Motivating Children to Develop New Technologies through Human-Computer Interaction Scenes on Movies, and Understanding Technology Based on Human Limitations

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Technology concepts like Human-Computer Interaction (HCI) products are used especially in science-fiction (sci-fi) movies and gather a significant amount of attention from the public. While some of the movies use technology in their real context and consider human limitations and needs; some of them use technology in the wrong context. As a result of the wide attention to technology usage in movies, it nearly becomes impossible for the audience not to get affected by movies. In that sense, one can argue that children are also affected by these movies. Several studies in the literature show that sci-fi movies might be effective for children to develop interest and motivation in science and technology. In addition, it is also mentioned that sci-fi movies provide grounds for future technologies, and inspire researchers and designers. In that context, HCI products like visual and haptic feedback systems are widely used in movies like Minority Report, and this paper argues that HCI scenes might be effective to increase kids' motivation to develop HCI technologies like haptic and visual feedback systems. On the contrary, it can also be found in the literature that misusage of the technologies in movies might lead to misconceptions regarding technological products and science for children. Therefore, students should be aware and able to learn how to differentiate the realistic and unrealistic technologies in movies.

Additional Keywords and Phrases: Human-Computer Interaction, Science-Fiction, Human Limitations, Children Education, Human Perception

1 INTRODUCTION

As technological development receives great attention from the public, its usage in the communication mediums like television programs, documentaries, and movies becomes inevitable. While some movies or programs are trying to use these technologies in their real context to make the show more realistic; inescapably some are using them to get attention. At that point, the effect of the movies on the audience should be discussed in terms of the usage of technology. Certainly, it should not be expected that all of the audience will be affected by movies the same, indeed, some of them will be affected more such as children. At that point, usage of the technology in the movies becomes a way of manipulation given the reason that children can be manipulated easily since they cannot understand the difference between reality and fantasy [1]. It seems that there are two ways to influence kids with the usage of technology. Either child can be

influenced by the usage of technologies in their correct context, and be motivated to develop these technologies in the future; or they can be manipulated by the wrong usage of technologies, so they might perceive the current limitations of the technology wrong way, and misunderstand the human limitations. In this study, we will discuss how HCI scenes in movies can increase the motivation of children, however, how the misuse of them can lead children to understand human limitations wrongly. We suppose that topic might be interesting for readers and turning point for the literature since children are the future generation of engineers, and scientists to continue scientific development, and it is in our hands to influence them correctly through movies.

In regard to the positive effects of the HCI scenes in the movies on the scientific development of children and the effect of increasing motivation, the discussion will be general to specific. In this sense, the general effect of movies, animations, documentaries on children will be discussed through examples. The focus will be scenes where HCI technologies, such as haptic and visual feedback devices, were present. On the other hand, for the counter topic, the negative effect of movies on children, why children are affected, how they cannot differentiate the difference between reality and imagination, what damages misuse of HCI technologies can give to children, hence, why children should learn human limitations and needs for the technological development will be discussed. There are many studies done about topics like the effect of movies on children, their usage and benefits on education and how they can negatively affect children are widely discussed. However, very few discussions specifically made on how the use of HCI scenes can be effective to increase motivation, and at the same time, how they can mislead children regarding limitations of human perception and technology. The intention of this paper is to fill that gap, and provide a detailed analysis of the usage of technology, specifically in HCI scenes, discuss their both positive and negative effects on children. As mentioned, scope of the discussion starts with general influence of movies and ends with the specific effect of HCI scenes and technologies on children.

The main point of this investigation is to discuss how HCI scenes in movies can be effective on children like driving them to develop new technologies. Moreover, children should be warned with human limitations and needs while involving these technologies. Both the positive effects and negative consequences of the HCI scenes on children will be thoroughly discussed. Wide range of studies in the literature, are used through this paper and cross-comparison between them made in order to make grounds for the aim of our study. Additionally, arguments that are made will be supported by the examples that are found in the literature. In the rest of the paper, the list of different works in the literature is clarified in Section 2, the motivation to investigate this topic will be mentioned in Section 3, the main discussion with examples will take place in Section 4, a conclusion of the paper will be provided in Section 5.

2 PREVIOUS WORK

There are several works that examine the relationship between children, sci-fi movies, and HCI products. Schmitz et al. [2] examined the connection of techniques in sci-fi films with current products or emerging fields in computer interaction, through interaction types. Thus, this paper deals with different topics like the adaptation of the technologies used in the films with real technologies, whether they have been realized yet, the inspiration they can make for the HCI field in the future, and cooperation with scientists. It was emphasized that some movies such as Star Wars and Star Trek, which had a great impact on the audience, could not meet the expectations in the short run. However, it has also been shown that sci-fi movies and HCI research interact closely, with researchers developing products similar to the technologies shown in movies.

A study conducted by Mubin et al. [3] focused on media-based sci-fi content like movies and the work shows that there is a direct relationship between scientific knowledge, sci-fi work, and the inspiration of the scientist. Similarly,

Marcus [4] mentions that sci-fi movies visualized HCI products before they actually developed. In addition, he even argues that the research and development group in a company might be able to make an analysis regarding their HCI products by looking at the reactions of the audience in sci-fi movies that contains HCI scenes. Also, Linehan et al. [5] described the relationship between new technologies and fiction as “long” and “productive”. In addition, they argue that fictions are not only helpful for designers but helpful for a wide range of population because they reflect the implications of new technologies. For an example of this situation, Kirby states in [6] that there are clear pieces of evidence which are obtained from social studies; show that there is a direct connection between space travel films and interest in space travel from scientists, and the public.

Regarding the general effects of media on children, Ray et al. [7] mentioned, since the exposure to media increased, the media can have both negative and positive effects on children. Accordingly, these effects should be optimized to have a healthy relationship with the media.

In terms of the effect of sci-fi movies as a motivation source to learn science and technology, Ongel-Erdal et al. [8] found that the movies affect and influence the perception of science for the students. The same results were also found in [9], as they suggested after watching sci-fi movies, some groups of students started to perform better regarding practical technology-education design activities. Barak et al. [10] also indicated the importance of animated movies to increase the encouragement to involve with science as students can relate the material that is shown in the movies to real life.

In [1], Celepoglu et al. discussed the effects of fantastic movies on children. As they mentioned that it might be difficult for children to differentiate reality and fantasy, they also provide quantitative data regarding the children’s opinions about the movies (e.g., whether children think movies are realistic or making contributions to themselves, etc). In another study [11], Barak et al. pointed out how animated movies can be effective on students’ motivation to learn science. This work provides grounds to support HCI scenes are motivating to design technological products. In the work, animated movies are watched by 1335 secondary school students. Results of a few questionnaires indicated that integrating animated movies into the curriculum helps children to understand topics, and increases their motivation to study science. Pedersen et al. [12] revealed how Iron Man viewers followed HCI technologies closely and this close follow-up translates into real products that can meet the audience's expectations. For example, a graduate student tried to imitate a robotic arm like the one in the movie.

On the other hand, some papers that can be found in the literature argued that the connection between HCI scenes in sci-fi movies and their effect might be misleading. In [13], Barnett et al. argued that sci-fi movies did not make significant contribution on students or they can “negatively” affect the perceptions of students regarding science and technology. They observed that some of the students who watched the movie gave similar answers to the scientific issues mentioned as those who did not watch the movie. Moreover, Gerbner discussed [14] that television entertainment provides the opportunity for “hostile” perceptions of science, and additionally, scientist images presented on the screens are most likely to be “negative” than the images of doctors, law enforcers, etc. In addition, this topic is widely discussed in the literature in terms of humans’ interaction with robots in movies. Bartneck in [15], suggests that it would be best to “let go” several concepts regarding interactions of robots with humans in movies since they only use fear of the unknown future to have better stories. Similarly, Bruckenberger et al. in [16], mentions people’s perception of robots is generally affected by movies since they do not regularly interact with robots. Therefore, people’s fear of highly developed robots is because of their representations in movies. In addition to the wrong representations of technology, a study in [12] gets attention to Tony Stark’s effort to overcome his mortality by advancing technology like “cyborgism”.

3 MOTIVATION

In this work, the aim is to analyze the relationship between kids and movies that contain HCI technologies like haptic and visual feedback devices; and how these HCI technologies can increase the motivation and incentive of children to involve with them. On the other hand, misleading parts in movies regarding human limitations and how these might affect children will be discussed.

Firstly, an analysis based on the general influence of movies on the advancement of technology, specifically for HCI technologies will be made on the grounds that are provided by [2, 4]. Then our aim is to prove that HCI technologies that are used in the movies are inspirational for the scientist to develop new technologies, and they raise curiosity for the public on the basis on [3, 5, 6]. Secondly, the importance of science fiction or animations in children's understanding of scientific and technological issues has been discussed [8, 9, 10, 11]. Following these ground arguments, indeed, the one of the main motivations of this study is to describe the possible effects of HCI technologies in sci-fi movies on children. Some of these effects can be given as the fact that movies provide inspiration, curiosity and creativity for children to develop these technologies.

On contrary, the second major aim of this paper is to prove the argument of how technologies that are used in sci-fi movies might be non-realistic; therefore they might be misleading for children so that children should learn about human and technology limitations. As a starting discourse for this aim, the general negative effect of movies on public perception of technologies and scientists are mentioned in [14, 15, 16]. Then the goal is to link these misperceptions regarding technology, science [13], and specifically on children basis misperceptions and show an example of the HCI scene in movies in this context [12].

Consequently, starting from the most general argument which is the general influence of movies on people, and new technologies, we will try to specify our discourse. Our overall aim will be on specifically HCI elements in sci-fi movies and their effect on children, and how they motivate them. Finally, the focus will be on how children should be careful given the fact that technologies in movies might be misleading.

4 DISCUSSION

As today's technology continues to advance, new mediums for communication technologies are emerging and improving. One of the most widely used media platforms is without doubt movies. At some context, technology is highly influenced by movies as much as audiences and designers who are watching them [5]. Due to the intense interest of children in sci-fi films more than other genres, the positive or negative effects of sci-fi films on children should be well analyzed for child development.

4.1 Impacts of HCI Scenes on Children's Motivation of Technology

In context to the topic that is going to be discussed throughout the paper, it is suggested that scenes where people interact with technology in movies might affect children's development in a good way, such that they can motivate kids to develop novel technologies in the future. First of all, the effect of visual mediums such as movies, animations, and documentaries on education should be discussed since education is the most important factor to develop children's motivation for certain areas. In [10], Barak et al. discussed the effect of animated movies as a medium of communication regarding their effect on children's motivation to learn about scientific subjects. Also, as it is highlighted in [6], sci-fi movies like The Lawnmower Man (1992) can get the attention of public to the HCI topics like potential of Virtual Reality. Considering these two examples together, using HCI scenes in the movies can increase the motivation of children and their cognitive level about these technologies.

Another effect of sci-fi movies is increasing children's curiosity, perception of technology and creativity. A study that is made by Lin et al. [9] concluded that sci-fi movies can stimulate technological creativity in children. They mention that children that are exposed to sci-fi movies are better performing in regard to the performance of modeling, functioning, and technological creativity than others. Besides, Mubin et al. [3] evaluates science fiction as “the literature of ideas” and emphasizes that it is a source of inspiration for HCI research. It can be expected that the richness of ideas in sci-fi movies will be a source that feed the creative world of children. Consequently, students' increased motivation to learn HCI with sci-fi movies can also stimulate their creative side.

To support the claim, one quantitative example might be given based on the work [1]. In this work, after conducting an experiment regarding how elementary school students are affected by fantasy movies, several questions are addressed to students. In one question, students were asked whether fantasy films improve themselves, and, 11 of the 15 students (73.3%) who watch fantasy movies believed that these movies have contribution on them. Also, 44% of students also added that these movies improved their imagination.

Beyond the fact that sci-fi films increase children's creativity in developing HCI technologies, it should not be forgotten that today’s HCI products and studies were used in sci-fi films in the past. Moreover, one can argue [4] that HCI products that are used in movies will be useful for the research and development teams within the companies which are developing these products. Also, it is stated that audience can see products of latest technologies which are in development. According to Schmitz et al. [2], customer’s desire of HCI technologies that they saw in the movies, such as Star Wars and Star Trek, will increase. However, it is not possible to meet this demand in the near future. Although it is not possible to make the flawless and impressive interfaces seen in movies in a short time, it is impressive for future ideas. An interface using speech recognition is from a movie made in 1970, and an interface that listens and fulfills the commands of the user in the movie Star Trek [2] can be examples of that since speech recognition programs are started to be a part of our lives, even on our mobile phones. Therefore, it would not be wrong to say that sci-fi films will shed light on future technologies. If we consider that the children affected by these technologies will also be the scientists and engineers of the future, movies have a great impact on the children who will develop these products in the future.

The fact that the producers of some sci-fi films create scenarios in cooperation with academia and industry also plays a role in creating realistic expectations for the future. Examples such as director S. Spielberg's work with HCI scientists in Minority Report [17], shows that sci-fi movies drive more technology than we think. One of the most striking scenes in the movie, main character who wears technological gloves, is browsing among screens with hand gestures such as scrolling and dragging on transparent screen. Today, small and large-scale studies are conducted on whether we can communicate with the device by following the movement of gestures. As Du et al. [18] stated, Leap Motion Controller (Figure 1) can understand hand gestures well and today’s Leap Motion technology can provide many gestures like zooming, scrolling, rotating an object as it was seen in Minority Report. Therefore, it should not be forgotten that the subjects that children are affected by in the films created in cooperation with scientists can be a part of realistic plans and long-term research.

Figure 1: Tracking finger and hand motion with Leap Motion Controller. Photograph by Ultraleap, Inc. [Public domain], via Ultraleap. (https://www.ultraleap.com/product/leap-motion-controller/)

4.2 Children's Understanding of Human Limitations and Technology

High influence of sci-fi movies on children might affect them adversely. These undesirable effects on children may result in i) the psychological gap that may occur as a result of inability to distinguish reality from fiction, ii) children having unrealistic, false understanding of human limitations, iii) misinterpretation of HCI technologies.

Designing fictional stories need ignoring the applicability of technology and some limitations. Although this concept which contributes to fictionality, does not prevent scientist from working on these future technologies, it may contain potential risks in children's perception of these technologies. For instance, children cannot catch the difference between fiction and reality smoothly [1]. Children's inability to distinguish between fact and fiction in HCI technology scenes in sci-fi movies can leave them in a dilemma about the reality and imagination which has an important role in their development. It should not be forgotten that the ability to distinguish between reality and fiction is the first step towards developing the technologies of the future.

Movies, especially whose genres are science fiction, can convey scientific and technological subjects in an intuitive way. In an experiment [13], it is showed how a single film can result in students' perception of scientific subjects differently. Therefore, directors and producers should avoid misinterpretations of technologies for audience in the movies. Some scenes where humans interact with well-developed robots may cause fear in the perspective of audience because robots' wrong representations raises questions about the future of this technology as it is stated in [15, 16]. For example, the possibility of a child watching the movie Moneyball [19] being able to easily interpret his/her success in business life with computer programs should be taken into consideration. Children should be told that this computer program or other HCI technologies can be a part of our lives as a result of long-term studies.

Sci-fi movies such as Iron Man [20] and Minority Report [17], where we can see prototypes of future HCI technologies, have scenes such as technology and extraordinary powers that exceed human limits in order to leave an impression on their audience. Iron Man has a lot of motivating examples for HCI concepts with an inventor character directly communicating with technology, but at the same time, the superhero's immortal and extraordinary powers are reflected [12] in the audience. While such sci-fi movies have the positive effect of influencing the inventors, making them think about the possibility of the fictional HCI products as depicted in the film, like the invention of the combining AR and the robot arm developed by graduate student Natan Linder [12], they also might have harmful effects such as making unconscious children believe that they can seek immortality with technologies. The use of technologies, such as the durable clothes that superheroes wear, and the way they heal themselves, can be very impressive for children. At this point, the focus of children should be on more realistic engineering projects and possible future use of HCI technologies, rather than the extraordinary use of technology.

All in all, the impacts of movies with HCI scenes on children are analyzed. Then, several of examples of these technologies from different movies are provided. It is stated that children will have role to develop these technologies in future with the influence of movies. Nevertheless, they should be informed about the possible misunderstanding of human limitations.

5 CONCLUSION

As it is stated in the introduction, sci-fi movies containing HCI scenes are important for children to be affected by the development of new technologies and to take a role in developing these technologies in the future. However, these movies can have negative consequences for children, like misinterpretation of science and technology. Therefore, children should be made aware of human limits and needs in the development of these technologies.

Sci-fi movies, animations and documentaries have a serious impact on the development of children's perception of science and technology. Considering that children's interest in technology and their creativity level increase with the technology scenes in the movies, it is expected that they will have a role in the development of these technologies in the future. While explaining the possible effects of HCI technologies in sci-fi movies on children, children should be told that the “fiction” side is not realistic. Our focus is emphasizing that children should not be adversely affected by impossible technologies which can push our biological limits in movies.

To reiterate, movies are one of the primary media tools through which technological advances are conveyed to the public, and children are greatly affected by these technologies. The importance of documentaries and animations in children's perception of scientific issues is demonstrated by many examples [9, 11]. Considering that sci-fi movies activate the creative side of children, the impact of HCI scenes on children is inevitable, which affects a large part of society [6]. Also, taking into account that sci-fi movies are produced in collaboration with scientists and current research, it is likely that children's interest in developing these realistic HCI technologies, such as visual and haptic feedbacks, will increase over time. Nevertheless, it should not be forgotten that sci-fi movies contain many “unrealistic” and “fictional” scenes, and the audience is also very impressed by these scenes. For children, these unrealistic scenes can lead to misinterpretation of the use of technology. In order for children to be positively affected by the HCI scenes and contribute to these developments, they should be told about the limits and needs of humanity.

The significance of this work relies on the connection between motivation of children and HCI scenes. However, children should be aware of what is realistic, correct understanding of human limitation, and perception to create these novel technologies in future. To conclude, effects of HCI scenes are significant but they should be understood by children in the scope of human limitations.

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