THE INFLUENCE OF EMOTION WITH DIFFERENT LEVELS OF REALISMS OF ANIMATED TALKING-HEADS ON STUDENT PRONUNCIATION LEARNING IN COMMUNITY COLLAGES

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ABSTRACT This study aims to evaluate the influence of emotion with different levels of realism of animated talking-heads on student pronunciation learning. Emotional evaluation was made after students completed their learning based on courseware provided to them. Four animated talking-head courseware with various levels of realism were developed and tested. These models composed of unrealistic 3D (3D-NR) , realistic 3D (3D-R), 2D animated (2d) and real human (HUMAN) talking-head. A total of 150 students in a Semester 1 course for a Certificate in Creative Multimedia Animation at four Community Colleges were sampled for the study. overall, test scores of descriptive, linear regression and multiple linear regression analysis was used to answer the research questions. The results have shown that emotion is significant as a partial mediator in influencing student pronunciation learning based on realism levels of animated talking head.

KEYWORDS: animation; emotion; courseware; talking head; realism levels.

1 INTRODUCTION

The use of talking-head technology may spur student achievement and motivation, especially in properly pronouncing words (Wik & Hjalmarsso, 2009). This may be due in part to the fact that animated talking-heads, especially three-dimensional ones, generate interest in the student and have a positive impact on student memory (Ostermann & Liew, 2009). Moreover, talking-head animations have the potential to replace conventional audio instruction previously used in language education (Massaro, Liu, Chen & Perfetti, 2006). They also have been shown to activate both visual and verbal channels in student memory, compared to students who use audio tools that activate only verbal channels (Massaro, Bigler, Chen, Perlman & Ouni, 2008; Massaro et al., 2006). Using dual channels for dissemination of information has a positive impact on student learning when using talking-heads *(*Massaro et al., 2008; Massaro et al., 2006). However, in order to ensure that animated talking-heads have a maximum impact on student learning, realistic character animation must be a vital part of the design phase for animated instruction (Yang, Wang & Schneider, 2007). The “uncanny valley” phenomenon means that certain factors may lead to discomfort and disturbed emotions when students are confronted with an animated character that somewhat resembles an actual human (Piwek, Mckay & Pollick, 2014; Kaba, 2013; Tinwell, Grisnhaw & William, 2010). This phenomenon causes emotional issues such as fear, horror, or other negative reactions when a character has a highly realistic level of design (Geller, 2008). However, this effect is often not considered in the animation industry (Moore, 2012). For example, the somewhat realistic character animations of the movie *Final Fantasy* were one factor that led to its failure at the box office (Geller, 2008). This claim is supported by a study by Tinwell, Grisnhaw and William (2010), who determined that using realistic three-dimensional animated characters may lead to discomfort among video game players.

In general, levels of realism for three-dimensional characters are higher for real human figures compared to two-dimensional animated characters (Oddey & White, 2009). This means that people tend to be more emotionally comfortable with three-dimensional animated characters than two-dimensional animated characters in most animated productions (Oddey & White, 2009). However, impressions of realism may be more carefully controlled if characters are designed not to be too realistic (Ventrella, 2011). This principle may be seen in films such as *Shrek, The Incredibles* and *The Adventure of Tintin,* which were successful worldwide despite using three-dimensional characters that were not realistic (Kaba, 2013; Butler & Joshko, 2007). One then wonders whether these factors may also influence animation used in instruction. Most studies on levels of realism have focused on

entertainment rather than education (Brutcher, 2013). Therefore, it is important to have a study which examines the effects of levels of realism on teaching- and learning-based animation.

Some studies have examined the effects of real human characters with a more conventional appearance in order to mitigate factors present in teaching and learning animation. One such study by Tinwell, Grimshaw, Nabi and Williams (2011) found that using animated characters caused greater emotional distress than using actual human characters. Simply put, levels of realism must be seriously considered, especially when developing animated characters for use in instructional materials. This study will thus examine the appropriate level of realism for animated talking heads for learning the pronunciation of English words, especially from the perspective of student emotion. In order to achieve this, three prototype courseware products were developed, with a two-dimensional (2D) animated talking-head, a three-dimensional unrealistic talking-head (3D-NR) and a three-dimensional realistic talking-head (3D-R) for testing against various groups, as well a control group, to determine the influence of emotion on student pronunciation learning based on types on realism for animated talking heads.

2 THE UNCANNY VALLEY AND REALISM

In terms of theory, animated talking heads may provide both audio and visual channel stimulation during the learning process. Facial expressions and lip movements are processed through the visual and audio channels, while the text itself is processed through the verbal channel. However, meaningful instruction may be lost if animated characters are used improperly, just as cognitive burden may be reduced through the use of both visual and verbal channels. This is because the level of realism in animated characters affects the level of emotional comfort for students throughout the learning process, especially if they are very realistic (Tinwell, Grinshaw, Nabi & William, 2011). These effects may also impact the success of animation-based learning methods. Therefore, a study on the effects of realistic character animation on learning is important.

It is important to consider the so-called *Uncanny Valley* phenomenon, which is demonstrated in Figure 1. This phenomenon describes the relationship between various levels of character realism and human emotions (Mori, 2012). The *Uncanny* phenomenon was first described by a German psychologist, Enrst Jenstach in 1906 (Kaba, 2013). He determined that humans have difficulty determining if a visual is alive or resembles a human or an animal (Kaba, 2013). The *Uncanny* phenomenon was examined in depth by Sigmund Freud in 1919, and he determined that it only occurs when presented with *abnormal* human figures, corpses, or a disturbing atmosphere (Kaba, 2013). In modern times, the *Uncanny* phenomenon has been further investigated by Masahiro Mori in his book *Uncanny Valley* (MacDorman, 2005). The phenomenon specifically refers to levels of comfort that a character produces in human emotions. He created a graph to describe the theory as shown in Table 1 (Mori, 2012)**.**

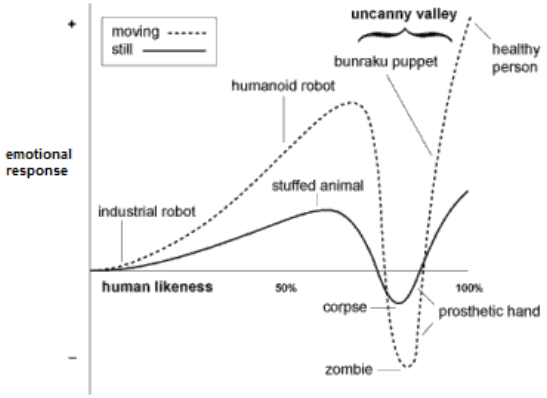

Figure 1. Phenomenon of the *Uncanny Valley*
Source: Mori, 2012

Based on Figure 1, the *Uncanny Valley* phenomenon may be divided into two main categories, namely dynamic and static characters. Findings from the graph show that when a figure is more like a human (*human likeness*), positive emotions tend to arise. The graphs show that human emotions tend to become negative when 80 to 85% realism is achieved. This dip is known as the Uncanny Valley.

The *Uncanny Valley* is also a factor in horror and fear as a character's facial design and expressions become more realistic or human-like (MacDorman, Green, Chin &, Koch, 2009). However, human emotions become positive again as the appearance becomes more like real people (Mori, 2012). Based on the graph, it may be said that the Uncanny Valley effect is stronger for moving or dynamic characters than static characters.

Although the phenomenon above has been developed to identify the impact of realism on robotics, it may also be used to analyze animated talking-head characters. This is because animated characters also have varying levels of realism by category or type (Mori, 2012). Due to this, it is important that designers avoid using animated characters that fall within the *Uncanny Valley*, especially for three-dimensional animated characters. If animation is to be used, it must not be too realistic, maintaining a character which is cartoon-like and two-dimensional.

3 THE EFFECT OF REALISTIC CHARACTER ANIMATION ON HUMAN EMOTIONS

Based on the *Uncanny Valley* phenomenon, many studies have examined the effects of realism of animated characters and real people. These studies have examined human acceptance of robot characters, real human characters, and realistic "android" robots which resemble humans more closely (Bartneck, Kanda, Ishiguro & Hagita, 2007). One such study was conducted at the University of Kyoto, Japan. The study was conducted on 58 respondents among the staff and students of the university. A questionnaire was distributed, which asked respondents to identify their levels of acceptance of three types of characters. The study found that the robot character had the highest level of acceptance, followed by human characters and then the android robots last, showing a very low acceptance level (Bartneck et al., 2007). The conclusions of that study indicate that the Uncanny Valley phenomenon may occur with a realistic character that resembles an actual human as well as human character which resembles robots. The study also discovered a related phenomenon known as the Uncanny Cliff (Bartneck et al., 2007). This occurs when very unrealistic robot characters had a high level of acceptance. The results of this study were rejected by Schoenherr and Lacroix (2013), who found that low levels of acceptance only applied to characters which were less than fully realistic. However, both studies were conducted with robots, leading to the question of whether realistic animations may have the same Uncanny Valley effect.

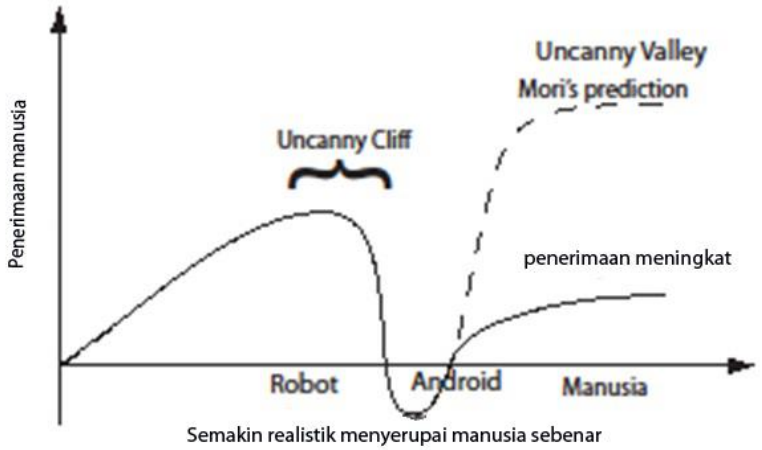

Figure 2. Acceptance of respondents to robots, androids, and real human characters (Bartneck, Kanda, Ishiguro & Hagita, 2007)

This question was answered in a study by Tinwell (2009), who examined student comfort level with 13 character types, including animated characters and real human characters. 13 video clips were shown to 65 students from the University of Bolton to identify their level of comfort with the videos. The videos contained two-dimensional character animation, three-dimensional character animation, or three-dimensional real human characters. The findings of the study are shown in Table 1 and Figure 3.

Table 1.Student comfort level for three-dimensional animated characters and real people

Character	Comfort level
Mario	8.4
Lara Croft	7.7
Sonic	7.6
The Warrior	7.5
Emily	7.4
Sackboy	7.0
B. Kibbitz	6.9
Human	6.7
A.Shepherd	6.7
Zombie 2	6.1
Mary Smith	5.9
Zombie 1	5.3
Chatbot	3.2

(Tinwell, 2009)

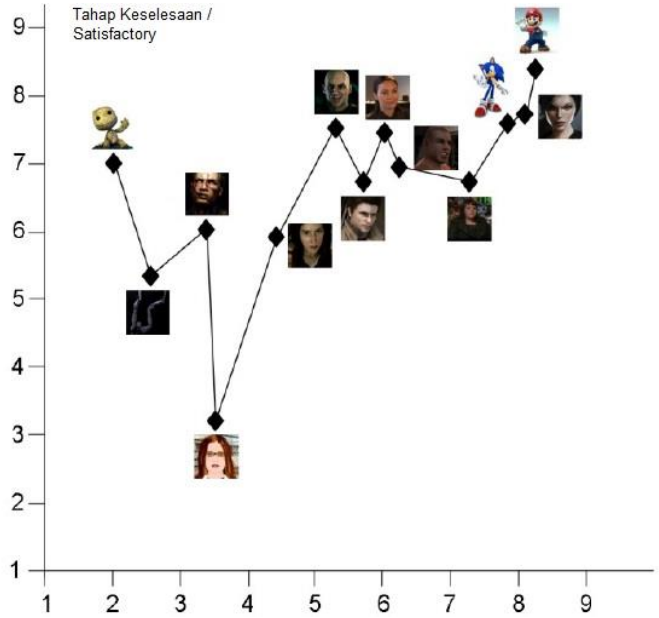

Figure 3. Student comfort level for video-based 3D character animations and real people (Tinwell, 2009)

Based on Table 1 and Figure 3, the characters of *Chatbot* (score= 3.2), *Zombie* (score= 5.3) and *Mary Smith* (score = 5.9) received the lowest score in terms of student comfort. This is because the *Chatbot* and *Mary Smith* characters were realistic three-dimensional animated characters, while the *Zombie* character was a horror character (Tinwell, 2009). However, this did not occur with the character *Lara Croft*, which had a high level of realism, where students reported a high level of comfort. This may be because the character is well known and popular in electronic media (Tinwell, 2009). Additionally, the study shows that real humans had an average score (score= 6.7). An attempt to extend the study was continued with 15 types of characters. The findings obtained similar results to the first, indicating that high levels of realism have a strong impact on audience discomfort (Tinwell & Grimshaw, 2009).

The contribution of the three studies above shows that a high level of realism in characters has a stronger emotional impact on humans, especially for three-dimensional animated characters (Tinwell, 2009). However, if the character is already well-known, there is an opposing effect, as demonstrated by *Lara Croft* (Tinwell, 2009). Also, the use of characters such as *Sonic,* which are

unrealistic and do not resemble real human characters, leads to higher comfort among students (Tinwell et al., 2009; Tinwell, 2009).

4 INFLUENCE OF EMOTIONS ON INSTRUCTION

The importance of emotions during the learning process must be considered to ensure that students receive quality instruction, especially inside the classroom. This is because emotional distress may have a negative impact on the learning processes (Goleman, 1998). This will lead to negative implications for overall academic achievement. To address these problems, many studies have been conducted on student emotions as they relate to emotional intelligence or EQ (Goleman, 1996). EQ refers to the ability of students to regulate their own emotions (Norshahril, 2011). Goleman (1996) has stated that EQ is more important than intellectual intelligence or IQ. Therefore, the influence that emotions have on learning processes is important to be addressed (Pekrun, Goetz, Frenzel, Barchfeld & Perry, 2011). Whenever a student feels negative emotions, such as worry or fear, this may impair the cognitive process (Kensinger & Corkin, 2003). This can potentially lead to a decline in student performance (Ruthing et al., 2011). However, some studies have ruled out the claim that student emotions have an effect on student performance. One study conducted on Bachelor of Engineering students at University Tun Hussein Onn indicated that students with negative emotions had better test results than those reporting more positive emotions (Mohd Rakimie, 2002). Even so, most studies have confirmed that emotional factors do have a contributing effect on influencing student achievement. Based on a study by Pekrun et al. (2011), emotions contribute to four main factors influencing student performance, namely affective, cognitive, motivational, and physiological. For example, if a student is worried during the learning processes, each of these four factors will affect their performance (Pekrun, 2011). The affective factor makes students feel uncomfortable with studying, while the cognitive factor leads to information not being processed properly by students. The motivational factor means students may tend to avoid studying, and the physiological factor makes the student feel that they are not suited to study (Pekrun et al., 2011). Based on these studies, a questionnaire known as AEQ has been designed to evaluate student performance during the learning processes (Pekrun et al., 2011). The model was developed based on the *Circumplex* model, which is a well-known model of emotion (Feldman Barrett & Russell, 1998; Linnenbrink, 2007). Therefore, this questionnaire is often used in evaluating student emotions and their effects.

In general, it may be concluded that emotions play a key role in student achievement. The Uncanny Valley phenomenon occurs when students are faced with factors related to the realism level of a character, and may disrupt the emotions of students in a negative way. Although many studies have examined the Uncanny Valley and its effect on emotions, these studies have not clearly described the instruments they used. Accordingly, it is important that a study examines the level of emotions generated by realistic characters in terms of widely-used, valid and reliable instruments such as AEQ.

5 METHODOLOGY

5.1 Study Objectives

Based on a strategy of using animation with varying levels of realism, this study seeks to identify the effect of emotion as a mediator in influencing student pronunciation learning based on realism levels of animated talking head in language study. Therefore, the hypothesis of this study is as follows:

Ha1. There is a significance of emotion as a mediator in influencing student pronunciation learning based on realism levels of animated talking heads 2D, 3D-NR, 3D-R and HUMAN.

6 PROTOTYPE COURSEWARE FOR ANIMATED TALKING-HEADS

The development of animated courseware with talking-heads has followed the principles which have been established in the field of multimedia Human Computer Interaction (HCI). These principles are designed to ensure efficient interaction between the user in terms of instructional materials that are developed to make sure that information is effectively provided to users (Ahmad Zamzuri, Laili & Syamsulaini, 2012). The talking-head prototype animation here started with an introductory screen.

From the intro screen, students are able to choose to continue to the main menu, help menu, or courseware objectives.

After students select a word, the screen displays an animated character talking-head pronouncing the word along with the *syllable breaks* in the word (example: Pro.nun.ci.a.tion). After that, students are shown an animated character talking-head which pronounces the word fully (example: Pronunciation). Then, students are shown the meaning of the word on the next screen. After completing the learning session, students may repeat the process or choose another word. Additionally, the talking-head prototype has been developed with a combination of linear navigation and hierarchical navigation. Linear navigation consists of a sequential structure (Faraq & Shamy, 2011). This lets students proceed step by step from their word choice until the character animation says the word. The navigational hierarchy also allows students to return to the main menu to choose a new word or repeat already studied words (Lee & Olson, 2005). The animated talking-head courseware strongly supports effective learning strategies (Rozinah, 2005). Essentially, the differences between the four courseware solutions examined are as follows:

a) Two-dimensional (2D) animated character talking-head

This strategy uses 2D animated characters with both text and audio spoken by the animated character.

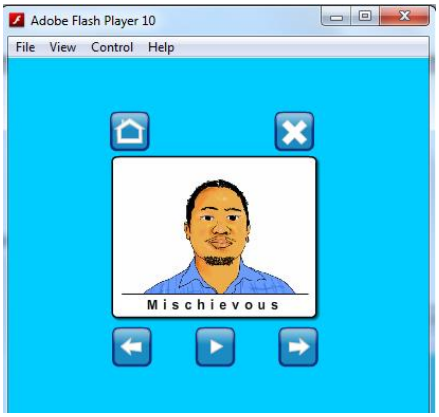

Figure 4. Example of a two-dimensional character

b) Three-dimensional non-realistic (3D-NR) animated character talking-head

This strategy uses 3D animated non-realistic characters with both text and audio spoken by the animated character.

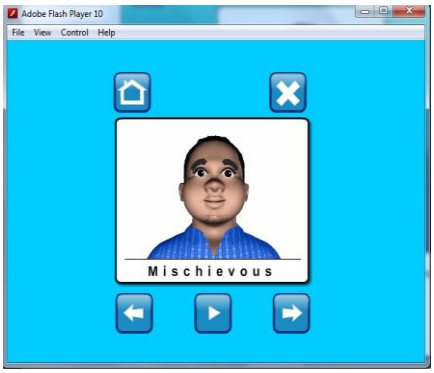

Figure 5 Example of three-dimensional non-realistic character

c) Three-dimensional realistic (3D-R) animated character talking head

This strategy uses 3D animated characters with a realism level closer to human to display both text and audio spoken by the animated character.

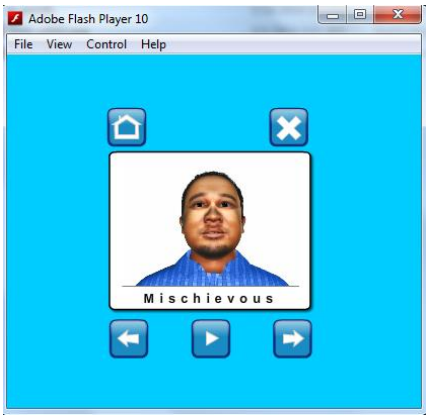

Figure 6 Example of three-dimensional realistic character

d) Human talking-head (HUMAN)

This strategy uses a real human face and voice to display both text and spoken audio.

Figure 7. Example of three-dimensional realistic character

STUDY SAMPLE

The sample for this study consists of students in their first semester of a Creative Multimedia Animation Certificate course from 4 community colleges (Creswell, 2012). The samples were chosen based on existing community college groups. 150 people were used for this study.

7 STUDY INSTRUMENTS

The study instruments are the tools used to obtain data from the sample. As per Mohd Najib (2003), instruments used will help determine the type of data collected and influence research analysis. The instruments used in this study are intended to analyze emotion. Student emotion was assessed using the *Achievement Emotions Questionnaire* (AEQ). The questionnaire was developed by psychologists to determine the effect of emotions on student achievement (Pekrun, Goetz, Frenzel, Barchfeld & Perry, 2011). The AEQ questionnaire is divided into three sections, namely dealing with emotions in the classroom, emotions in studying and emotions during tests (Pekrun et al., 2011). For this study, a questionnaire about learning and emotions has been used. This is because the questionnaire may be used to achieve the goal of the study to examine the emotions of students during the learning processes, especially when students are using courseware with animated talking-heads. The results of each item have shown Cronbach's Alpha values greater than 0.7 ($\alpha > 0.7$) (Pekrun et al., 2011). Additionally, the validity of each item has been confirmed by several experts through qualitative research (Pekrun, Goetz, Titz & Perry, 2002). Due to the advantages of high validity and reliability of this questionnaire, it has been used in several studies relating to emotions and the learning process.

As the AEQ questionnaire was first developed in English, it has been translated into a bilingual English and Bahasa Malaysia format. The translation was evaluated and approved by a psychologist with academic qualifications in psychology and sourced from an academic staff from a university.

Emotional assessment of students was carried out both before and after interaction with the animated talking-head courseware. The two questionnaires both contain different questions concerning the emotions of the students before learning began and also during and after the study. The questionnaire used before learning consists of 14 items while the questionnaire for after learning consists of 60 items. The questions consist of both positive and negative emotions. The Likert scale was used to determine the level of acceptance for each item. The total score was based on the level of agreement for each item as calculated according to the evaluation of student emotion. Before carrying out the analysis, negative items were coded as follows to obtain a total overall score.

Table 2. Value scale for before and after recode

Original value	Value after recode
1	5
2	4
3	3
4	2
5	1

Source: Levesque (2006)

8 STUDY PROCEDURE

This study used a quasi-experimental design with a pre-test and post-test. The study involved four student groups from a Creative Multimedia Animation Certificate course. The implementation of the study was managed by independent lecturers from each Community College. A briefing was provided to the lecturers before the study was conducted. A pre-test was conducted to determine prior knowledge of the selected sample. The pre-test also examined the emotions of the students. After the pre-test, students were instructed to explore the courseware installed on each student computer in the lab. Researchers first explained the courseware to the students, after which the students learned for 25 minutes in the laboratory. The post-test evaluation was carried out after the students completed the self-study activities. The implementation of this process was carried out by the Community College's independent lecturers.

9 DATA ANALYSIS

Overall, the descriptive analysis, linear regression analysis and multiple linear regression analysis were used to answer the research questions.

Table 3. Summary of Mean score descriptive analysis of pronunciation test

Level of Realism	N	Mean	SD
3D-R	38	71.48	8.38
HUMAN	37	73.82	7.64
2D	38	72.88	6.62
3D-TR	37	76.50	5.36

The results of descriptive analysis show that the 3D-NR group showed the best pronunciation performance of the mean scores at (M=76.50, SE= 5.36), followed by, HUMAN (M=73.82, SE = 7.64), 2D (M=72.88, SE =6.66) and 3D-R (M= 71.48, SE =5.36). Meanwhile the analysis of emotional test shows that the 3D-NR group has the highest positive emotion of the mean score at (M=226.34, SE= 3.21), followed by 2D (M=225.16. SD = 3.13), HUMAN (M=223.40, SE = 3.26), and 3D-R (M= 210.86, SE =3.12).

Table 4. Summary of Mean score descriptive analysis of emotion test

Level of Realism	**N**	**Mean**	**SD**
3D-R	38	210.86	3.12
HUMAN	37	223.40	3.26
2D	38	225.16[a]	3.13
3D-TR	37	226.34[a]	3.21

The method recommended by Baron and Kenny (1986) was used to answer the research question, which is to identify the mediator effect of 'student's emotions' on the relationship between the realism level and the performance in the pronunciation test. Baron and Kenny (1986) proposed four conditions to test the effects of mediators as follows:

1. The independent variable (IV) must affect the dependent variable (DV) (ß1 must be significant).
2. The independent variable (IV) must affect the mediator variable (MV) (ß1 must be significant).
3. The mediator variable (MV) must affect the dependent variable (DV) (ß1 must be significant).
4. To declare that the mediator variable (MV) acts as fully mediator on the relationship between the independent variables (IV) with the dependent variable (DV), the impact of independent variables (IV) on the dependent variable (DV) is 0 or ß4 not significant. While a partial mediator exists when ß4 is significant but the significance value is decreased.

The results of three conditions from four conditions are shown in Table 5. The analysis found a positive relationship between the independent variables (the level of realistic) with the dependent variable (students' pronunciation performance), which is significant with the regression coefficient (ß = 0.25). This indicates the level of realism affects 6 percent ($R^2 = 0.06$) in influencing students' pronunciation performance. Thus, the first condition is fulfilled.

The second condition is to identify the relationship between the independent variables (the level of realistic) with the mediator variable (emotional students). The results show that the relationship between these two variables is significant with the regression coefficient (ß = 0.21). This indicates that the level the level of realism affects 4 percent ($R^2 = 0.04$) student emotions. Thus, the first condition is fulfilled.

The third condition is to identify the relationship between the mediator variable (students' emotion) with the dependent variable (students' pronunciation performance). The results show that the relationship between these two variables is significant with the regression coefficient (ß = 0.30). This suggests that emotions affect students' emotion by 9 percent ($R^2 = 0.09$) in the student test performance. Thus, the third condition is fulfilled.

Table 5. Regression analysis requirements mediator

	B	SE B	ß	sig
First condition				
Level of realism– student test performance	1.60	0.52	0.25	0.00
Second condition				
Level of realism – Student emotion	4.13	1.59	0.21	0.01
Third condition				
Student emotion – student test performance	0.10	0.03	0.30	0.00

Notes:
B= *Unstandardized coefficient beta*; SEB= *Standard error of regression coefficient*ß= Beta coefficient

Previous analysis has shown that realism levels do influence student's emotions and pronunciation test performance, while student's emotions also influence the results of the pronunciation test. This indicates the possibility of mediating effects of student's emotions on the relationship between the realism level and results of the student's pronunciation test. In other words, there is probably an indirect relationship between the realism level and performance in the pronunciation test and a direct relationship with student's emotions. In order to test the effect of the mediator, the last regression test, which is the multiple linear regression test, was carried out using the realism levels and student's emotions as independent variables and the performance in the pronunciation test as the dependent variable to demonstrate the effect of the mediator variable in this study.

Table 6 below shows the results of the multiple regression analysis used to identify the mediator effect of student's emotions on the relationship between the realism level and the performance in the pronunciation test. This analysis was used to test the fourth condition that determines the mediator effect. Before the multiple regression analysis was conducted, the basic requirements such as the normality, linearity, the extreme values and multicollinearity must adhere to the conditions. The results of the analysis show that the realism level influences the performance of the pronunciation test in Step 1. In Step 2, the mediator variable (student's emotions) was introduced in the regression calculations as an independent variable. The presence of the mediator variable (student's emotions) in Step 2 had caused the regression coefficient value (ß) of the independent variable, which is the realism level, to experience a reduction in value from 0.25 to 0.20 after the mediator variable (student's emotion) was introduced. This indicates the existence of a partial mediator effect in the relationship between the independent variable and the dependent variable. Besides that, the value ($R^2 = 0.12$) after the introduction of 'emotions' had influenced the performance in the pronunciation test (12%) compared to before the 'emotions' was introduced (6% or $R^2 = 0.06$). Hence, it could be concluded that student's emotions is a significant mediator in the relationship between the various realism levels of the talking-head animation (Ha4 is accepted). This shows the indirect effect of realism levels on the performance in the pronunciation test and the direct effect with the presence of student's emotions. Thus, the regression model obtained from this analysis is:

Student Pronunciation test perfomance = 52.01 + 1.26 (level of realism) + 0.08 (Student emotion)

Table 6
Four condition - The mediator effect of student's emotions on the relationship between the realism level and the performance in the pronunciation test.

Dependent variable (DV)	**Variables**	**First step**			**Second step**			**Sig**	**Mediator effect**
Student pronunciation test performance		Constant value	Beta	ß	Constant value	Beta	ß		Partial Mediator
	Independent variable (IV) level of realism	69.68	1.60	**0.25**	52.10	1.26	**0.20**	0.015	
	Mediator Variable (MV) Student emotion					.08	0.25	0.00	
	R	0.26			0.35				
	R^2	**0.06**			**0.12**				
	F	9.61			10.22				

9 DISCUSSION

Overall, the pronunciation and emotional tests showed that the group of students in the 3D-NR realism level obtained the best mean score among the groups of students, while the students in the 3D-R animated character realism level had the lowest score. This is due to several factors; among them is the 3D-NR animated character design, which is attractive, non-realistic and very cartoon-like (Butler & Jashko, 2007). This is further substantiated by studies that have shown a majority of students preferring the 3D-NR animated character (Mohd Najib & Ahmad Zamzuri, 2014). This factor has a great potential to evoke positive human emotions during and after watching these characters (Butler & Jashko, 2007). The findings of this study are portrayed in the success of *Shrek* and *The Incredibles*, which were found to positively touch on the emotions of viewers by using cartoon-like 3D animated characters for most of the films' characters (Butler & Jashko, 2007). In addition, a study by Tinwell (2009) revealed similar findings when *Mario* and *Sonic* characters, which were 3D-NR animated characters, were well received by students who were video game enthusiasts. Saygin, Charminade and Ishiguro (2010) further substantiated this when they concluded that a non-realistic character design would reduce the burden of cognitive activities in the student's brain cells compared to the effect of a realistic character.

This situation is different from the 3D-R group of students who used the talking-head realistic character design, which was similar to actual humans. This factor could have caused the group of students in the 3D-R realism level mode to obtain the lowest mean score in the pronunciation test compared to other groups of students exposed to varying levels of realism. Hence, the question is, why does the realistic character factor have the potential to influence the formation of mental models in the working memory when talking-head animated learning involves the use of visual and verbal channels that have the potential to lower the working memory's cognitive burden?

Therefore, the findings of this study show that the realism level of animated characters does have a 6% (R^2=0.06) influence in ensuring the pronunciation performance of students. Meanwhile, the presence of emotions as a mediating variable together with the realism level of animated characters has enhanced the influence by 12 % (R^2 = 0.12). The increase in percentage indicates that the combination of the animated character's realism level and emotions has a greater influence on the pronunciation performance compared to only the animated character's realism level. The findings also show the existence of a partial mediating effect, which is the 'student's emotion', in the relationship between the animated character's realism level and the level of pronunciation. Hence, the findings of this study support the findings of Brutcher (2013), in which the effect of the *Uncanny Valley* phenomenon had influenced the 'student's emotions' and thus, has the potential to affect the student's learning. Therefore, based on the regression model that was obtained from the analysis, a projection of the student's learning performance could be determined based on the chosen animated character's realism level and the student's emotional test scores.

Student Pronunciation test perfomance = 52.01 + 1.26 (level of realism) + 0.08 (Student emotion)

However, this regression model only affects 12 percent (R^2 = 0.12) of the pronunciation test result and this value is still small. Therefore, more research needs to be carried out to identify other factors to increase the percentage of regression model.

The use of real human character is still considered to be conventional and less attractive from the learning aspect (Hyde, 2014). However, this study shows that the group of students in the HUMAN realistic level has received the second highest score of pronunciation test among all groups of students who receive a realistic level of strategy animated talking-head. This is because human character is free from the realistic (Mori, 2012). The analysis results are in line with the findings of Liu et al. (2011), which show that the performance of students who use the term real human characters and unrealistic three-dimensional animated characters showed no significant difference. In addition, the factor in the study of human character selection also likely contributes to the improved performance of a reference group of students in this mode. This is because the HUMAN character selected in this study is typical Malaysian. In this regard, the question arose whether the same results will be obtained, if the character is selected is

not a typical Malaysian character. This is because race is one of the factors that could contribute to the level of realism. Further studies on this issue are needed to answer this question.

Based on development of design technology of animated characters, three-dimensional technology is seen to be more widely used compared to the two-dimensional technologies that are more traditional (Decanters, 2011). Thus, progress has led to the obsoleteness of two-dimensional animated characters design technology compared to the design technology of three-dimensional animated characters, which are more attractive and perfect in terms of the design of anatomical characters developed (Wang et al, 2012; Ostermann & Liew, 2009). Hence, these factors are likely produce a better result on the pronunciation test of the group of students in the 3D-TR realistic level than that of the realistic 2D group. However, 2D animation characters that are not realistic can also potentially help learning. The finding is consistent with the study of Cosker et al. (2005) which found that the use of three-dimensional animated characters as talking-head characters for the learning process is more effective than the use of two-dimensional animated characters, which are less effective in terms of character design and producing a perfect lip sync movement.

11 CONCLUSION

The results of this study show that 3D-R group of students suffers from the Uncanny Valley phenomenon that has caused them to have less positive emotion than other students. Therefore, this study recommends the use of talking-head 3D-NR, 2D, and HUMAN figures so as not to disturb student emotions during the learning process. The use of realistic 3D-R characters should be avoided in order to prevent problems with the Uncanny Valley when designing instructional materials that employ a *talking-head*. This is true because student emotions are an important element as a potential predictor and mediator in determining student achievement on pronunciation learning.

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