study and potential future use within hologram technology with *Prometheus* being classified as the most intuitive. The gesture demonstrated in the movie *Her* of moving your hands toward your body to zoom into a first person view was found to not be intuitive with both error rate and time to complete being well above the threshold of 15 seconds and 3 errors respectively and the users had a difficult time deciphering what gesture was used in the movie for that particular task. To further prove that *Her* was not found to be intuitive, *Her* was found to have statistically significant differences from the other two movies (p < .00001). This study was performed with less participants than optimal, so further study is warranted on the subject with additional participants.

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