

DEVELOPMENT OF A HEXAGON AESTHETIC
USER EXPERIENCE MODEL FOR
AUGMENTED REALITY
COMICS

MOHD EKRAM AL HAFIS BIN HASHIM

UNIVERSITI PENDIDIKAN SULTAN IDRIS

2022

DEVELOPMENT OF A HEXAGON AESTHETIC USER EXPERIENCE MODEL
FOR AUGMENTED REALITY COMICS

MOHD EKRAM AL HAFIS BIN HASHIM

THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR
DEGREE OF DOCTOR OF PHILOSOPHY

FAKULTI SENI, KOMPUTERAN DAN INDUSTRI KREATIF
UNIVERSITI PENDIDIKAN SULTAN IDRIS

2022



ACKNOWLEDGEMENT

After almost three years of conducting this research in order to meet the needs of PhD studies, it finally be completed. I want to grasp this opportunity to express my respect to my main supervisors who have always provided invaluable knowledge, experience and time throughout the process of completing this study. Not forgetting also to my second supervisor who was very accommodating in terms of data analysis and provided good references.

This appreciation is also extended to the sponsor that supported me in this study, namely Sultan Idris Education University (UPSI) and the Ministry of Higher Education (MOE). Not forgetting the entire faculty management (FSKIK) and the Creative Multimedia Department in particular who always provide the best support.

This appreciation is also dedicated to my wife and daughters who have always been encouraging in the process of completing my PhD study. Without their enthusiasm this study may not be possible.

Finally, to all parties involved in this study, especially the Malaysian comic industry, developers of augmented reality technology, artivive applications and colleagues, thank you and good luck.





ABSTRACT

This study aims to examine the potential of synergising models from two different theories, known as aesthetic experience (AX) and user experience (UX), which highlight a sizeable theoretical gap for augmented reality comics (AR comics). Thus, a new model called aesthetic user experience (AUX) was purposed in this study. Design Development Research (DDR) model was adapted through research design in this study. Two evaluation phases namely Fuzzy Delphi Method (FDM) and Structural Equation Model (SEM) were used to develop and to test the constructs and elements. Five experts from comics and five experts from AR were selected to obtain the initial AUX constructs. The analysis was conducted based on FDM conditions: threshold, $d \leq 0.2$, expert consensus percentage $> 70\%$ and fuzzy score, $A_{max} > 0.5$. The FDM results have established seven constructs namely storytelling, amusement, harmony, inspiration, incentive, mindfulness and efficiency. Model validation was performed using SEM through confirmatory factor analysis (CFA). A total of 193 samples ($n = 193$) comprised of generation Y and millennials (born in 1982–2010) who had knowledge in the creative fields and information technology were selected. This analysis is based on the condition of model fit in CFA: factor loading $\lambda > 0.7$, $df < 5.0$, CFI and TLI > 0.8 , RMSEA > 0.05 to 0.09 and convergent validity (AVE) > 0.45 . The CFA analysis confirmed six constructs namely storytelling, amusement, harmony, inspiration, mindfulness and efficiency, hence the name hexagon AUX model. The new proposed model has immense implications for emerging areas of art and technology. Potential applications for the hexagon AUX models can be extended beyond VR comic such as VR drawing, AR painting and immersive digital art installation.





PEMBANGUNAN MODEL PENGALAMAN PENGGUNA ESTETIK HEKSAGON UNTUK KOMIK REALITI TERIMBUH

ABSTRAK

Kajian ini bertujuan untuk mengkaji potensi integrasi model dari dua teori yang berbeza, yang dikenali sebagai pengalaman estetik (AX) dan pengalaman pengguna (UX), yang menonjolkan jurang teori yang cukup besar untuk komik reality terimbu (augmented reality comics-AR comics). Oleh itu, model baharu yang dipanggil *aesthetic user experience* (AUX) dicadangkan dalam kajian ini. Model *Design Development Research* (DDR) telah diadaptasi melalui reka bentuk kajian dalam kajian ini. Dua fasa penilaian iaitu Kaedah *fuzzy delphi method* (FDM) dan *structural equation model* (SEM) digunakan untuk membangun dan menguji konstruk dan elemen. Lima pakar dari komik dan lima pakar dari AR telah dipilih untuk mendapatkan model awal AUX. Analisis dijalankan berdasarkan persetujuan FDM: threshold, $d \leq 0.2$, peratusan konsensus pakar $> 70\%$ dan skor fuzzy, $A_{max} > 0.5$. Hasil FDM telah membentuk tujuh konstruk iaitu *storytelling*, *amusement*, *harmony*, *inspiration*, *incentive*, *mindfulness* dan *efficiency*. Pengesahan model dilakukan menggunakan SEM melalui analisis faktor pengesahan (CFA). Sebanyak 193 sampel ($n = 193$) terdiri daripada generasi Y dan milenium (lahir pada 1982–2010) yang mempunyai pengetahuan dalam bidang kreatif dan teknologi maklumat telah dipilih. Analisis ini berdasarkan keadaan model sesuai dalam CFA: factor loading $\lambda > 0.7$, $df < 5.0$, CFI dan TLI > 0.8 , RMSEA > 0.05 hingga 0.09 dan convergent validity (AVE) > 0.45 . Analisis CFA mengesahkan enam konstruk iaitu *storytelling*, *amusement*, *harmony*, *inspiration*, *mindfulness* dan *efficiency*, dan dinamakan *the hexagon of AUX* model. Model baru yang dicadangkan mempunyai implikasi yang besar untuk bidang integrasi seni dan teknologi. Aplikasi yang berpotensi untuk model *hexagon AUX* dapat diperluas di luar konteks komik seperti lukisan VR, lukisan AR dan seni installasi.



TABLE OF CONTENT

	Page
DECLARATION OF ORIGINAL WORK	ii
DECLARATION OF THESIS	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENT	vii
LIST OF TABLES	xi
LIST OF FIGURES	xvi
CHAPTER 1 INTRODUCTION	
1.1 Research background	1
1.2 Problem statement	4
1.3 Research objective	10
1.4 Research question	10
1.5 Hypothesis	10
1.6 Conceptual framework	12
1.7 Significant of research	14
1.8 Limitation of research	15
1.9 Operational definition	15



CHAPTER 2 LITERATURE REVIEW

2.1 Introduction	17
2.2 Human experience in HCI	18
2.2.1 User experience (UX) concept	20
2.2.3 Model of UX	24
2.2.4 Multi-layered mobile augmented reality	27
2.2.5 UX for augmented reality	31
2.2.6 The elements of UX	37
2.3 Aesthetic experience (AX)	40
2.3.1 Model of AX	45
2.3.2 Model of aesthetic appreciation and judgment	49
2.3.3 Components of AX	53
2.3.4 The Elements of AX	60
2.4 Emotion	66
2.5 Comic	70
2.5.1 Digital comics	76
2.5.2 Interactive comics	79
2.5.3 Motion comics	81
2.6 Mix reality (MR)	84
2.7 Augmented reality (AR)	86
2.8 Design development research (DDR)	93



CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction	100
3.2 Research Design	101
3.2.1 First Phase: Synergise phase	103
3.2.2 Second Phase: Develop phase	104
3.2.3 Third Phase: Validate phase	104
3.3 Stimulus	105
3.4 The procedure for selecting respondents	105
3.4.1 Experts phase respondents	105
3.4.2 Validate phase respondents	106
3.5 The procedure of fuzzy delphi method (FDM)	107
3.5.1 Formulation of FDM questionnaire elements	107
3.5.2 The implementation process of FDM	108
3.6 Factor analysis procedure	111
3.7 Structural equation model (SEM)	113
3.8 Questionnaires and respondents	116
3.9 Summarise	117

CHAPTER 4 FUZZY DELPHI METHOD (FDM) ANALYSIS

4.1 Introduction	119
4.2 research question 1	125
4.3 AUX model formulation	141
4.4 The Heptagon of Aesthetic User Experience (AUX)	147

CHAPTER 5 AR COMIC DEVELOPMENT

5.1 Introduction	150
5.2 research question 3	151
5.3 Comics selection phase	152
5.4 Animation development	
5.4.1 Pre- production	155
5.4.2 Production	157
5.4.3 Post- production	161
5.4.4 AR comics development	163

CHAPTER 6 CONFIRMATORY FACTOR ANALYSIS (CFA)

6.1 Introduction	166
6.2 Model Process Evaluation	167
6.3 Model evaluation study: Demographical respondents	170
6.4 Reliability analysis	174
6.5 Research question 4	180
6.5.1 Storytelling Construct Analysis	181
6.5.2 Amusement Construct Analysis	185
6.5.3 Harmony Construct Analysis	188
6.5.4 Inspiration Construct Analysis	191
6.5.5 Incentive Construct Analysis	194
6.5.6 Mindfulness Construct Analysis	197
6.5.7 Efficiency Construct Analysis	200
6.6 Multiple Factor Analysis	203
6.7 Research Question 5	206
6.8 The Hexagon of Aesthetic User Experience (AUX) model	20

CHAPTER 7 DISCUSSION, SUGGESTION AND CONCLUSION

7.1 Introduction	212
7.2 Discussion of phase 1 study findings	213
7.3 The Heptagon of AUX model	217
7.4 Discussion of phase 2 study findings	218
7.5 Discussion of phase 3 Study findings	220
7.6 Discussion of the comparison between the Heptagon of AUX model and The Hexagon of AUX model	226
7.7 Implications of the AUX model on theory	232
7.8 Research contribution	234
7.8.1 Academic contribution	234
7.8.2 Industry contribution	235
7.8.3 Theoretical contribution	236
7.9 Limitation and recommendation for future research	236
7.10 Conclusion	238
REFERENCE	239
APPENDIX	256

LISTS OF TABLE

Table No		Page
1	The relationship between research objective and research question	11
2	Summary of the previous UX model by Hassenzahl (2007), Irshad&Rambli (2016) and Ritos (2011)	36
2.1	Summary of the characteristics of expected mobile augmented reality user experience (Olsson and Mattila,2011)	37
2.2	Summary of the previous AX model by Redies (2007), Leder et al., (2004) and Markovic (2012)	59
2.3	Breyfogle in Klaehn (2015) aesthetics principle of comics and aesthetics response	62
2.4	A selection of lists essential or fundamental of emotions (Ortony & Turner,1990)	67
2.5	Advance emotion, compose of emotion and advance opposite emotion, (Plutchik, 1980).	68
2.6	Categorises emotions: primary emotion, secondary emotion and tertiary emotion (Parrot, 2001)	69
3	MR proses of construct and element of AX and UX	102
3.1	Seven-level fuzzy scale of consensus (Jamil et al., 2014)	110
3.2	3.2 Likert scale level for factor analysis	117
4	The activity and research question of FDM analysis	120
4.1	The MR on the previous model of AX	121
4.2	The MR on the previous model of UX	122
4.3	The construct and elements of AX in comics	123
4.4	The construct and elements of UX in AR	123
4.5	Threshold value (d) and percentage consensus for AX construct (amusement)	125

4.6	Overall of the threshold value (d) and percentage consensus for AX construct (amusement)	126
4.7	Threshold value (d) and percentage consensus for AX construct (Paradox of tragedy)	126
4.8	Overall threshold value (d) and percentage consensus of AX construct (Paradox of tragedy)	127
4.9	Threshold value (d) and percentage consensus for AX construct (Mental jolt)	127
4.10	Overall threshold value (d) and percentage consensus for AX construct (Mental jolt)	128
4.11	Overall threshold value (d) and percentage consensus of AX construct (Harmony)	128
4.12	Threshold value (d) and percentage consensus for AX construct (Storytelling clarity)	129
4.13	Overall threshold value (d) and percentage consensus for AX construct (Storytelling clarity)	129
4.14	Threshold value (d) and percentage consensus for UX construct (Tangibility)	130
4.15	Threshold value (d) and percentage consensus for UX construct (Intuitiveness)	130
4.16	Overall threshold value (d) and percentage consensus for UX construct (Intuitiveness)	131
4.17	Threshold value (d) and percentage consensus for UX construct (Captivation)	131
4.18	Overall threshold value (d) and percentage consensus for UX construct (Captivation)	132
4.19	Threshold value (d) and percentage consensus for UX construct (Playfulness & entertainment)	132
4.20	Overall threshold value (d) and percentage consensus for UX construct (Playfulness & entertainment)	133

4.21	Threshold value (d) and percentage consensus for UX construct (Meaningfulness)	133
4.22	Overall threshold value (d) and percentage consensus for UX construct (Meaningfulness)	134
4.23	Threshold value (d) and percentage consensus for UX construct (Liveliness)	134
4.24	Overall threshold value (d) and percentage consensus for UX construct (Liveliness)	135
4.25	Threshold value (d) and percentage consensus for UX construct (Creativity)	135
4.26	Overall threshold value (d) and percentage consensus of UX construct (Creativity)	136
4.27	Threshold value (d) and percentage consensus of UX construct (Motivation)	136
4.28	Overall threshold value (d) and percentage consensus of UX construct (Motivation)	137
4.29	Threshold value (d) and percentage consensus of UX construct (Inspiration)	137
4.30	Overall threshold value (d) and percentage consensus of UX construct (Inspiration)	138
4.31	Threshold value (d) and percentage consensus of UX construct (Increase awareness)	138
4.32	Overall threshold value (d) and percentage consensus of UX construct (Increase awareness)	139
4.33	Threshold value (d) and percentage consensus of UX construct (Efficiency)	139
4.34	Overall threshold value (d) and percentage consensus of UX construct (Efficiency)	140
4.35	Overall acceptance and rejection construct and element of AX and UX	140
4.36	The acceptable construct and element from the expert consensus of AX and UX.	141

6	The constructs, elements, and measurement item for AUX initial model.	167
6.1	Alpha Cronbach's reliability analysis	175
6.2	Reliability test analysis	175
6.3	Normality analysis	178
6.4	Loading factor for storytelling analysis	182
6.5	X ² , CFI, TLI and RMSEA value for storytelling	182
6.6	The detail of construct, element and measurement item of Storytelling	184
6.7	Loading factor for amusement analysis	186
6.8	X ² , CFI, TLI and RMSEA value for Amusement	186
6.9	The detail of construct, element and measurement item of Amusement	187
6.10	Loading factor for Harmony analysis	189
6.11	X, CFI, TLI and RMSEA value for Harmony	189
6.12	The detail of construct, element and measurement item of Harmony	191
6.13	Loading factor for inspiration analysis	192
6.14	X ² , CFI, TLI and RMSEA value for Inspiration	192
6.15	The detail of construct, element and measurement item of Inspiration	194
6.16	Loading factor for incentive analysis	195
6.17	X ² , CFI, TLI and RMSEA value for Incentive	195
6.18	The detail of construct, element and measurement item of Incentive	196
6.19	Loading factor for mindfulness analysis	198
6.20	X ² , CFI, TLI and RMSEA value for Mindfulness	198
6.21	The detail of construct, element and measurement item of Mindfulness	200

6.22	Loading factor for efficiency analysis	201
6.23	X ² , CFI, TLI and RMSEA value for efficiency	201
6.24	The detail of construct, element and measurement item of Efficiency	202
6.25	X ² , CFI, TLI and RMSEA value for multiple factor analysis of AUX model	204
6.26	Construct, elements and item after CFA	205
6.27	List of rejected item	208
7	Detail of construct, elements and item of AUX model	224

Figure No		Page
1	Conceptual framework of synergising the UX and AX in AR Comics	12
2	The visual mapping on the concept of UX Azzawi (2014)	22
2.1	The hedonic and pragmatic model of UX Hassenzahl (2007)	25
2.2	MAR framework for positive UX Irshad and Rambli (2016)	28
2.3	UX for AR (UX4AR) Ritos (2011)	31
2.4	The triangulation between self, memory, art objects, and AX. Carol (2003)	43
2.5	The AX concept Carrol (2003)	45
2.6	AX model by Redies (2015)	46
2.7	A model of AX. Leder et al. (2004)	50

2.8	The two stages of the functional relationship between the cognitive, attentional, and emotional aspects of AX of an object. Markovic (2012)	54
2.9	The model shows four parallel streams of aesthetic information processing Markovic (2012)	55
2.10	Morreall's (2009) cognitive shift of AX in comic art	61
2.11	Plutchik's (1980) wheel of emotions with eight basics emotion	68
2.12	Muliyadi (2015) timeline of comics and cartoons in Malaysia	73
2.13	The link between McCloud (1993) element of comics and Eisner (2000) the elements of making comics	75
2.14	The Construction theory of comic elements between Eisner (2000), McCloud (1993) and Lee (2010)	76
2.15	<i>Sinkha</i> Graphic Novel, 1995	79
2.16	Watchmen motion comics 2008	81
2.17	Hashim & Idris (2016) the framework of the motion comics construction methods	82
2.18	McCloud (2000) infinite canvas and Smith (2017) component of motion comics	83
2.10	MR spectrum the blending of physical and digital reality. Michaud (2017)	85
2.20	Sesorama 1962	88
2.21	Milgram's reality-virtuality continuum (1994)	90
2.22	The head-mounted AR, handheld AR and spatial AR. Images retrieve from www.astrid.org	91
2.23	The 6-phase design and development research approach. Ellis & Nova (2010)	96
2.24	DDR approach through 4 phases Richey and Klein (2007)	98
3	Research design framework	101

3.1	Triangular fuzzy number. Mustafa and Darusalam (2018)	109
3.2	The concept of factor analysis (Piaw, 2009)	111
3.3	The formulation of the AUX model	145
4.1	The heptagon of AUX model	147
5	AR comic development pipeline	151
5.1	Comics panels selection	154
5.2	Pre-production pipe-line	155
5.3	Animation planning and scene setup	156
5.4	Production pipe-line	157
5.5	The character library	158
5.6	Rough animation process	159
5.7	The clean animation process	160
5.8	Post-production pipe-line	161
5.9	Visual effect editing	162
5.10	Voice over-editing	162
5.11	Final compositing	163
5.12	AR project setup	165
6	Percentage of the respondent's age	170
6.1	Percentage of the respondent's gender	171
6.2	Percentage of the respondent's field and involvement	171
6.3	Percentage of the respondent's Institution	172
6.4	Percentage of the respondent's comic reading frequency	173
6.5	Percentage of the comic reading genre	174
6.6	CFA single factor for storytelling	181
6.7	CFA single factor for amusement	185

6.8	CFA single factors for harmony	188
6.9	CFA single factors for inspiration	191
6.10	CFA single factors for incentive	194
6.11	CFA single factors for mindfulness	197
6.12	CFA single factors for efficiency	200
6.13	CFA multiple factors for AUX model	203
6.14	The Hexagon of aesthetic user experience model	209
7	The Heptagon of AUX model	217
7.1	The Hexagon of AUX model	224
7.2	The Hepta AUX model and the Hexa AUX model	226



CHAPTER 1

INTRODUCTION

1.1 Research Background



Since 2013, the printing industry, especially books, magazines, and newspapers, has been through a more robust challenge when there is a decline in sales and acceptances to the media (Abdulah and Ishak, 2016). The issue starting with the declining of newspaper sales like the New Straits Times (NST), which was recorded with the most significant drop of 32.4% to 37,885 copies a day followed by a 25% drop of *Harian Metro* sales. On the contrary, there was a considerable increase in each of these newspapers' digital platforms when NST recorded 12.65 million users in news and information categories. Simultaneously, *Harian Metro* registered 13.07 million users, and *Berita Harian* gathers 41.06 million users throughout 2017 (Alivi et al., 2018 ; Nielsen 2018)



Likewise, with the National book industry, the fall of physical book sales has made the iconic bookstore MPH close one of its shops located in *One Utama* Kuala Lumpur in August 2018, proving that the book industry is also going through a tough challenge. MPH also expects that there will be another branch closing down as the response to the demand of physical books is getting less and alarming.

Worryingly, Malaysia's desire to develop Kuala Lumpur as a world-class city book by 2020 under United Nations educational, scientific and cultural organizations (UNESCO) will be affected by the national book industry (Sanusi and Adnan, 2014). However, simultaneously, an increase of 2% demand to digital books recorded every month allows a substantial shift of reader trends to favourite books to a more interactive environment (Alivi et al., 2018 ; Nielsen, 2018 ; Santos, 2011)

Equally important, the comic book industry was also affected by this challenge when the two largest comic producers, DC comic and Marvel, announced a 6.5% drop in 2017 from US \$ 1.015 billion down to US \$ 70 million by 2016. One of the most prominent factors why this issue occurred is due to the rapid growth of digital environment around the world. By way of example, DC Universe platforms are among the highest platforms streaming content by user (Alivi et al., 2018 ; Nielsen, 2018 ; Santos, 2011; Abdulah and Ishak, 2016).

In August 6, 2015, a local comic magazine created an unexpected history when MOY publication that publishes popular magazines *Apo* and *Ujang* was officially closed for the magazine publication. MOY publishing director admitted that digital readers' trend contributes to the magazine's sale to collapse. Aligned with this, MOY



has taken a digital approach by setting up *Bekazon's*, which is focusing on e-comics and motion comics besides making online comic sale.

Since the new media's birth in 1995, the changes in life, social, way of thinking, and working environment grow gradually (Alivi et al., 2018). In the publishing area, the newspapers, books, or comics are holistically changing from content form presentation to book production processes involving editing, designing, printing, and distribution. In today's digital era, all conventional content is no longer tied to a particular form. It is more interactive and co-existed with the device that became its reading platform (Abdullah & Ishak, 2016; Sanusi & Mustaffa, 2015). The birth of new media, as well as internet technology, directly boosts up the method of delivering information. In publication, Silva (2011), mentions that digital publishing is not merely conventional format transfer to digital-only but has distinctive characters such as; interactivity and motion, which completely changed its publication format from conventional to digital screen.

Recently, we are moving towards 4.0 industry revolution that comes with mix reality technology (MR), Virtual reality (VR), augmented reality (AR), and Hologram. They shift the landscape of the publication to something unexpected when text, sound, visual and animation appear in lines not only on screen but beyond that. This has caused greater impact on digital technology. By the same token, internet speed phenomenon and cloud computing has also become a significant contributor to the publishing industry when Nielsen (2018) reported that digital media had grown steadily through the usage of the internet.





More than 70% of Malaysians from the age of 15 years old and above use the internet, with 98% using the internet via smartphone, each subscribing to a data plan, and 63% using Wi-Fi. Nielsen (2018) also reported an average of 15 hours used by Malaysians using smartphones and the rest for other devices such as laptops and tablets. This trend data demonstrates that the landscape of Malaysian thinking and life has changed holistically and directly affects the national publishing industry.

1.1.Problem Statement

Digital technology allows comics to evolve from conventional printed media to more interactive digital comics, on-screen, non-sequential pages, animations, sound, and special effects. It was coupled with advancement in mobile technologies that plays a significant role in transforming comic art (Arroio, 2011; Smith, 2015).

The transformation of conventional comics into digital comics reflects the growth of comic's demands in digital environment. It started with comics on the web, and then switched to interactive comics and eventually to motion comics. Comics are no longer presented in the traditional forms, but the medium is relevant as technology progresses. In a practical sense, it can be said that comics are an ever-expanding aesthetic object.

The effect of today's digital technology has integrated augmented reality (AR) with virtual reality (VR) into mix-reality (MR) and is widely explored in various fields. AR itself is moving fast in content, visual, animation, media, and interactivity.





In addition, mobile technology's existent makes AR more relevant to users and achieving high user targets (Jamali et al., 2014). Under these circumstances, there is a wide range of AR-based products on the market such as AR coloring books, prosthetic reality, AR advertising, and AR shopper (Furht, 2011; Webel et al., 2011; Cowling et al., 2017).

Lately, AR products have been improved with new quality and experience to art objects such as drawing, painting, and posters. Undoubtedly, in comics, there has been an emergence of conventional comics that make an AR element a new experience for readers or comic fans. In 2014, an initiative in the Modern Polaxis AR comic book project by Sutu, has incorporated AR experience as a new comic reading medium. Destiny's Sword and the Masters of the Sun comics were involved where these comics are presented traditionally and supplemented with the AR experience. As the result, AR has become a bridge that transforms conventional comics to digital technology.

Theoretically, AR product relates to the science of human-computer interaction (HCI) and uses a user experience approach (UX) as a method of measuring an AR product (Law et al., 2008; Peng et al., 2009; Zaphiris, 2013). In Hassenzahl's (2007) study, there are two primary UX components, which are pragmatic and hedonic. Both components support each other to achieve positive UX. In a pragmatic approach, the focus is on UX products that are perceived to have the ability to support achievements or do-goals. On the other hand, hedonic refers to the ability to achieve goals.





In the study of Schrepp et al. (2013), pragmatic and hedonic elements were used as an impression guides for the product on its acceptance or rejection. The study stated pragmatics approach includes task-oriented quality aspects, efficiency, and learnability, whereas the hedonic approach focuses on stimulation, aesthetic impression, and novelty.

Empirically, Matcha and Rambli (2011) emphasize that positive UX elements are crucial in a technology product or device to determine the effectiveness and usability of a product to a user. It means that the UX approach is meant to avoid the negative UX into technology product (Azzawi, 2013). In other words, to test or implement a technology product, negative elements of UX such as dislike, frustration, and complexity will be avoided to improve a technology product.



Usability is also an essential component in UX where the aspects of time, function, priority, and positive experience are incredibly stressful. Considering how the user responds to a product and what is the UX element reaction before, during, and after using a product (Alenljung et al.,2017; Irshad & Rambli, 2016).

Irshad (2013) confirms that a significant UX component is designed to find the emotion. Each product that was created, takes into accounts the positive emotions that come from the user's response to the product. Olsson (2013) advocated in his research by proving a substantial UX in order to measure and collect the user positive feedback for designing UX products and avoiding negative UX (Ritos, 2011; Irshad & Rambli, 2016; Hassenzahl, 2007).



Conversely, comics are classified as one of the art forms or an aesthetic object and should be measured from an aesthetic perspective. There are narrative, visual and text elements in comics that can be used as a medium of expression to invoke emotion (Mulyadi, 2015; Eisner, 2000; McCloud, 1993).

Moens (2018) inspired AX's characteristics based on elements such as, formalities, content, cognitive, perceptions, and emotions to create a vital component which is essential in assessing and measuring aesthetic objects (Harrison & Clark 2016).

Markovic's (2012) study emphasizes that an art object's context seeks to determine the AX element that will be reflected from contemplating an art object. In the context of AX, the process of appreciating the artwork involves the spiritual sense born of its biological, psychological, and social functions, not just to see or appreciate the beauty of the work from a formalistic point of view. Still, it can evoke aesthetic emotions such as sadness, anger, joy, passion, motivation, or even annoyance.

Redies (2015) mentions that appraisal or appreciating a piece of art needs the beholder to go through five stages of aesthetic judgment which is, formalistic, cognitive, content, emotions, and ultimately AX. On the other hand, the beholder who can only appraise the beauty of a formalistic point of view (color, line, composition, and form) is considered providing a naive assessment and requires an expert appraisal to appraise an artwork.



Obviously, AX has essentially design to stir the emotion by captivating the negative and positive emotion. In the context of an aesthetic object, the art-forms determines the negative or positive emotional elements such as, joy, fun, amusement, sad, anger, fear and dislike that needs to be reflected on aesthetic object to measure the AX element in the comic (Redies, 2015; Leder et al., 2004).

Based on the literature review, it is safe to say that there was no element of AX in the AR product even though studies were done using aesthetic objects as its subject and vice versa, no UX element in the art-forms was found, despite using AR as its medium. Several studies involving AR products integrating arts as its subject matter were evaluated in UX terms such as time, efficiency, usability and design. However, from design context, the evaluation is limited, which only involves the formalistic elements and discard the emotion factor. In the facet of emotions, it is more than positive emotions such as motivation, passion, and encouragement. In other words, it avoids evoking the negative emotions (Radoslavov et al., 2015; Dirin et al., 2018; Qu et al., 2017; Olson et al., 2011).

By way of example, Morreall (2009) used elements of AX in his study to measure comics such as amusement, the paradox of tragedy, and mental jolt without reference to UX elements even though the comic was already integrated with technologies such as interactive, motion comics, webcomics, and AR comics (Smith, 2015; Ayer, 2014; Wang et al., 2019).

Empirically, there is a clearly a huge theoretical gap between AX and UX when managing art and technology-based products like AR comics. This requires a new





model to review this product. Among UX features that are featured in AR are efficiency, inspiration, motivation, creativity, and meaningfulness, while AX features in comics are; amusement, harmony, storytelling clarity, and mental jolt (Morreall, 2009; Klaehn, 2015; Plutchiks, 1980; Olsson & Mattila, 2011).

In short, this study suggests the synergising of UX and AX in AR comics should be based on several reasons 1) AR is an HCI-based product and highly relevant to UX as a measuring method while, comics are aesthetic objects and necessarily use AX as their measurement method, 2) UX evaluates users, usability, time, and design, while AX involves feeling, content, and expert appraise 3) UX involves technology products and usability, while AX is an aesthetic object and requires appreciation. AR is produced only in enhanced information, but it is imaginative and enhances emotion



1.2 Research Objective

1. To examine the similarity and dissimilarity of construct and elements in AX and UX
2. To explore the possibility of synergising both AX and UX construct as a new model for New Media Art.
3. To design a desirable AR Comic based from Aesthetic User Experience (AUX) model.
4. To validate AUX model using AR Comic as a stimulus.

1.3 Research Question

1. What is the similarities and dissimilarities of AX and UX construct?
2. What are the constructs and elements suitable to be synergised for AUX model?
3. How to integrate AUX model with exiting process to develop AR Comic?
4. How many construct in AUX model deem to be vital to design desirable AR Comic?
5. What are the vital constructs in AUX model in designing desirable AR Comic?

1.4 Hypothesis

H1 There is a vital construct in AUX model to design a desirable AR Comic

H2 There is a strong conformation construct in AUX model in designing AR Comic.

Table 1

The relationship between research objective and research question.

No	Research Objective	Research Question
1	To examine the similarity and dissimilarity of construct and elements in AX and UX.	<ol style="list-style-type: none"> 1. What is the similarity and dissimilarity of AX and UX construct? 2. What are the constructs and elements suitable to be synergised for AUX model?
2	To explore the possibility of combining both AX and UX construct as a new model for New Media Art.	
3	To design a desirable AR Comic based on Aesthetic User Experience (AUX) Model.	<ol style="list-style-type: none"> 1. How to integrate AUX model with exiting process to develop AR Comic?
4	To validate AUX model using AR Comic as a stimulus.	<ol style="list-style-type: none"> 1. How many construct in AUX model deem to be vital to design desirable AR Comic? 2. What are the vital construct in AUX model in designing desirable AR Comic?

1.5 Conceptual Framework

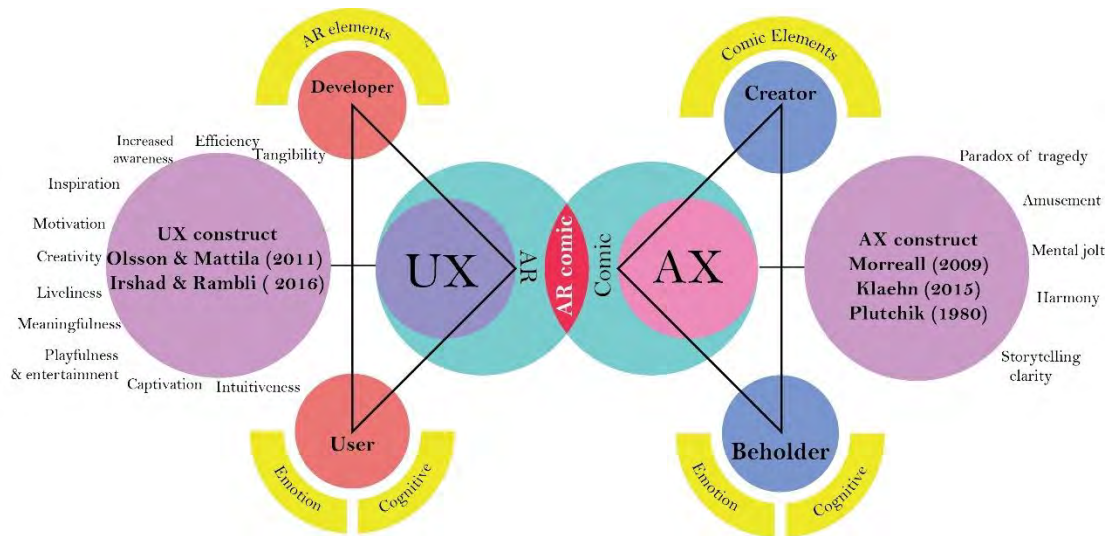


Figure 1. Conceptual framework of synergising the UX and AX in AR comic

In this conceptual framework, it illustrates how AR comic integration based on AX and UX theory. At the development stage, the AR elements are emphasised to meet an AR features such as, to sense properties about the real world, a process in real-time, output (overlay), to provide contextual information, to track real-world object, and mobility. In addition, AR techniques will also be applied in AR comic design, such as, situated visualization, object as context, sensor data as context, the scene as context, and uncertainty as context (Kalkofen et al., 2011; Stefan et al., 2014, Billinghamurst et al., 2001 & Braun, 2003).

Meanwhile, at the creation stage, the comic elements become a guideline to create a comic content using AR. According to the comic principles, this element is essential for the content, technical and comics narrative. The intended element are trails, distance pacing, narrative subdivision and fidelity, sustained rhythm,



gradualism, motion, spatial depth, animated comic book panel, cinematic adaptation, screen-based format and genres (McCloud, 2000; Smith, 2015).

Users need to contemplate AR comics with cognitive and emotion in order to appreciate an AR Comics and reflects the experience in three focused time which are, before, during, and after using the AR comic products. The user cognitive elements need to be regulated because, according to Markovic (2011), prior knowledge is significant in order to contemplate an aesthetic object and give an assessment to an art-forms.

The appraisal of AX and UX ratings against AR comics depends on what elements evoke the user's emotion. In AR, several UX elements react to AR products such as, efficiency, inspiration, motivation, creativity, liveliness, meaningfulness, playful and entertainment, captivation and intuitiveness (Olsson & Mattila, 2011). Conversely, in comics, the cognitive shift occurs when the user reads the comics and produces an AX element. Cognitive shifts such as amusement, arouse, funny, the paradox of tragedy, tragic and mental mode jolt generating bizarre and fantastic modes toward comics (Morreall, 2009).

However, there are many AX and UX elements that need to be considered when measuring AX and UX in AR comics, as outlined by Plutchik (1980), such as contempt, aggressiveness, optimism, love, submission, awe, disapproval and remorse as well as technical elements in UX product such as time, effort, device and design (Parrot, 2001; Matsumo & Hwang, 2011).





1.6 Significant of research

This study aims to develop a model from a combination of AX and UX to the development of AR comics. The problem statement mentioned earlier clearly shows the need to carry out this research. Positive impacts are expected to few benefits, such as; 1) printed comics will be used extensively because AR comic requires image data to read AR content digitally. This means comics in physical form are needed in line with the AR content that will appear. 2) propose the addition of AX to UX theory since UX is a theory that works with HCI and aesthetic objects require AX as a measurement method and propose the addition of UX to AX theory since AX is a theory that works with aesthetic objects while AR products need to be measured in UX theory.



Next 3) propose a new model in product validation based on HCI technology and art-forms that is currently being developed. This leads to the need for a combination of new models to measure or evaluate the combined products in art and technology that is produced rapidly. 4) expand the combination of research methodology by proposing Fuzzy Delphi Method (FDM) and Structural Equation Model (SEM). FDM and CFA are two types of a powerful and reliable analysis instruments. The combination of the two analysers will make this research more credible, and 5) expand media use by integrating aesthetic, AR, animation, mobile and 4.0 industries revolution that touches on inter-media technology.





1.7 Limitation of research

1. Respondents are the generation of Y and Z (18-35 years old) who are the average mobile technology users, the usage internet and most exposed to new media. Cognitively, they also have prior knowledge of the comics and the revolution of technology that affect them.
2. Existing comics are selected from the latest comic works around 2016 to 2017.
3. Using only AR comic as a stimulus agent rather than a conventional comic or other digital comics.



1.8 Operational definition



1.8.1 User experience

As it is known that UX covers a wide range of areas, like usability, time, effectiveness, system, design, and aesthetics. However, UX in this study refers to HCI related to technology products relevant to MR in generals and AR in particular (Hassenzahl, 2007; Dirin and Laine, 2018; Irshad and Rambli, 2017)





1.8.2 AX

AX is a field affiliated with art and art activities, including dance, film, theatre, paintings, and sculptures. It is also referred to as an art-form or an aesthetic object. Relatedly to this study, AX refers to the comics as an aesthetic object that is part of illustration art (Harrison and Clark, 2016; Docherty, 2018; Scarles, 2020).

1.8.3 AR comics

AR comics is a combination of aesthetic objects (comics) with technology products (AR). The name AR comics has been popularized and widely used in AR comics released by Marvel namely Master of the Sun in 2017 and comic painter Sutu in 2014 by releasing AR comics titled "Sutu Eat World". Through this study, both entities are different in terms of their scientific field and two significant theories, namely AX and UX.

