



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Research Topic:

A review assessing the need for greater emphasis on eudaimonia in the design process of virtual environments

M.Sc. Interactive Digital Media

A research paper submitted to the University of Dublin,
in partial fulfilment of the requirements for the degree of
Master of Science in Interactive Digital Media

Faculty of Supervision:

Trinity College Dublin

School of Computer Science

Supervisor: Ms. Diana Wilson, Assistant Professor, Computer Science

Declaration

I have read and understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: <http://www.tcd.ie/calendar>. I have also completed the online tutorial on avoiding plagiarism 'Ready, Steady, Write', located at [http://tcd-
ie.libguides.com/plagiarism/ready-steady-write](http://tcd.ie.libguides.com/plagiarism/ready-steady-write). I declare that the work described in this research paper is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this university or any other university.

Signed:



Gareth Walsh 03/06/2021

Permission to lend and/or copy

I agree that Trinity College Library may lend or copy this Research Paper upon request.

Signed:



Gareth Walsh 03/06/2021

Acknowledgements:

I would like to thank Dr Mads Haahr for his guidance in directing and developing my initial research thoughts and providing me the opportunity to further develop my research skillset by allocating a suitable supervisor. I would also like to thank my research supervisor Diana Wilson for her tremendous support and encouragement in progressing this paper amidst such challenging circumstances. I would also like to thank all the IDM lecturers for providing such stimulating content and teaching, which has inspired and guided my thinking in the subject.

Abstract:

Well-being has been a term defined as an individual's physical, social, and mental health. To research the more specific psychosocial and psychological well-being requirements and needs of users in the context of virtual environments a suitable conceptual framework must be adopted. This research continues to examine the dyad of hedonia and eudaimonia in the context of virtual environments, through the process of a literature review, to determine the value of increased emphasis on eudaemonic components in the design process of virtual environments.

Some research has already been established in this area, with Huta and Waterman (2013) creating a three-part framework for classifying hedonia and eudaimonia as research constructs under; degree of centrality, category of analysis and level of measurement.ⁱ In human computer interaction, a positive human factors design framework is incorporated and highlights design under; usability, functionality, safety and hedoniaⁱⁱ. However, notably a eudemonic component in the design framework is not present. Katie Seaborn has included this issue in her paper "*Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being*" and this literature review aims to build on this argument.

The eudemonic component absent in the design framework suggests a missing link, with a lack of design emphasis placed on designing for personal growth and meaningful, expressive, and self-actualizing experiencesⁱⁱⁱ. The argument of this literature review aims to examine evidence supporting the need for greater emphasis on eudaimonia in the design process of virtual environments.

Table of Contents:

List of search terms.....	p.6
List of abbreviations.....	p.6
Definitions.....	p.6
1: Wellbeing in the context of virtual environments.....	p.7
1.1: Additional stressors in the 21 st Century.....	p.8
2: Dyad of Hedonia and Eudaimonia.....	p.9
2.1 Huta’s three-part framework.....	p.11
2.2 Eudemonics extensions to the hedonics framework.....	p.12
3 Eudaimonia in practice; examining user experience of technology.....	p.14
3.1 Motivation of Users Desiring Games Rooted in Eudaemonic Needs.....	p.18
3.2 Agency and Eudaimonia in Virtual Environments.....	p.19
3.3 Eudaemonic Experience in Digital Games.....	p.20
4 Methodology.....	p.23
5 Results and Discussion.....	p.24
6 Further Research.....	p.26
7 Conclusion.....	p.27
Bibliography.....	p.29
References.....	p.31

Search Terms: “Digital Well-being”, “Well-being in Virtual Environments”, “Eudaimonia and Hedonia in Design”, “Self-Determination Theory and Eudaimonia”, “Eudaimonic Attributes”, “Eudaemonic Experience in Digital Games”, “Agency and Eudaimonia in Virtual Environments” and “Eudemonics extensions to the hedonics framework”

Abbreviations:

WHO – World Health Organisation

AR - Augmented Reality

VR – Virtual Reality

PTSD – Post-Traumatic Stress Disorder

CBT – Cognitive Behavioural Therapy

SDT – Self-Determination Theory

PA – Pragmatic Attributes

HA – Hedonic Attributes

EA – Eudaimonic attributes

UX – User Experience

HCI – Human Computer Interaction

ADM – Application Data Management

ML – Machine Learning

EU – European Union

Definitions:

To avoid confusion and misinterpretation in this research paper some expressions used will be defined. Hedonics, hedonia or hedonic happiness is attained by engaging in experiences of pleasure or enjoyment. Eudaemonic and eudaimonia happiness is attained by engaging in experiences of meaning and purpose.

1: Wellbeing in the context of virtual environments

Well-being while at first glance might appear an elusive and inconsequential factor for measuring quality of life. However, positive well-being is meaningful for individuals and certain elements of society as it allows researchers to assess how individuals perceive their own lives to be progressing in a quantifiable way. There are many elements and factors which contribute to positive well-being, such as housing and employment, and monitoring these factors often plays a role in directing government policy on these issues. Despite this, by measuring only these definite metrics researchers fail to measure how individuals are experiencing their own lives, too often overlooking the quality of their relationships, their positive emotions and resilience, their potential, and their overall satisfaction in their own life, regarded as their “well-being”^{iv}. In the context of virtual environments, this research aims not to examine the definite, short-term and hedonic metrics of virtual environments, but instead to examine the long term eudaemonic effects of virtual environments on well-being, examining in particular what factors drive these emotional responses.

In the section that follows the paper examines a number of studies which look at well-being in the wider context.

The first of which is a study conducted by Lee Ln, Kim MJ and Hwang WJ 2019. It examined the potential of augmented reality and virtual reality technologies in older adults to overcome mobility limitations, cognitive ability, and socialisation limitations. The study suggests that while AR and VR technologies are often suitable to combat such issues facing older adults, this age group is often overlooked in their implementation. This study by Lee Ln, Kim MJ and Hwang WJ identified that most AR and VR studies not only closely monitor physical wellbeing but also make extensive endeavours to promote their psychological well-being, including evaluating “fun factors” which would motivate the elderly^v.

Another paper by Naylor and Morrison 2019 examined the potential of VR as a workplace wellbeing intervention. Here they pick up on previous research suggesting that the typical “nine to five” working week is no longer the conventional working week (Currie and Eveline, 2011^{vi}), and the clear separation between “work” and “home” had largely been diminished with the proliferation of modern laptops, facilitating the ability to work anytime, anywhere (Merecz and Andysz, 2014^{vii}). They discuss in the practical terms of policy making the three levels of wellbeing intervention considered by employees and businesses: primary (stress reduction), secondary (stress management) and tertiary (counselling) according to Murphy (1988). They suggest the potential of VR for well-being, as VR enables an easy to learn, self-directed approach^{viii}. A systematic review of the VR in psychological treatment has shown VR treatment to be at least as effective as traditional treatments (Valmaggia, 2016^{ix}). Similarly, VR treatments for PTSD were shown to be at least as effective traditional CBT (Goncalves, 2012^x). Similar results were also seen in using VR treatments for social anxiety issues over traditional group therapy (Anderson, 2013). In many similar areas such as Dialectical Behavioural Therapy, treatment of sexual assault survivors, and even in the rehabilitation of stroke survivors, VR treatment has been showing promising signs in early testing^{xi}. VR which could even be used for meditation assistance has been shown to be in early development (Kosunen, 2016).

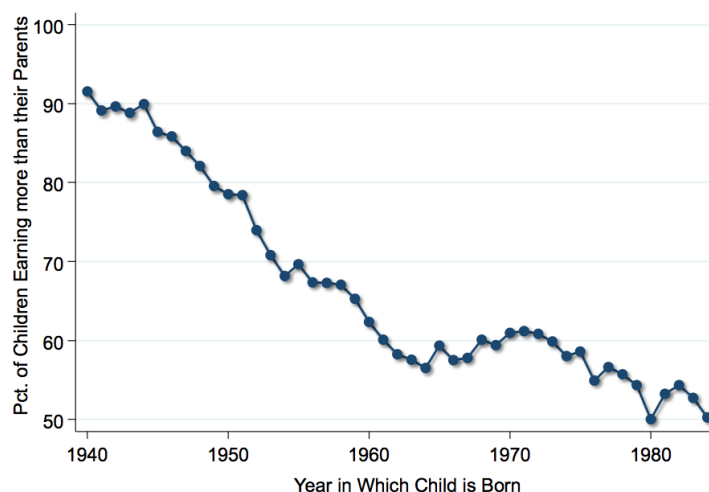
Perhaps the greatest strength VR interventions can provide to promoting positive well-being is its footing in uniquely being able to provide a strong connection to the present moment without interruptions or disturbances from the surrounding environment (Giglioli, 2015^{xii}). Because of this, studies have researched the highly immersive environment VR can create as a means of stress reduction interventions in workplaces (Ahmaniemi, 2017^{xiii}).

This trend in research can also be seen in the work of Niklas Johannes at the *Oxford Internet Institute*, who conducted a study of players who played *Plants vs. Zombies: Battle for Neighborville* and *Animal Crossing: New Horizons* in order to assess their well-being, motivations, and need satisfaction during play. This study found a potential link between positive well-being and game play based on these games^{xiv}. Similarly, Jennifer Wild’s study found that internet delivered CBT showed recovery in social anxiety which were in a similar range to those seen in face to face CBT^{xv}.

1.1: Additional stressors in the 21st Century

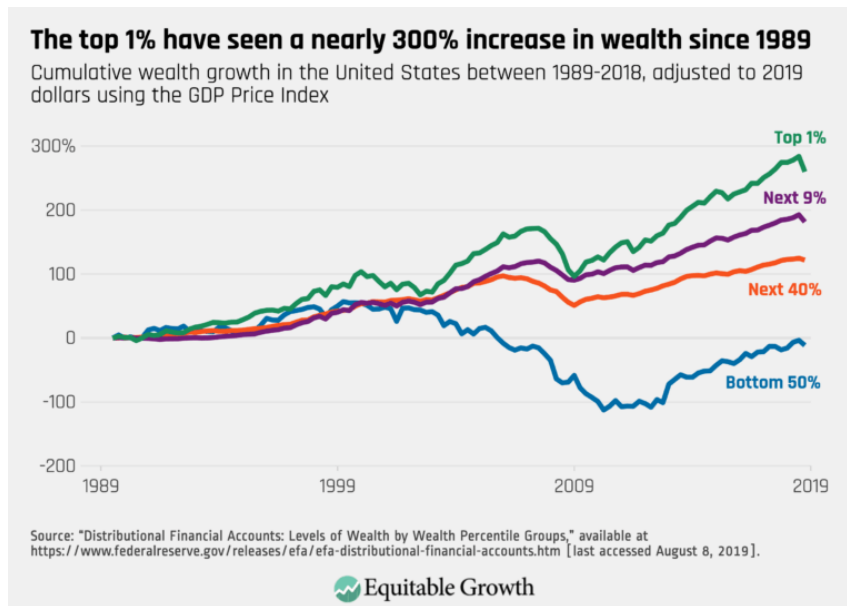
To understand why the importance of well-being in the 21st Century has dramatically increased and furthermore why it is more relevant today more than ever, one must first examine the relevant socio-economic and socio-political factors which are placing more stressors on the youth of today than seen in previous generations. Heather Boushey touches on some of these issues and explains how inequality is negatively affecting our economies and to an extent our well-being in her book *Unbound : How Inequality Constricts Our Economy and What We Can Do about It*. Here she illustrates some economic trends which are affecting younger generations.

Mobility in the US has fallen sharply between 1940-1984



(Source: The Fading American Dream)

Here we see how in the 1940’s over ninety percent of children were earning more than their parents, compared to just over fifty percent of children out earning their parents in the 1980’s. This illustrates a seismic shift in the quantity and proportion of people in the US who are increasing their earnings over a short period of time. This conveys the idea that for many Americans growing up today they have come to expect less economic growth in their generation and this in turn may be increasing the value of well-being to individuals as a means to perceive how their own lives are progressing in terms of meaning rather than economic value.



(Source: Equitable Growth)

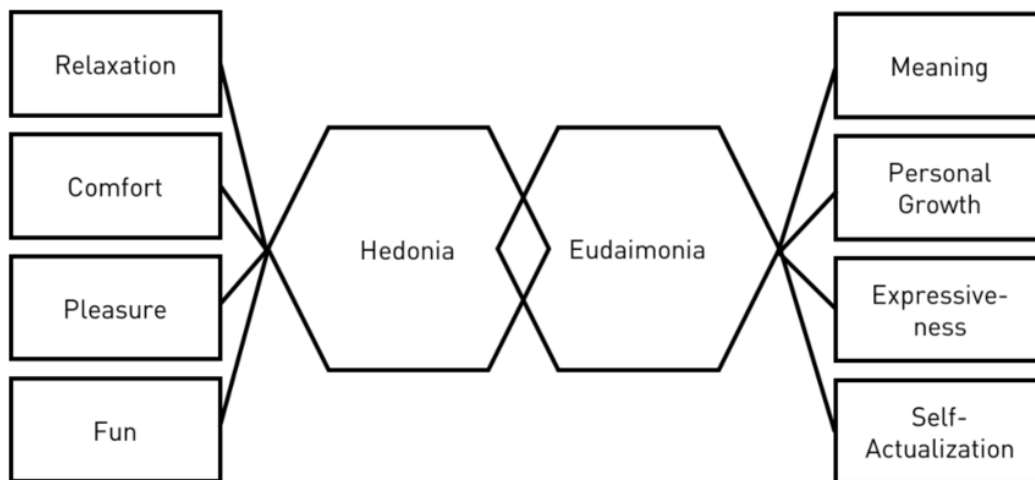
Interestingly as upward mobility in the US has decreased, income inequality has also rapidly increased. This has meant that in the case of the US, as the top 1% has seen their wealth increase nearly 300% since 1989, the bottom 50% has roughly seen their wealth stagnate or even decline. This stagnation in terms of wealth increases for the majority of Americans could suggest that financial stress is having an effect on their subjective well-being, and as a result increasing the emphasis placed on well-being amongst this generation. One such study which could support this argument was a study conducted in Finland which examined financial stress and well-being in children. The results show that financial stress shows a strong and negative association on cognitive subjective well-being^{xvi}.

By designing and implementing a novel digital and VR intervention to improve well-being, many diverse applications could be applied to help combat this sharp increase in demand for these services. One such study conducted by Antonia Rich examined how interventions with medical students to discuss stressors and discuss methods to combat smartphone addiction, mediation and exercise had reduced burnout and improved boundary control^{xvii}.

2: The Dyad of Hedonia and Eudaimonia

The work of Ryan 2008 focuses on identifying the differences in rationale in researching hedonic and eudaemonic strategies to well-being, as well as establishing a framework for carrying out this research. The work discusses that the aim of eudaemonic research is to define what "living well" requires, the likes of which may include some hedonic elements^{xviii}. Traditional researchers have been particularly focused on factors in a high quality of life, such as vitality, intimacy, health, sense of meaning, and other similar factors^{xix}.

Hedonic research in contrast, is largely conducted on positive effect, such as the desire for comfort and relaxation, and pursuit of pleasure^{xx}. Pleasure and positive affect are important to well-being as they facilitate and support other human functioning (Isen, 2003), contributing to psychological health and optimal functioning^{xxi}.



(Hedonic-Eudaemonic dyad, Source: Katie Seaborn)

Ryan argues that focusing solely on hedonic attributes cannot result in positive well-being, as to do so would be a proposal to maximise pleasure and avoid pain, the likes of which could result in a life absent of depth, meaning or community^{xxii}. Interestingly his work goes on to detail maximising pleasure as a means to achieving well-being could lead to materialism, objectified sexuality and ecological destructiveness. Instead Ryan suggests that eudaemonic living not only serves as a guiding set of values to achieve a more meaningful life, but that living in such a manner also produces more stable and hedonic happiness^{xxiii} (Huta and Ryan, 2006).

By separating the hedonic from the eudaemonic outlooks on well-being, Ryan proposes a model of eudaimonia based in self-determination theory. He argues that there are four main pillars to eudemonic living: (1) pursuing intrinsic goals, such as personal growth, relationships, community, and health, as opposed to extrinsic goals and values, such as wealth, fame, image, and power; (2) behaving autonomously, as opposed to heteronomously; (3) acting with mindfulness and awareness; (4) satisfying basic psychological needs for competence, relatedness, and autonomy^{xxiv}. Interestingly it has been shown that people who conduct a high level of eudaemonic living live in more prosocial ways. By doing this the benefit of one's efforts, not only positively affect the individual, but also the collective community, highlighting the importance of family, community, and trust in society. The relationship between collective trust and economic growth or GDP can also be seen.

2.1: Huta's Three-Part Framework

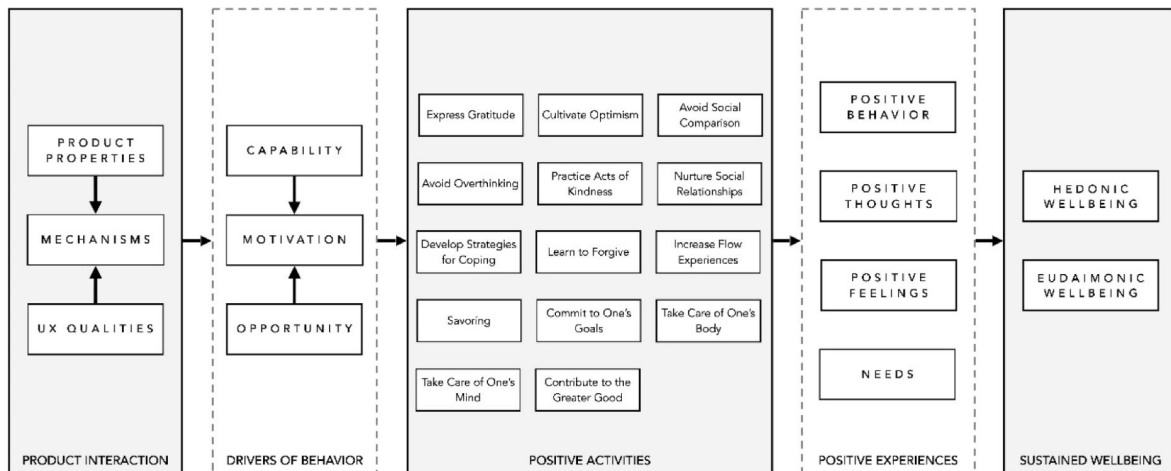
The difficulty posed to study eudaimonia and hedonia in the context of virtual environments is the potential ambiguity between the two co-existing concepts. The work of Huta 2013 sought to overcome these hurdles by producing a set of terminology to aid more specific research on the topic. This resulted in a three-part framework which was broken down into (1) *Degree of Centrality*, (2) *Category of Analysis*, and (3) *Level of Measurement*^{xxv}.

Degree of centrality focuses on establishing certain factors at the heart of a researcher's perception of hedonia or eudaimonia and separates them from factors that are close to core or merely correlates. Core elements as defined in the framework as elements which are considered essential by the researcher, as supported by the researchers conceptual and operational definitions. Core elements must also be cited in order to define the scope of a researcher's definition. Close-to-core elements are not essential aspects of a researcher's definition of eudaimonia or hedonia and do not play a role in the main research purposes but are to be given some degree of attention.^{xxvi}

Category of analysis allows researchers to define research in one or more of the following categories: (1) Orientations: values, motives or goals, (2) Behaviours: behavioural content and activity characteristics, (3) Experiences: subjective experiences, emotions, and cognitive appraisals, and (4) Functioning: indices of positive psychological functioning, mental health, and flourishing.

Orientations, values, motives or goals are grouped together as one of the four categories as they contribute to the direction of one's actions, addressing the "why" of one's behaviour. This is in contrast to the behaviours category which focuses on the "what" of one's behaviour as opposed to the "why". The experiences category is perhaps the most subjective and as a result the most difficult to assess, with assessment mainly carried out through self-reporting. This category focuses on the individual's subjective experiences such as the emotional and cognitive impact of a particular human experience. The category of functioning is examined over an extended period of time and is examined as an outcome. In terms of assessing this category, in theory it is a hybrid of objective and subjective elements and as a result is suitable for self-reporting methods or scoring^{xxvii}.

Level of measurement in the framework assesses one's level of eudaimonia or hedonia under trait level or state level. Trait level refers to one's average level of eudaimonia or hedonia and is considered 'stable' but evolves with time. The state level refers to one's characterisations at a particular moment in time. It is possible to study eudaimonia or hedonia individually at trait and state level or discuss at both trait and state level.

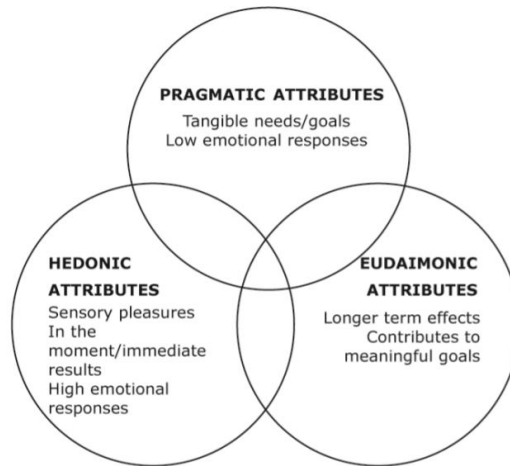


(Multi-Stage Framework for Sustained Well-being Promoted by Technology, Source: Wiese L^{xxviii})

The diagram above is taken from Lisa Wiese’s study of *Design for Sustained Wellbeing through Positive Activities* and builds on the concepts discussed in Huta’s three-part framework. In the case of technology, in Wiese’s work we can see that product properties, mechanics and UX contribute to how an individual interacts with the product, and that this interaction informs one’s drivers of behaviour. The diagram also illustrates how one’s motivation feeds into positive activities which has a knock-on effect on positive experiences and sustained well-being.

2.1: Eudemonics Extensions to the Hedonics Framework

Recently there has been research carried out which has built on Huta’s framework three-part framework. In 2014 Desmet and Kamp were interested in studying how the long-term effect of technology affects an individual’s well-being and how a tool could be used to assess the contribution of products to well-being. To better understand how a product might affect a user’s well-being they discuss products in terms hedonia and eudaimonia. Pleasurable products should be designed as products which are fun to use and designers should not assume that this means products which are easy to use^{xxix}. While in other research it has been shown users can separate pragmatic from hedonic attributes, Desmet and Kamp build on the hedonomics vs ergonomics discussion by introducing eudaimonic attributes.



(Product-Attribute-Categories, Source: Desmet and Kamp^{xxx})

The diagram above illustrates how pragmatic, hedonic and eudaemonic attributes relate to each other while being distinctly separate. Pragmatic attributes apply to products which achieves a certain tangible goal while not evoking an emotional or an engaging experience. Hedonic attributes on the other hand concern products which evoke high emotion experiences, such as in terms of aesthetics or sensory pleasures in the immediate timeframe. The eudaemonic attributes addition concerns products which add to a meaningful goal or symbolise a long-term engaging activity or goal.

Additionally, Seaborn and Pennefather conducted a study using a questionnaire on older powered chair users' perceptions on and attitudes towards mixed reality and modern facilitating technologies. Participants in the study were given a questionnaire and interviewed, and this data was analysed using descriptive statistics and thematic analysis. The study found that community-dwelling older powered chair users are a technologically forward group that use or are keenly interested in trying new technologies and interaction paradigms^{xxx}. However, the study also identified several key factors which were identified as obstacles affecting this group in particular such as identity mismatch, affordability and social acceptability. Participants in the study also showed enthusiasm for the concept of combining assistive and non-assistive technology to foster enhanced social entertainment, or as means of further empathising with one's particular situation^{xxxii}. The results of this study are not only useful as a means of better comprehending how the framework might be used in empirical, everyday situations, but it also highlights the suitability and broad range of ways the framework could aid research in AR and VR. The study also reflects the importance and value in focusing on eudaemonic research in technology, as small adjustments may have a large human impact on the groups concerned.

3: Eudaimonia in Practice: Examining User Experience of Technology

UX typically examines the factors which make interactive technologies perform well, typically examining the degree of entertainment, affect and stimulation of the technology or product. As examined previously, many theory-based studies have examined the importance of balancing hedonia and eudaimonia in product design to achieve products which support nuanced and sustainable well-being. However, little research has looked at the importance of eudaimonia in UX in practice. A study carried out by Mekler and Hornbaek sought to examine this by examining 266 reports of positive experiences with technology and researching the relationship between eudaimonia and traditional UX theory.

Mekler and Hornbaek initially identified four concept areas where the study of eudaimonia and UX could be of great value in the future. The first examining experiences with technology involving meaning which hedonia does not include, such as embarrassing interactions, uncomfortable interactions and designing for the self^{xxxiii}. Secondly the research could be of value in clarifying empirical research issues associated with research in hedonia. Thirdly research could contribute to not only a better UX experience for the user but also allow researchers to better understand how technology may assist to one's sustainable well-being. And lastly the research in this area could better inform the design process by illustrating the value and diversity of meaningful experiences occurring with interactive technology^{xxxiv}. However, because it was uncertain whether eudaimonia definitively manifests with user's experience based on past research and to what degree it would be separated from hedonia in such instances, they conducted in-depth analyses of previous experiences. In this analyse they explored how hedonic and eudaemonic UX differ, by basing the theory of eudaimonia in UX research. This approach allowed for empirical evidence to be drawn of how hedonic experiences differ from eudaemonic experiences, and how these separations are echoed in traditional UX concepts such as user needs, affects, attribution and product quality^{xxxv}.

The results from this study found that eudaemonic and hedonic motivating factors can be separated in user's descriptions of experiences with interactive technology and that they can be further delineated by eudaemonic sub-factors such as affect, fulfilment and long-term importance^{xxxvi}. This confirms the potential of UX research focused on eudaimonia and the benefits future research might have on well-being. Furthermore, it supports the idea further UX research should focus on eudaimonia in virtual environments given their recent popular adoption, with demand only expected to grow significantly in the years to come.

In relation to virtual environments, on screen and immersive, UX in these conditions adds an additional layer of consideration given the "signs and signals interfacing" semiotic dimension of computing^{xxxvii}. Contrary to traditional representations of signs as dyadic, algorithmic signs are triadic in concept. This additional component becomes the active production of adding meaning to the sign itself^{xxxviii}. An example of this in practice would icons on a computer screen. The folder icon itself is not just a sign but instead it is an element of sign-production. As one interacts with the interface, we quickly discover the relationship between the folder and the functions we wish to achieve through manipulation of the folder icon. This representation of the icon can be informed by graphical elements such as the digital display or be aesthetically inspired by everyday objects and the meaning they are supposed to represent^{xxxix}.



(Example of VR Interface for Oculus, Source: WIRED)

As the image above illustrates, we can see that VR environments such as the one shown, the Oculus homepage, follow similar design principles as in earlier digital interfaces. As a result, they similarly retained the use of “universal” algorithmics which are similarly triadic in nature.

	iPhone	NOKIA		MOTOROLA		SAMSUNG		SONY ERICSSON	
	2007-2010 (4 εκδόσεις)	2006 (N73) 2008 (5320)	2008 (5800) 2009 (N900)	2003 (V609)	2009 (evolve QA4)	2008 (D780)	2009 (bada OS)	2005 (K750)	2009 (C903)
PHONE BOOK									
PHONE CALL									
MESSAGE									
SETTINGS									
CAMERA									
CLOCK									
INTERNET									
GAMES									

(Mobile Interface Icons Across Brands, Source: Int. J. Comput. Sci. Appl. 2012)

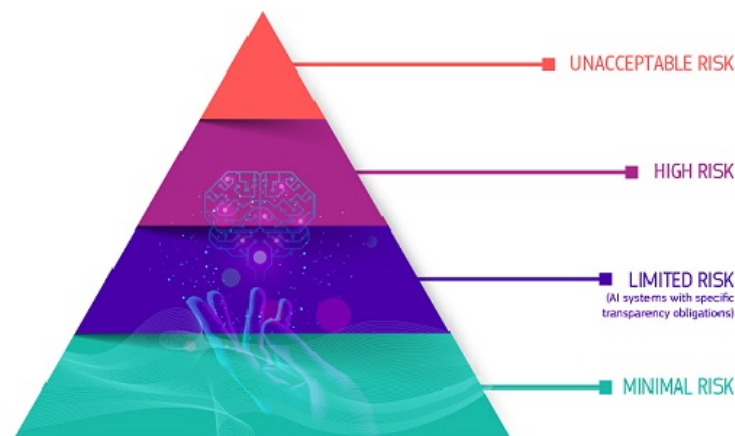
Above we can see how a generalisation occurred in semiotics across many brands for the most commonly used functions in the early 2000’s which has largely remained and informed the current interaction and design of VR environments.

Similarly, materiality and semiotics are intertwined in the design process of many HCI elements. For example, the folder sign on a desktop is the combination of materiality of the light emitting from each pixel in the screen and semiotics of the graphic piece itself, referencing corporate culture. This allows the user to associate and interpret the meaning of the function to the sign naturally and easily. It also disguises the true function being undertaken as the computer is processing data, in a sense humanising the process^{xl}. By always thinking simultaneously about materiality and semiotics in HCI, design of systems is enabled to go beyond the limits of what either of these aspects allows individually, enabling HCI to be redeveloped according to “matter and meaning”. Driving this

concept is thinking of computing as “technological semiotics”. Technological semiotics studies how technology disseminates social and personal information with new kinds of artifacts which conjure up new signs of meaning as well as new methods of acting and thinking^{xli}. As a result of studying such an area, technological semiotics often raises questions on normalisation and ethical character in technology. By thinking of HCI in this way, it allows for another perspective which is more aligned to the computer’s individuality as opposed to more traditional cognitive engineering perspectives which have been used in HCI in the past^{xlii}.

The paper by Kurosu suggests new materialism could innovate some of the past concept assumptions in HCI. In the paper two assumptions were made. The first was to acknowledge the prominence of computational technology in socio-economic, socio-political, and technological development and the far-reaching accountability obligations. The second assumption made was viewing computing as “technological semiotics”. By employing the use of these assumptions in HCI, the traditional segregation line between the human and the computer becomes fragmented, and as a result further emphasis on responsibility and accountability needs to be seen as an essential element of computing^{xliii}.

This increased emphasis on responsibility with new materialism is more complete than operating on a basis of current ethics. This is because materiality is seen as an active, vital element and not seen as a passive resource. As a result, operating on this basis as opposed to current ethics focuses attention towards social and ecological sustainability, as well as questions where materials for computing elements are found and the labour force involved in their production. New materialism also seeks to explore alternative methods of engagement other than being physically present. (E.g. the future development in virtual environments used for remote working, remote learning, and many more diverse applications). New materialism also builds on traditional concepts in HCI while adding responsibility both in terms of diversity of interaction options and enhancing the ability to confront difficult and delicate socio-economic and socio-political issues. This extremely relevant to everyone as operations are carried out in many aspects of daily lives using socially debated technologies such as Machine Learning (ML) and Application Data Management (ADM)^{xliv}. Recently this gained much attention as the EU has proposed socially responsible regulations on ML technologies.



(Risk Based Approach, Source: EU Digital Strategy)



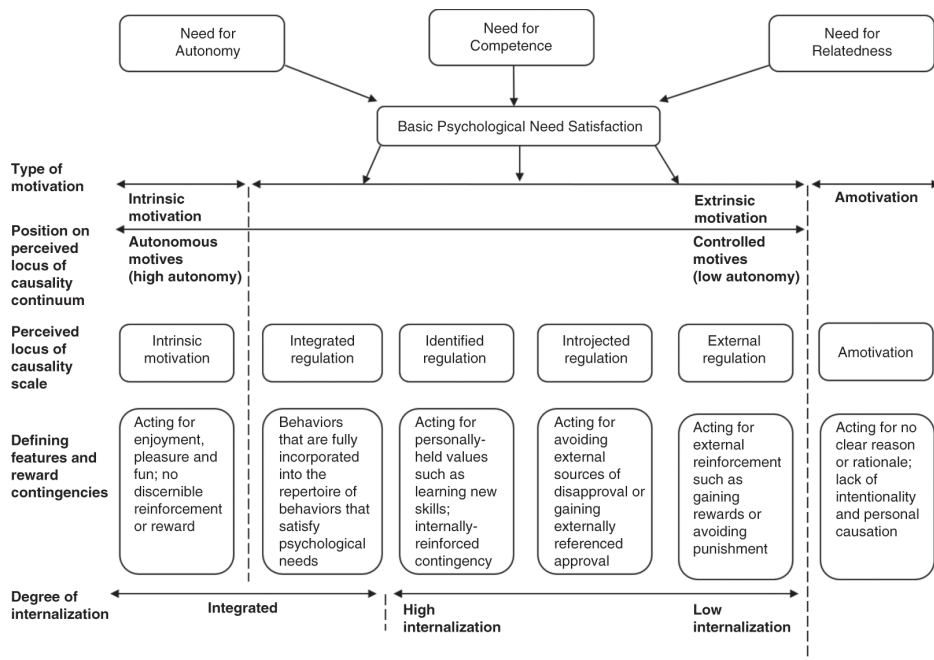
(4-Step Approach, Source: EU Digital Strategy)

The EU recently announced a risk-based approach to help regulate ML technologies in a socially responsible manner. Their approach focuses on categorising the risk posed by the technology into one of four categories: Unacceptable risk, high risk, limited risk, and minimal risk. Furthermore, the EU established how the regulations may be organised moving into the future with the announcement of a four-step regulation process. The first step involves the creation and development of a sensitive AI system. Step two involves the AI system undergoing a conformity assessment, as well as ensuring the AI systems complies with AI requirements and regulations. Step three progresses to the registration of the AI system. Finally, step four allows for a declaration of conformity to be signed, with the AI system bearing CE markings. Following this the AI system can be publicly placed on the market. Interestingly, this regulation process for AI systems also caters for significant changes in the AI technology. It stipulates that's if the technology undergoes a significant change, the regulation process starts afresh from step two.

This recent change in strategy by the EU underscores the growing of acceptance of the influence of computational technology in socio-economic, socio-political, and technological development, and furthermore an acceptance of technological semiotics. The development of this EU digital strategy serves as a potent reminder of the regulations virtual environments may face going into the future should they be deemed to influence user's social and political viewpoints, or for the purposes of this research paper have an effect of user's eudaimonia.

3.1 Motivation of Users Desiring Games Rooted in Eudaimonic Needs

A study carried out in 2010 by Przyblyski, Rigby and Ryan sought to investigate a motivational model of video game engagement. They approached this investigation using self-determination theory established by Deci and Ryan 2010, and reviewed empirical evidence according to need satisfaction in games and short-term well-being^{xlv}. In this study and analyse researchers used a macro-theory of motivators which influence individuals' behaviour to establish an understanding of psychological processing and well-being. Results demonstrated a potential method of study using a "motivational lens" to understand video game engagement. In particular the study found that the appeal of video games is rooted in the "need satisfaction" video game play can give to the user. Interestingly, the study found this motivation for "need satisfaction" was consistent across genres and content and rejects violence as a significant motivator. The study found that for the majority of players violent content in games was unrelated to the motivational appeal of the game to the player^{xlvi}. Researchers in this study discovered that when players need satisfaction was being inhibited in gameplay, it served as a motivator of player aggression. Furthermore, they found that when players exhibited severe need satisfaction deprivation in their daily life, they were at an increased risk to be compulsively engaged in video games. This is in sharp contrast to individuals who possess high levels of need satisfaction who were shown to engage in video games in a more nuanced and harmonious way, with motivation based a strong sense of choice. It was also shown that compulsive video game play was associated with low game enjoyment, high game engagement and negative post-play mood^{xlvii}. Given the shared similarities between video games and virtual environments, this research raises serious concerns about how people with low need satisfaction may be at risk of becoming compulsive in virtual environments.



(Self-Determination Theory, Source: The Handbook of Behaviour Change)

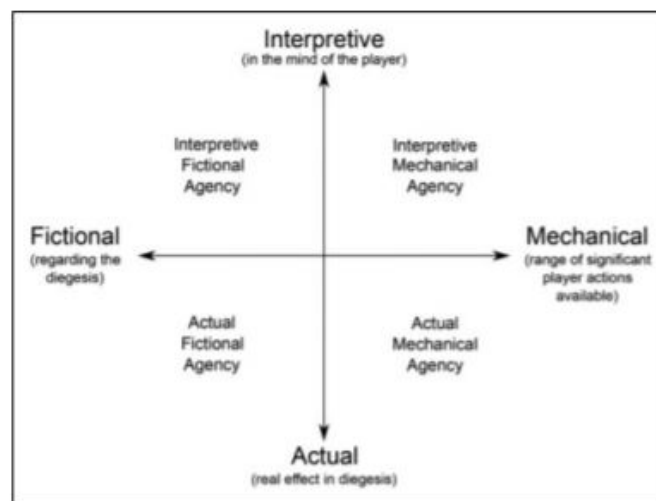
Given this potential for compulsive behaviour for certain individuals which would negatively affect one's eudaimonia and overall well-being, the research illustrates why further emphasis on eudaimonia in the design process of virtual environments is vital. However, while further research

needs to be carried out, an obstacle for carrying out conclusive research on this topic is limited by researcher’s ability to control need satisfaction outside of games or virtual environments.

Another key finding of this study involved to ability of immersion in virtual environments as a means of intensifying the effect of virtual content on users’ goals and decision making. The study examined the influence of natural and artificial content on users’ prosocial attitudes, discovering that immersion in natural environments was more positively associated with prosocial goals and decision making, compared to negative association with artificial environments on goals and decision making^{xlviii}. This further supports the argument of this thesis paper, that further emphasis and consideration should be placed on eudaimonia in the design process of virtual environments. This is because by carefully considering and curating virtual environments to imitate and mimic natural elements, the immersive environment experienced by the user may be more conducive to supporting prosocial goals and decision making.

3.2 Agency and Eudaimonia in Virtual Environments

Another study by Tom Cole and Marco Gillies was also interested in trying to better understand this under-researched area of the cognitive effect on eudaimonia in virtual environments. They sought to research the how the eudaemonic experience during video game play is created, perceived and how designers might best design for virtual environments. Participants in this study were interviewed regarding their emotional experiences during play of video games^{xlix}. The study established a framework which managed to categorise agency according to one of four categories.



(4 Categories of Agency, Source: Games and Culture)

According to the new framework established by Cole and Gillies, they proposed the categories of *Actual*, *Interpretive*, *Fictional* and *Mechanical* to segregate the experiences described by the participants. The *Actual* category as defined by Cole and Gillies refers to the meaningfulness of a player’s actions in virtual environments and to the meaningful effect such actions have to the player¹. Conversely, if a player can choose from a wide range of outcomes but these outcomes are of no consequence then the player would have no actual agency. Interpretive agency according to the framework entails the capability of the player to assemble their own cognitive and emotional understanding of the environment and navigate ambiguous and interpretive space. The framework

also goes on to define fictional agency as that which refers to the narrative and setting of the game's virtual environment. Finally, the framework describes mechanical agency as the player's scope of actions that the avatar can engage in in the virtual environment of the game^{li}.

Through this categorisation framework of Coles and Gillies it is believed that by thinking of agency as consisting of many different types which are distinct yet can co-exist it is hoped research on the topic can move forward in the future. Results from the study suggest interpretive fictional agency was common in many of the games involved in the study and suggests that the high level of agency involved in these titles support a very emotional game play experience contrasted against more generic video games^{lii}. Previous work on the topic conducted by Cole showed much more variation in emotional experiences associated with avant-garde video games compared to generic video games^{liii}. This research illustrates that players in avant-garde games engage with the material in a manner which is indicative of their authentic selves and greater emotional meaning. This increased engagement and emotional commitment lends itself for returning greater emotional satisfaction in game play as a result^{liv}. Crucially to the argument of this thesis, the implication made suggests that games with high levels of interpretive fictional agency, such as games which facilitate players to create and manipulate their own perception of the narrative and behaviours, result in higher levels of eudaimonia in the game play experience^{lv}. Given the broad similarities between video games and virtual environments, this is suggestive of a similar scenario for virtual environments and further supports why greater emphasis on eudaimonia should be taken in the design process of such environments.

3.3 Eudaemonic Experience in Digital Games

Eudaemonic narratives has recently become an interesting topic of digital games research, with Appela and Slater 2019 studying how the dark triad of narcissism, Machiavellianism, and psychopathy, affect participants responses to eudaemonic narratives. During this study, eudaemonic and non-eudaemonic videos were presented at random to participants. The results found the more participants were found to be displaying signs of the dark triad the more they reported viewing eudaemonic narratives as unauthentic and phony^{lvi}.

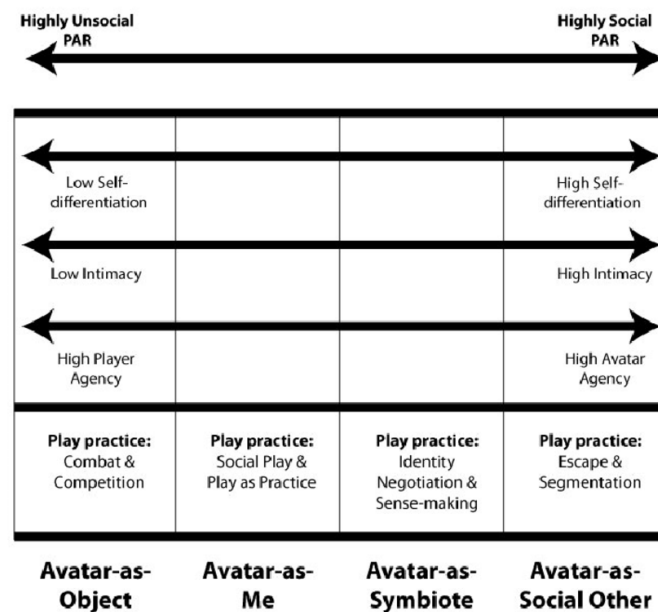
A review of the concept of eudaemonic experience in digital games conducted by Daneels and Bowman of eighty-two publications showed that different concepts relating to eudaimonia in digital games could be identified and relationships between these concepts could be studied further. From this analyse Daneels and Bowman identified four main patterns of eudaemonic concepts which were i) appreciation of an overall eudaemonic outcome, ii) a mix of meaningful, moving, and self-reflective eudaemonic experiences, iii) the capability of digital games to foster and support eudaemonic social connectedness, and iv) other eudaimonia-related concepts such as nostalgia and well-being^{lvii}.

Appreciation of an overall eudaemonic outcome was seen on almost a third of studies reviewed by Daneels and Bowman. However, reviewed material differs in how specify game elements evoke appreciation, which is further implicated by the means in which studies define the concept of appreciation in and of itself. In spite of these variations, most studies in the review defined appreciation as a positive interdependent experience distinct from the hedonic experience. As a result, this review illustrates appreciation is widely understood in digital game research to be a key element of eudaimonia.

Regarding the meaningfulness of digital games experiences, the studies can mostly be segregated into two categories: 1) Those exhibiting idiosyncratic meaning of in-game experiences, and 2) Those exhibiting direct connections between in-game experiences and struggles experienced in the

users real life. Findings on moving experiences in the study found it to be broadly understood as ‘affective’ responses to ‘in-game’ elements. In the majority of the reviewed pieces of literature in this study, a moving experience was defined as a gaming experience which was identified by intense negative or mixed affective responses occurring simultaneously^{lviii}. With regards to self-reflective experiences in digital games, two broad categories were identified in the study: 1) Perspective-taking for empathy, and 2) Personal growth and development^{lix}.

Interestingly the concept identified in the study fostering and supporting social connectiveness, raises an intriguing argument given social connection is not an explicitly eudaemonic quality. In the study, it identified social connectedness as being conceptually related to appreciation, incorporating ideas such as socialising, connection with others, togetherness, relatedness, closeness, and character attachment^{lx}. In Bowman and Webers study of *How Others Affect Performance at and Enjoyment of Video Games* they found stronger eudaemonic game experiences were associated with a higher satisfaction of relatedness needs, such as the need to connect with others and the experience of caring for these individuals^{lxi}. Overall, the study suggests social connectedness in digital games can improve eudaemonic well-being with it being particularly effective in niche areas where individuals can gain a sense of belonging through meaningful social connections. Another concept flagged in this area is the idea of character attachment to avatars which was associated with positive eudaemonic appreciation in some studies. One study in the review found that users who use avatars as social companions typically do so in a manner that is considered eudaemonic^{lxii}. This is because users typically react to their avatars similarly to authentic, human encounters. Furthermore, users in digital games defined these encounters with digital avatars as eudaemonic as they were experienced by the user to be an origin of personal growth and self-actualisation^{lxiii}.



(A social typology of player-avatar relationships, Source: Object, Me, Symbiote, Other)

Other concepts discussed in the studies include nostalgia, which was defined as emotional and cognitive state where users possess fond and bittersweet recollections of both close others and

events in their life, suggesting a relation to meaningful, emotionally moving, reflective, and socially connecting eudaemonic experience^{lxiv}.

The findings of the review by Daneels and Bowman highlighted key areas where further research may be of use going into the future. These include the experience of deep social connections an outcome of gaming which can fuel the perception of meaning and the minimum number of eudaemonic experiences required for players to consider a game impactful or appreciable. Furthermore, the review highlighted a neglect of eudaemonic motivations in academic literature when contrasted against player motivation research broadly speaking. Reasons for this gap in research may originate from the relative infancy of research on eudaimonia in the context of video games, or perhaps many players do not specifically seek out video games in the search for meaning, personal growth or being moved, but are rather primarily motivated by experiencing pleasure^{lxv}.

Despite these gaps in research in the context of digital video games, Daneels and Bowman review raises many key points which can similarly be applied to the context of virtual environments. This is vital to the argument of this thesis, as researched concepts of appreciation, meaningful, moving, and self-reflective eudaimonic experiences, social connectedness, and nostalgia highlight why greater emphasis on eudaimonia in the design process of virtual environments is important.

4 Methodology

This paper analysed existing literature on the topic of virtual environments and the significance of eudaimonia by conducting a backward chain search of relevant literature. Due to the varying definitions of eudaimonia and its relationship to virtual environments and its relatively recent adoption as a phenomenon of investigation, the use of specific search terms would not be sufficiently effective for the work of this paper. Instead the more appropriate approach to adopt of an anchor paper as a basis for identifying relevant studies.

Searching for specific terms would therefore be constrained and limited as it would fail to consider the broader context of contributing factors in the area. The use of an anchor paper and backward chain searching allows for a scope to investigate and research correlating and significant themes and concepts. The methodology behind this review involved choosing a suitable research paper which was relevant to the argument of this thesis which could be used for the backward chain search.

For this research paper the anchor paper of Seaborn 2020 was used as it was one of the first studies to design and implement a co-operative game considering hedonia and eudaimonia using a framework which included an extension to Huta's framework. Given the areas discussed in this paper, it was a suitable anchor paper as it examined concepts relevant to the argument of this research paper as well as being highly regarded within HCI.

To implement this backward chain search key references used by Seaborn were examined in further detail and key concepts raised by Seaborn and existing key references were identified and further grouped. To achieve a context and introduction for the reader, the initial two chapters of the research focused on the root causes effecting well-being, such as wellbeing in the context of virtual environments, and additional stressors in the 21st Century. Following this, chapters were segregated between the dyad of hedonia and eudaimonia, Huta's three-part framework, eudemonics extensions to the hedonics framework, eudaimonia in practice - examining user experience of technology. The motivation of users seeking games could be rooted in eudaemonic needs, agency and eudaimonia in virtual environments and eudaemonic experience in digital games.

The backward chain search focused on key studies related to Seaborn's study including & Przybylski 2020, Ryan and Deci 2008, Huta and Waterman 2014, Wiese L 2020, Desmet 2014, Seaborn 2016, Mekler and Hornbæk 2016, Kurosu 2020, Przybylski 2010, Cole 2021, Banks 2015, and Daneels 2021. Researchers in these key studies discuss similar concepts and theories relating to video games and virtual environments anchored in previously conducted research on eudaimonia in this context.

5 Results and Discussion

The results of this review were presented in a way which illustrated the wider argument for the value and increased relevance of well-being, and more specifically eudaimonia in the fast-paced world we live in today. Given recent changes in remote working and flexible working hours, the separation between work and home has become increasingly blurred as our reliance on technology has increased. As a result of these changes, digital well-being interventions, digital platforms and virtual environments which promote well-being are becoming increasingly desired. This increased need for such services may be rooted in additional stressors which are affecting millennials and generation Z. As discussed in this review, additional stressors may be associated with decreased economic upward mobility combined with a simultaneously widening inequality gap between the top one percent of the population and the poorest fifty percent of the population. Such economic factors as well as others such as housing, could be responsible driving this increased need to achieve an improved sense of well-being.

To examine what is entailed to achieve a strong sense of well-being the research paper explains the two sub-categories of wellbeing, hedonia and eudaimonia. Given the relatively well-researched and short-term outcome focus associated with hedonia, it was more appropriate to examine recent developments in the area of eudaimonia. Furthermore, the paper examines a model of eudaimonia proposed by Ryan (2008) which is grounded in self-determination theory. This theory defines elements to eudaemonic living, which are intrinsic goals, autonomous behaviour, mindful awareness and need satisfaction.

In order to relate Ryan's model of eudaimonia to the use of virtual environments a suitable framework needs to be applied. This review found Huta's framework as well the specific extensions to the framework as a suitable manner to achieve this connection. Huta's framework is broken down into *Degree of Centrality*, *Category of Analysis*, and *Level of Measurement*. Lisa Wiese's study of *Design for Sustained Wellbeing through Positive Activities* builds on this framework, and in the context of virtual environments enables research of how product properties, mechanics and UX contributes to interactions with the environment, and how such interactions informs drivers of behaviour.

Similarly, Desmet and Kamp 2014 further builds on the study of digital technology and eudaimonia by introducing an eudaemonic attributes addition to the framework. This is of note as it is a tool which could be used to further assess the effect of digital technology on long-term well-being. The eudaemonic attributes addition proposed by Desmet and Kamp involves digital products which add to a meaningful goal or symbolise a long-term engaging activity or goal, to an individual's life.

As UX qualities form the foundation of a products properties according to Lisa Wiese's study, this review examined eudaimonia in practice by examining how user experience is used in this context in digital technology and virtual environments. To explore this topic, this review analysed Mekler and Hornbaeks study of two hundred and sixty-six reports of positive experiences with technology to determine the relationship between eudaimonia and traditional UX theory. The results from this study showed that eudaemonic and hedonic motivating factors can be separated in user's descriptions of experiences with interactive technology and that they can be further delineated by eudaemonic sub-factors such as affect, fulfilment and long-term importance. This confirms the potential of UX research focused on eudaimonia and further supports the argument of this thesis that greater emphasis should be placed on research in this area. Furthermore, it is suggestive of the potential benefits future research in this area may have on well-being.

Specifically, in relation to UX in virtual environments research has shown there is an additional layer of consideration and complexity measuring the effect on eudaimonia given the “signs and signals interfacing” semiotic dimension, and the triadic nature of algorithmic signs. Despite these additional complexities, there is also room to make tremendous progressions in this area of materiality and semiotics through technological semiotics. This consists of technology which disseminates social and personal information with new kinds of artifacts which conjure up new signs of meaning as well as new methods of acting and thinking.

Building on this ethical dilemma posed by technological semiotics, Kurosu argues new materialism could innovate existing concepts in human computer interaction by assuming two things. Firstly, to accept computational technology has far reaching consequences on socio-economic, socio-political, and developmental issues facing societies today. And secondly, that computational technology is technological semiotics. Given these assumptions Kurosu argues that the boundary between human and machine becomes blurred. New materialism as debated by Kurosu develops on conservative thinking in HCI and adds an additional responsibility on HCI’s ability to solve delicate socio-economic and socio-political issues facing our world today.

The scope of this review also examined why individuals seek out digital games because of eudaemonic needs. Przyblyski, Rigby and Ryan’s study examining the motivational model of video game engagement found the attraction of video games was embedded in the sense of “need satisfaction” engagement it can provide for the user. Interestingly this study was also able to highlight that when players exhibited severe need satisfaction deprivation in their daily life, they were at an increased risk to be compulsively engaged in video games compared to individuals with high levels of need satisfaction who did not engage in video games compulsively. More research is needed in this area, particularly regarding whether a similar relationship exists with users of virtual environments such as workplaces, or online learning. Despite this, Przyblyski, Rigby and Ryan’s identified a further key finding involving the capacity of immersion in virtual environments as a mechanism for increasing the effectiveness of content in altering users’ goals and decision-making processes. They found that the virtual environment the user was immersed in mattered, with natural environments resulting in users’ developing more prosocial attitudes when compared against artificial environments.

To examine the cognitive effect on eudaimonia in virtual environments in greater detail this research paper looked at Coles and Gillies study on how the eudaemonic experience is created and perceived in digital games. They proposed a framework separating experiences into actual, interpretive, fictional, and mechanical categories. The argument from this study suggests that high levels of interpretive fictional agency, such as games which facilitate players to create and manipulate their own perception of the narrative and behaviours, may result in higher levels of eudaimonia in the game play experience. This is likely to be a quality which transfers to other virtual environments more generally, and as a result supports further research into eudaimonia and virtual environments.

Similarly, this paper examined previous studies on the eudaemonic experience in digital games, which Daneels and Bowman found could be delineated into four main concepts, i) appreciation of an overall eudaemonic outcome, ii) a mix of meaningful, moving, and self-reflective eudaemonic experiences, iii) the capability of digital games to foster and support eudaemonic social connectedness, and iv) other eudaimonia-related concepts such as nostalgia and well-being.

On the concept of fostering and supporting social connectiveness, Daneels and Bowman’s study raised a compelling argument as being conceptually related to appreciation, incorporating ideas such as socialising, connection with others, togetherness, relatedness, closeness, and character attachment. In Bowman and Weber’s study of *How Others Affect Performance at and Enjoyment of*

Video Games they found stronger eudaemonic game experiences were associated with a higher satisfaction of relatedness needs, such as the need to connect with others and the experience of caring for these individuals. Overall, the study suggests social connectedness in digital games can improve eudaemonic well-being with it being particularly effective in niche areas where individuals can gain a sense of belonging through meaningful social connections. The argument of character attachment to digital avatars was also raised given their associated link to positive eudaemonic appreciation in some studies. One study in the review found that users who use avatars as social companions typically do so in a manner that is considered eudaemonic. This is because users typically react to their avatars similarly to authentic, human encounters. Furthermore, users in digital games defined these encounters with digital avatars as eudaemonic as they were experienced by the user to be an origin of personal growth and self-actualisation. This raises many questions for virtual environments and eudaimonia more broadly speaking given the recent ubiquitous adoption of virtual environments for many diverse functions such as socialising, working and teaching.

6 Further Research

From this review on eudaimonia in the design process of virtual environments, it can be deduced from examination of existing literature that further emphasis in research should be placed on this topic. During the course of carrying out an analyse of literature for this review, some particular areas where a greater need for emphasis on research were identified. One such area could involve further research relating to eudaemonic extensions to Huta's framework. This could involve further research building on Seaborn's study to examine eudaimonia and virtual environments as a means to enhance social entertainment, training or as means of further empathising with one's particular situation. Further research in this topic could examine the suitability and broad range of applications the eudaemonics extension to the framework in AR and VR.

Another area where further research would be of benefit regarding this topic is regarding technological semiotics and potential for new materialism to progress existing concepts in human computer interaction. Further research could examine the decaying line between human and computational technology, and what this blurred responsibility and accountability might mean for the socio-economic, socio-political, and technological development it affects.

Further areas of research which could be of use to eudaimonia and virtual environments includes the motivations of users of such services. This is because research has shown users who exhibited severe need satisfaction deprivation in their daily life, were at an increased risk to be compulsively engaged in video games. Given the shared similarities between video games and virtual environments, this raises the possible research topic investigating how people with low need satisfaction may be at risk of becoming compulsive in virtual environments. Similarly, future research could examine the effect of immersion in natural virtual environments compared to immersion in artificial virtual environments on eudaimonia, prosocial goals and decision making.

Furthermore, this concept of motivation and eudaimonia in virtual environments could further be researched through the lens of agency. As games with high levels of interpretive fictional agency facilitate player to achieve higher levels of eudaimonia in the game play experience, further research could examine if this relationship exists in virtual environments more broadly. If so, further support why greater emphasis on eudaimonia should be taken in the design process of virtual environments.

7 Conclusion

In conclusion, having discussed the wider arguments for increased relevance of well-being, and more specifically eudaimonia in the fast-paced world we live in today, this research paper has reviewed eudaimonia in the context of virtual environments to establish if further research needs to be carried out. The paper reviewed the model of eudaimonia proposed Ryan is grounded in self-determination theory, which defines elements to eudaemonic living as intrinsic goals, autonomous behaviour, mindful awareness and need satisfaction. To study virtual environments specifically in relation to eudaimonia, Huta's extended eudaemonic framework is discussed. Huta's framework with extensions by Lisa Wiese enables researchers to study how product properties, mechanics and UX contributes to interactions with virtual environments, and how such interactions with virtual environments informs drivers of behaviour. Similarly, the addition of eudaemonic attributes to the framework further builds on the study of digital technology and eudaimonia by studying digital products which add to a meaningful goal or symbolise a long-term engaging activity or goal, to an individual's life.

User's descriptions of experiences with interactive technology can be delineated by eudaemonic sub-factors such as affect, fulfilment and long-term importance. This confirms the potential of UX research focused on eudaimonia and further supports the argument of this thesis suggesting greater emphasis should be placed on research in this area. Specifically, in relation to UX in virtual environments research has shown there is an additional layer of consideration and complexity measuring the effect on eudaimonia given the "signs and signals interfacing" semiotic dimension, and the triadic nature of algorithmic signs. However, new materialism could innovate existing concepts in human computer interaction by assuming two things. Firstly, to accept computational technology has far reaching consequences on socio-economic, socio-political, and developmental issues facing societies today. And secondly, that computational technology is technological semiotics.

Understanding the motivation of users in virtual environments is key to understanding its relationship to eudaimonia. As shown in the study we saw a direct relationship severe need satisfaction and compulsive engagement. More research is needed in this area, particularly regarding whether a similar relationship exists with users in other virtual environments such as workplaces, or online learning.

This paper also reviewed existing literature relating to how the eudaemonic experience is created and perceived in digital games. In particular, agency which was delineated according to actual, interpretive, fictional, and mechanical categories could be of particular value for future research. This is because it was shown that high levels of interpretive fictional agency, such as games which facilitate players to create and manipulate their own perception of the narrative and behaviours, may result in higher levels of eudaimonia in the game play experience. This is likely to be a similar quality which translates to virtual environments more broadly, but more research would need to be carried out.

This paper reviewed previous studies on the eudaemonic experience in digital games, which can be separated into four main concepts, i) appreciation of an overall eudaemonic outcome, ii) a mix of meaningful, moving, and self-reflective eudaemonic experiences, iii) the capability of digital games to foster and support eudaemonic social connectedness, and iv) other eudaimonia-related concepts such as nostalgia and well-being.

The review also noted that character attachment to digital avatars had an associated link to positive eudaemonic appreciation in some studies. One study in the review found that users who use avatars as social companions typically do so in a manner that is considered eudaemonic. This is because users typically react to their avatars similarly to authentic, human encounters. Furthermore, users in digital games defined these encounters with digital avatars as eudaemonic as they were experienced by the user to be an origin of personal growth and self-actualisation. This raises many questions for virtual environments and eudaimonia more broadly speaking given the recent ubiquitous adoption of virtual environments for many diverse functions such as socialising, working and teaching. As a result, more research in this area would be of enormous benefit to realising the full potential of virtual environments in relation to meaning and eudaimonia in the future.

Bibliography:

- Potential of Augmented Reality and Virtual Reality Technologies to Promote Wellbeing in Older Adults
- Augmented Experiences: Investigating the Feasibility of Virtual Reality as Part of a Workplace Wellbeing Intervention
- Video game play is positively correlated with well-being
- Internet-delivered cognitive therapy for social anxiety disorder: a development pilot series
- Unbound: How Inequality Constricts Our Economy and What We Can Do about It
- Financial Stress and Subjective Wellbeing among Children -Evidence from Finland
- Evaluation of a novel intervention to reduce burnout in doctors-in-training using self-care and digital wellbeing strategies: a mixed-methods pilot
- Living well: a self-determination theory perspective on eudaimonia
- Eudaimonia and Its Distinction from Hedonia: Developing a Classification and Terminology for Understanding Conceptual and Operational Definitions
- Design for Sustained Wellbeing through Positive Activities—A Multi-Stage Framework
- Measuring product happiness
- Learn what we're going through: Attitudes of older powered chair users towards mixed reality games that involve power mobility
- Momentary Pleasure or Lasting Meaning? Distinguishing Eudaimonic and Hedonic User Experiences
- Design and User Experience: Thematic Area, HCI 2020
- The Importance of Mobile Interface Icons on User Interaction
- Information as signs: A semiotic analysis of the information concept, determining its ontological and epistemological foundations
- A Motivational Model of Video Game Engagement
- The interplay among green brand knowledge, expected eudaimonic well-being and environmental consciousness on green brand purchase intention
- Eudaimonia, Economics and the Environment: What do the Hellenistic Thinkers Have to Teach Economists about 'the Good Life'?
- Thinking and Doing: Challenge, Agency, and the Eudaimonic Experience in Video Games
- Eudaimonia as Media Effect
- Decentralized utilitarian mechanisms for scheduling games
- Emotion and the Structure of Narrative Film: Film as an Emotion Machine
- Best news yet on the six-factor model of well-being
- An Assessment of the Construct Validity of Ryff's Scales of Psychological Well-Being

The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research

Repelled by virtue? The dark triad and eudaimonic narrative

Facilitating Game Play: How Others Affect Performance at and Enjoyment of Video Games

Object, Me, Symbiote, Other: A Social Typology of Player-Avatar Relationships

A Framework for the Experience of Meaning in Human-Computer Interaction

Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being

Gamification in theory and action: A survey

How eudaimonic and hedonic orientations map onto seeing beyond the 'me, now, and tangible'

On happiness and human potentials: A review of research on hedonic and eudaimonic well-being

The Lens of Intrinsic Skill Atoms: A Method for Gameful Design

The Power of Positive and Pleasurable Ergonomics

Tools for Wellbeing-Supportive Design: Features, Characteristics, and Prototypes

Transforming experience: The Potential of Augmented Reality and virtual Reality for enhancing Personal and Clinical Change

When 'Feeling Good' is not Good Enough: Seven Key Opportunities for Emotional Granularity in Product Development

Technologies for fostering intergenerational connectivity and relationships: Scoping review and emergent concepts

Intergenerational Shared Action Games for Promoting Empathy Between Japanese Youth and Elders

Removing Gamification: A Research Agenda

Henosis Experience in Gaming: A Metric for Adjustments to Global Schema and Appraised Meaning

Designing for Experiences in Blended Reality Environments for People with Dementia

E-technology and work/life balance for academics with young children

Burnout and demographic characteristics of workers experiencing different types of work-home interaction

The application of virtual reality technology to understanding psychosis: Commentary on Valmaggia et al. (2016): using virtual reality to investigate psychological processes and mechanisms associated with the onset and maintenance of psychosis: a systematic review

Efficacy of virtual reality exposure therapy in the treatment of PTSD: a systematic review

Augmented Reality: A Brand New Challenge for the Assessment and Treatment of Psychological Disorders

Virtual reality experience as a stress recovery solution in workplace

References:

-
- ⁱKatie Seaborn, Peter Pennefather & Deborah I. Fels. 2020, "Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being", *Human-Computer Interaction*, pp. 289-337.
- ⁱⁱHancock, P.A., Pepe, A.A. & Murphy, L.L. 2005, "Hedonomics: The Power of Positive and Pleasurable Ergonomics", *Ergonomics in design*, vol. 13, no. 1, pp. 8-14.
- ⁱⁱⁱKatie Seaborn, Peter Pennefather & Deborah I. Fels. 2020, "Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being", *Human-Computer Interaction*, pp. 289-337.
- ^{iv}Diener E, Seligman ME. Beyond money. Toward an economy of well-being. *Psychological Science in the Public Interest* 2004;5(1):1-31.
- ^vLee LN, Kim MJ, Hwang WJ. Potential of Augmented Reality and Virtual Reality Technologies to Promote Wellbeing in Older Adults. *Applied Sciences*. 2019; 9(17):3556. <https://doi.org/10.3390/app9173556>
- ^{vi}Currie, J. & Eveline, J. 2011, "E-technology and work/life balance for academics with young children", *Higher education*, vol. 62, no. 4, pp. 533-550.
- ^{vii}Merecz, D. & Andysz, A. 2014, "Burnout and demographic characteristics of workers experiencing different types of work-home interaction", *International journal of occupational medicine and environmental health*, vol. 27, no. 6, pp. 933-949.
- ^{viii}Matthew Naylor, Ben Morrison, Brad Ridout, Andrew Campbell, *Augmented Experiences: Investigating the Feasibility of Virtual Reality as Part of a Workplace Wellbeing Intervention, Interacting with Computers, Volume 31, Issue 5, September 2019, Pages 507-523*
- ^{ix}Gayer-Anderson, C. 2016, "The application of virtual reality technology to understanding psychosis: Commentary on Valmaggia et al. (2016): using virtual reality to investigate psychological processes and mechanisms associated with the onset and maintenance of psychosis: a systematic review", *Social Psychiatry and Psychiatric Epidemiology*, vol. 51, no. 7, pp. 937-939.
- ^xGonçalves, R., Pedrozo, A.L., Coutinho, E.S.F., Figueira, I. & Ventura, P. 2012, "Efficacy of virtual reality exposure therapy in the treatment of PTSD: a systematic review", *PloS one*, vol. 7, no. 12, pp. e48469-e48469.
- ^{xi}Matthew Naylor, Ben Morrison, Brad Ridout, Andrew Campbell, *Augmented Experiences: Investigating the Feasibility of Virtual Reality as Part of a Workplace Wellbeing Intervention, Interacting with Computers, Volume 31, Issue 5, September 2019, Pages 507-523*
- ^{xii}Chicchi Giglioli, I.A., Pallavicini, F., Pedrolì, E., Serino, S. & Riva, G. 2015, "Augmented Reality: A Brand New Challenge for the Assessment and Treatment of Psychological Disorders", *Computational and mathematical methods in medicine*, vol. 2015, pp. 862942-12.
- ^{xiii}Ahmaniemi, T., Lindholm, H., Muller, K. & Taipalus, T. 2017;2018;, "Virtual reality experience as a stress recovery solution in workplace", *IEEE*, , pp. 206.
- ^{xiv}Johannes, N., Vuorre, M., & Przybylski, A. K. (2020, November 13). Video game play is positively correlated with well-being. Pages 1-5
- ^{xv}Stott, R., Wild, J., Grey, N., Liness, S., Warnock-Parkes, E., Commins, S., . . . Clark, D. (2013). Internet-Delivered Cognitive Therapy for Social Anxiety Disorder: A Development Pilot Series. *Behavioural and Cognitive Psychotherapy*, 41(4), 383-397. doi:10.1017/S1352465813000404
- ^{xvi}Marja, L., Nygård Mikael, Fredrica, N., & Mia, H. (2021). Financial stress and subjective wellbeing among children - evidence from finland. *Child Indicators Research*, 14(2), 799-819. doi:http://dx.doi.org.ucd.idm.oclc.org/10.1007/s12187-020-09779-9
- ^{xvii}Rich, A., Aly, A., Cecchinato, M.E., Lascau, L., Baker, M., Viney, R. & Cox, A.L. 2020, "Evaluation of a novel intervention to reduce burnout in doctors-in-training using self-care and digital wellbeing strategies: a mixed-methods pilot", *BMC medical education*, vol. 20, no. 1, pp. 1-294.
- ^{xviii}Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.
- ^{xix}Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.
- ^{xx}Katie Seaborn, Peter Pennefather & Deborah I. Fels. 2020, "Eudaimonia and Hedonia in the Design and Evaluation of a Cooperative Game for Psychosocial Well-Being", *Human-Computer Interaction*, pp. 289-337.
- ^{xxi}Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.
- ^{xxii}Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.

-
- ^{xxiii} Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.
- ^{xxiv} Ryan, R.M., Huta, V. & Deci, E.L. 2008, "Living well: a self-determination theory perspective on eudaimonia", *Journal of happiness studies*, vol. 9, no. 1, pp. 139-170.
- ^{xxv} Huta, V. & Waterman, A.S. 2014, "Eudaimonia and Its Distinction from Hedonia: Developing a Classification and Terminology for Understanding Conceptual and Operational Definitions", *Journal of happiness studies*, vol. 15, no. 6, pp. 1425-1456.
- ^{xxvi} Huta, V. & Waterman, A.S. 2014, "Eudaimonia and Its Distinction from Hedonia: Developing a Classification and Terminology for Understanding Conceptual and Operational Definitions", *Journal of happiness studies*, vol. 15, no. 6, pp. 1425-1456.
- ^{xxvii} Huta, V. & Waterman, A.S. 2014, "Eudaimonia and Its Distinction from Hedonia: Developing a Classification and Terminology for Understanding Conceptual and Operational Definitions", *Journal of happiness studies*, vol. 15, no. 6, pp. 1425-1456.
- ^{xxviii} Wiese L, Pohlmeier AE, Hekkert P. Design for Sustained Wellbeing through Positive Activities—A Multi-Stage Framework. *Multimodal Technologies and Interaction*. 2020; 4(4):71. <https://doi.org/10.3390/mti4040071>
- ^{xxix} Irene Kamp and Pieter M.A. Desmet. 2014. Measuring product happiness. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems (CHI EA '14)*. Association for Computing Machinery, New York, NY, USA, 2509–2514. DOI:<https://doi-org.ucd.idm.oclc.org/10.1145/2559206.2581274>
- ^{xxx} Irene Kamp and Pieter M.A. Desmet. 2014. Measuring product happiness. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems (CHI EA '14)*. Association for Computing Machinery, New York, NY, USA, 2509–2514. DOI:<https://doi-org.ucd.idm.oclc.org/10.1145/2559206.2581274>
- ^{xxxi} Seaborn, K., Pennefather, P. & Fels, D.I. 2016, "'Learn what we're going through': attitudes of older powered chair users towards mixed reality games that involve power mobility", *Universal access in the information society*, vol. 15, no. 4, pp. 699-711.
- ^{xxxii} Seaborn, K., Pennefather, P. & Fels, D.I. 2016, "'Learn what we're going through': attitudes of older powered chair users towards mixed reality games that involve power mobility", *Universal access in the information society*, vol. 15, no. 4, pp. 699-711.
- ^{xxxiii} Elisa D. Mekler and Kasper Hornbæk. 2016. Momentary Pleasure or Lasting Meaning? Distinguishing Eudaimonic and Hedonic User Experiences. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. Association for Computing Machinery, New York, NY, USA, 4509–4520. DOI:<https://doi.org/10.1145/2858036.2858225>
- ^{xxxiv} Elisa D. Mekler and Kasper Hornbæk. 2016. Momentary Pleasure or Lasting Meaning? Distinguishing Eudaimonic and Hedonic User Experiences. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. Association for Computing Machinery, New York, NY, USA, 4509–4520. DOI:<https://doi.org/10.1145/2858036.2858225>
- ^{xxxv} Elisa D. Mekler and Kasper Hornbæk. 2016. Momentary Pleasure or Lasting Meaning? Distinguishing Eudaimonic and Hedonic User Experiences. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. Association for Computing Machinery, New York, NY, USA, 4509–4520. DOI:<https://doi.org/10.1145/2858036.2858225>
- ^{xxxvi} Elisa D. Mekler and Kasper Hornbæk. 2016. Momentary Pleasure or Lasting Meaning? Distinguishing Eudaimonic and Hedonic User Experiences. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. Association for Computing Machinery, New York, NY, USA, 4509–4520. DOI:<https://doi.org/10.1145/2858036.2858225>
- ^{xxxvii} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.49
- ^{xxxviii} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.49
- ^{xxxix} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.49
- ^{xl} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.50
- ^{xli} Thellefsen, M.M., Thellefsen, T. & Sørensen, B. 2018, "Information as signs: A semiotic analysis of the information concept, determining its ontological and epistemological foundations", *Journal of documentation*, vol. 74, no. 2, pp. 372-382.
- ^{xlii} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.50
- ^{xliii} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.50

-
- ^{xliv} Kurosu, M. 2020, *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020*, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19-24, 2020, Proceedings, Part I, 1st 2020. edn, Springer International Publishing, Cham.pp.50
- ^{xlv} Przybylski, A.K., Rigby, C.S. & Ryan, R.M. 2010, "A Motivational Model of Video Game Engagement", *Review of general psychology*, vol. 14, no. 2, pp. 154-166.
- ^{xlvi} Przybylski, A.K., Rigby, C.S. & Ryan, R.M. 2010, "A Motivational Model of Video Game Engagement", *Review of general psychology*, vol. 14, no. 2, pp. 154-166.
- ^{xlvii} Przybylski, A.K., Rigby, C.S. & Ryan, R.M. 2010, "A Motivational Model of Video Game Engagement", *Review of general psychology*, vol. 14, no. 2, pp. 154-166.
- ^{xlviii} Przybylski, A.K., Rigby, C.S. & Ryan, R.M. 2010, "A Motivational Model of Video Game Engagement", *Review of general psychology*, vol. 14, no. 2, pp. 154-166.
- ^{xlix} Cole, T. & Gillies, M. 2021;2019;, "Thinking and Doing: Challenge, Agency, and the Eudaimonic Experience in Video Games", *Games and culture*, vol. 16, no. 2, pp. 187-207.
- ^l Cole, T. & Gillies, M. 2021;2019;, "Thinking and Doing: Challenge, Agency, and the Eudaimonic Experience in Video Games", *Games and culture*, vol. 16, no. 2, pp. 187-207.
- ^{li} Cole, T. & Gillies, M. 2021;2019;, "Thinking and Doing: Challenge, Agency, and the Eudaimonic Experience in Video Games", *Games and culture*, vol. 16, no. 2, pp. 187-207.
- ^{lii} Cole, T. & Gillies, M. 2021;2019;, "Thinking and Doing: Challenge, Agency, and the Eudaimonic Experience in Video Games", *Games and culture*, vol. 16, no. 2, pp. 187-207.
- ^{liii} Cole, R., Correa, J.R., Gkatzelis, V., Mirrokni, V. & Olver, N. 2015, "Decentralized utilitarian mechanisms for scheduling games", *Games and economic behavior*, vol. 92, pp. 306-326.
- ^{liv} Prince, S. 1997, "Emotion and the Structure of Narrative Film: Film as an Emotion Machine Ed S. Tan Barbara Fasting", *Film quarterly*, vol. 51, no. 1, pp. 45-46.
- ^{lv} Cole, R., Correa, J.R., Gkatzelis, V., Mirrokni, V. & Olver, N. 2015, "Decentralized utilitarian mechanisms for scheduling games", *Games and economic behavior*, vol. 92, pp. 306-326.
- ^{lvi} Appel, M., Slater, M.D. & Oliver, M.B. 2019, "Repelled by virtue? The dark triad and eudaimonic narratives", *Media psychology*, vol. 22, no. 5, pp. 769-794.
- ^{lvii} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.
- ^{lviii} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.
- ^{lix} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.
- ^{lx} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.
- ^{lxi} Bowman, N.D., Weber, R., Tamborini, R. & Sherry, J. 2013, "Facilitating Game Play: How Others Affect Performance at and Enjoyment of Video Games", *Media psychology*, vol. 16, no. 1, pp. 39-64.
- ^{lxii} Banks, J. 2015, "Object, Me, Symbiote, Other: A Social Typology of Player-Avatar Relationships", *First Monday*, vol. 20, no. 2, pp. 61.
- ^{lxiii} Banks, J. 2015, "Object, Me, Symbiote, Other: A Social Typology of Player-Avatar Relationships", *First Monday*, vol. 20, no. 2, pp. 61.
- ^{lxiv} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.
- ^{lxv} Daneels, R., Bowman, N.D., Possler, D. & Mekler, E.D. 2021, "The 'Eudaimonic Experience': A Scoping Review of the Concept in Digital Games Research", *Media and communication (Lisboa)*, vol. 9, no. 2, pp. 178-190.