Accessibility in Digital Health: Virtual Conversational Agents and Mental Health Services

Anastasios Koukopoulos

https://orcid.org/0000-0002-3286-874X

ELTRUN – The E-Business Research Center

Athens University of Economics and Business, School of Business,

Department of Management Science and Technology

Nikolaos Danias[1]

https://orcid.org/0000-0003-0678-5630

University of Strathclyde, Glasgow, United Kingdom

Department of Economics

ABSTRACT

Recent advances in Artificial Intelligence have led changes to the operation, the capabilities and the performance of a number of industries. Provision of Mental Health Services is expected to experience a paradigm shift, with the introduction of Artificial Intelligence-driven Virtual Conversational Agents (VCAs). This is a conceptual paper, focusing on the use of Personalised Anthropomorphic VCAs (PAVCAs), which we introduce as a term. We suggest the use of PAVCAs to support people suffering from Prolonged Grief Disorder (PGD). For such an application to be able to drive meaningful change for the users and to deliver economic

value and utility, we argue that the PAVCAs are configured to the known and public characteristics (e.g. personal linguistic peculiarities, moral principles, stated tastes and preferences across a range of themes) of the users beloved deceased ones. Such digital services aim to offer to service users solace, comfort and companion. We explore the options of having such applications personalized pre-mortem or post-mortem, and the source for information being affected by data limitations. Using two models, we suggest that the use of these platforms can comprise a reactive approach to the diagnosis of PGD; as well as a proactive approach, dealing with grief before PDG is manifested.

1. Introduction

In recent years, there has been a growing interest in the use of chatbots in the field of mental health care (Rauws, 2022) with their role expected to increase in subsequent years (Ahmed et al., 2023). Mental health chatbots are systems designed to create human-like conversation using spoken, written and visual languages, having been used to provide predictions, detections, treatment solutions and other services to individuals with mental health conditions (D'Alfonso, 2020). The potential benefits of using chatbots for mental health services are numerous, including their ability to provide 24/7 support, their accessibility and flexibility (Torous et al., 2021) and their potential to improve several mental health services issues. Previous research has examined the potential use and effectiveness of mental health chatbots in helping patients deal with a wide range of conditions such as: eating disorder; panic disorder; depression; and anxiety with the latter two appearing to have already seized the benefits of this technology (Ahmed et al., 2021). One such mental health condition is Prolonged Grief Disorder (PGD), a debilitating and often persistent form of grief that can significantly impact an individual's quality of life (Koukopoulos & Neimeyer, 2023). Xygkou et al., (2023) call attention to for further investigation in the use of chatbots and their potential benefits as also the risks that the implementation of this technology emerges since the results of the use – in the grief context – presented positive feedback.

In the use of chatbots in mental health services, a critical factor in terms of human-chatbot interaction lies in the anthropomorphic nature of the design. As chatbots are increasingly equipped with human-like characteristics (Konya-Baumbach et al., 2023), anthropomorphism in chatbots has risen the interest of the academic community (Li & Suh, 2022), addressing various issues in many distinct contexts from purchase intention and customer satisfaction (Crolic et al., 2022), to trust and behavioral intention (Youn & Jin, 2021). Chatbots can serve as a source of social support and companion (Mundhra et al., 2021; Ta et al., 2020), positively affecting wellbeing (Skjuve et al., 2021). Additionally, Pentina et al., (2023) in their seminal research noted the importance of AI anthropomorphism as a driver of the relationship with social chatbots. Taking those into consideration and effectively implementing anthropomorphic characteristics such as gender, personality, and visual interface cue (Kang & Kang, 2023), perceived anthropomorphism can mediate the interrelation of interaction intensity as also the social connectedness to the chatbot (Christoforakos et al., 2021).

In light of increasing Artificial Intelligence capabilities and the introduction of large language models, such as ChatGPT, and future iterations of such platforms with possible access to patients health record aligned with governmental data regulations, seem promising in advancing the health care industry (Patel & Lam, 2023). Although large language models are yet to reach the point of providing accurate consulting and eventually replacing doctors (Howard et al., 2023), familiarization and further investigation of the potential use from clinicians and interdisciplinary experts and researchers should be put under consideration.

Artificial Intelligence mental health chatbots may be an appealing solution to issues such as the increasing shortage of mental health professionals (Hoffmann et al., 2023; Johnson & Brookover, 2020) but despite their potential benefits, rapid technological developments also address several concerns and implications. Lack of research and underrepresenting information concerning data security, privacy and usage of third-party services (May & Denecke, 2022) are some of the areas that raise ethical and deontological concerns. These concerns have to be considered along with additional concerns over the suggested improvements in mental health outcomes from the adoption of these technologies, as well as the aggravation of the existing health inequalities as a result from the post-pandemic

technological developments and the wide adoption of them (Skorburg & Yam, 2022). The transition to a mental health services model which involves the use of anthropomorphic chatbots to support patients' mental health conditions and to harvest data that might be used from health care services systems become an increasingly more possible option. However, implementation of such an approach might mean that digital illiteracy can emerge as an objective barrier for patients to access such services offered to them.

This research explores the way in which the chatbot technology can be utilized to create Personalised Anthropomorphic Virtual Conversational Agents (PAVCAs). This is a novel term that is introduced by the authors of this research to describe what they anticipate might be a type of software application offering mental health services which are technologically enhanced through Artificial Intelligence, and which are focused on customizing the service to the personality of a deceased person.

This chapter constitutes a conceptual paper, in which the authors introduce the concept of the PAVCAs and of the ways in which these have the potential to result to paradigm shifts in several markets and industries, as well as in society and everyday life. The conceptual model introduces and analyses three models as theoretical constructs, and thus does not include analysis of primary or secondary data, which would have been extremely fascinating. Such data can become part of research and future publications on this matter, either through exploring relevant future secondary datasets on PAVCAs or through carefully designed large-scale studies over several years, again in the future. For this to become possible, PAVCAs need to be introduced for widespread commercial use across society, and to become accepted by society as normalized instruments.

PAVCAs can be used to support patients suffering from Prolonged Grief Disorder. In this application of the technology, the chatbot does not assume a generic format offering standardised assistance to patients, but instead mimics the behaviours and the interaction styles of the deceased beloved of the patients suffering from PGD. Each chatbot is thus very heavily personalized to achieve resemblance in interactions with the deceased person of

interest. One value proposition involves the ability of people to prepare detailed and accurate pre-mortem PAVCAs which can be used to offer companionship to their beloved persons who will live without them. PAVCAs could allow them to create a depository which stores their messages, ideas, linguistic peculiarities, and moral principles for these to be used in the future. The underlying assumption of this research is that if PAVCAs offer realistic depictions of the personalities of the deceased, it could be possible for users to get solace and companionship from their use. The abovementioned approaches can deliver utility and clear economic value to PAVCA users.

PAVCAs can offer options for being put together post-mortem through the utilization of information and data that the deceased might have let behind. The use and management of such a resource can be potentially a powerful agent of change for the way in which people can deal with grief and with the process of losing a loved one. In the theoretical models that the chapter introduces, the authors include the option of the PAVCAs being embedded in mental health services provision, supporting patients that deal with mental health issues associated with loss. This proposition is very relevant to the operation and the constraints faced by health care services. Moving to digital can deliver economies of scale and can improve the speed of services delivery, whilst also standardizing quality of services.

2. Literature review

2.1 Chatbots

Historically, the field of Marketing has a tradition of being open to the adoption of new technologies. One such technology is the use of chatbots, and this has been examined as a potential approach to the provision of customer service (Hoffman *et al.*, 2022). Published research has shown that the relationship between chatbots and users can be complex, and that in some cases where anger was involved the satisfaction from interaction with chatbots

was less than with human agents (Tsai *et al.*, 2021). Literature has examined the factors that influence the consumer's trust in chatbots, arguing for the importance of have an initial level of trust to them (Mostafa & Kasamani, 2021).

Research suggested that the use of social-oriented interaction style in chatbots positively affects the perception of the social presence of the chatbot (De Cicco *et al.*, 2020). It has been noted in the literature that chatbots have the ability to adjust the language in their responses to users in order to adopt a conversational style that reflects the personality of the use and that makes the interactions more personalised (Shumanov & Johnson, 2021). The importance of the chatbots being able to have intelligence dialogues with the users to enhance their experiences has also been identified in the literature (Sands *et al.*, 2021). Ethical challenges associated with the use of chatbots have also been discussed in the literature, focusing on the ethical management of interactions between chatbots and users (Murtarelli *et al.*, 2021).

A concerning factor that negatively affects the experience of users is the creepiness of the chatbots and the way that it performs during interactions that raise privacy concerns. Creepiness seems to lead to negative emotions, reduced trust and lower levels of loyalty (Rajaobelina *et al.*, 2021).

2.2 Chatbots in mental health

Use of Virtual Conversational Agents as a tool for psychiatrist care provision in mental health has been reported to be promising, and specifically on self-adherence suggesting that there is potential for these to be used in supporting psychiatric treatment of patients (Vaidyam *et al.*, 2019). Subsequent studies showed that mental health care professionals find the use of chatbots beneficial and with relatively high received importance (Sweeney et al., 2021), and that patients have positive opinions for mental health chatbots (Abd-Alrazaq et al., 2021). Another study found no statistically significant effect from the use of VCAs to support mental

health (Alaa A. Abd-Alrazaq *et al.*, 2020). Health sector seems to attract the most of interest as far as new technologies and global private investments are concerned. More specifically, the topics of drugs, cancer, molecular and drug discovery came first on the list on the "Artificial Intelligence Index Report" of Stanford University's "Human-Centered Artificial Intelligence Center" for 2021 with more than 13.8 billion US Dollars in private investments in Artificial Intelligence, which is an increase of more than 4% from 2019 (D. Zhang et al., 2021). As part of the health system, Artificial Intelligence is regarded as a promising technology to address specific gaps in the mental health care field capable of solving issues such as the shortage of human therapists, the need for 24/7 availability of specialized support, and the coverage of remote areas with such services (Potts et al., 2021).

Chatbots have been extensively used in the health care provision (Nadarzynski et al., 2019), and literature has also looked at the use of chatbots in the provision of mental health services specifically (Abd-Alrazaq et al., 2021; Sweeney et al., 2021; Vaidyam et al., 2020). Research has been published in recent years concerning Virtual Conversational Agents (VCAs) (Fosso Wamba *et al.*, 2021) – chatbots and voicebots – and their ability to contribute in mental health care (Boucher et al., 2021). The unpresented era of COVID-19 resulted in deterioration of the mental health of large numbers of people globally (Robinson *et al.*, 2022), and this resulted in mental health support systems being pushed to their limits. The specific impact of COVID-19 has been identified in the literature (Khan et al., 2022).

2.3 Anthropomorphism

Anthropomorphism stands as critical element in recent bibliography concerning the use of chatbots, voicebots and robots in a plethora of use cases in retailing, tourism and hospitality, health sector and others. The use of chatbots to resume customer service roles been looked at in the literature (Pillai and Sivathanu, 2020; Adam *et al.*, 2021; Chong *et al.*, 2021), noting the importance of anthropomorphism, appearance and interactivity. Mediators of anthropomorphism in chatbots, such as likeability and attractiveness of a chatbot have been

discussed in the literature, and it is noted that the triggers of anthropomorphism might be present in the user rather than in the VCA (Blut et al., 2021).

The human-like design characteristics of chatbots like having a name and using human-like language styles can be important for the way in which chatbots are regarded as social presences (Araujo, 2018; Crolic *et.al.*, 2022; Moriuchi, 2021). Anthropomorphism and social presence can influence outcomes relevant to emotional connection after interacting with a chatbot (Araujo, 2018). Literature suggests that errors in the interaction of chatbots with humans result in reduction of their anthropomorphic characteristics, and that anthropomorphic chatbots can provide value to users that wish to get human-like interaction (Sheehan *et al.*, 2020).

Also, research on chatbots that make conversations using anthropomorphic style characteristics like warmth and competence achieve greater effectiveness, persuading chatbot users to regard chatbots differently from a psychological point of view (Roy & Naidoo, 2021). Similar findings were published by other researchers (Cheng *et al.*, 2022), who also noted that these characteristics help users develop trust in chatbots, as well as that relationship norms can affect the outcomes of the interaction between chatbots and humans. Recent research identified four dimension in the anthropomorphic characteristics of service robots, and one of these was the existence of unique human characteristics (S. Zhang *et al.*, 2022), which relates very much with the approach suggested for the VCAs examined in this paper. Other research (Letheren *et al.*, 2021) on domestic service robots has suggested that despite users having a preference for humanness and social interaction, only some users like high-interaction dialogues with the robots.

Research has noted the importance of the emotional context in the use of chatbots. anthropomorphic chatbots can provide a negative experience to customers that are angry, whereas this is not true in cases where customers are not angry (Crolic et al., 2022).

3. Theoretical Framework and Analysis

3.1 Theoretical Framework

This research is structured on the template of Theory Adaptation (Jaakkola, 2020). The authors of this research consider this to be the best fit for the development of theories in this conceptual chapter.

On the basis of theoretical development, we consider the Uses and Gratification theory (U&G) (Rubin, 2009) as a psychological communication perspective to assume the goal-driven selection of VCA's as a medium from the PGD potential users, based on their current psychological needs or motivations, consolidating our argument with Kubler Ross's model for the Stages of Grief (Buglass, 2010). Moreover, it is important to take into consideration the perspective of the user's bonding with a VCA, through the presence of the element of trust, the strength of the relationship and the strength of the ties with the VCA overtime, as perceived through the prism of Media Multiplexity Theory (Ledbetter, 2021). Hence, our theoretical model is formed having as main axis the perspective of the user towards the anthropomorphic side of the artificial intelligence conversational agent, the psychological condition of the user, as well as the needs and self-fulfilling goals has been settled and other parameters such as: time invested in the procedure; strength of the relationship between the deceased in the form of the VCA and the end-user; and trust.

Theory Adaptation, as proposed by Jaakkola (2020) focuses on the amendment of an existing theory by the mean of using other theories. In our case, the use of U&G theory, focused on the medium of chatbots (Brandtzaeg & Følstad, 2017), lays the foundation of understanding and explaining the motivation of patients with PGD to communicate with a chatbot based on their needs.

3.2 Analysis of Models

Based on the aforementioned, this research introduces three different conceptual models. In these three models, the authors explore how Personified Anthropomorphic Virtual Conversational Agents can impact users' everyday life quality. Model 1 and Model 2 are contextualised for users who had a bereavement and who use a PAVCA that assumes the personality traits of the deceased loved one.

Model 1

Model 1, illustrated in Figure 1, provides an illustration of how Personified Anthropomorphic Virtual Conversational Agents can provide a reactive approach to dealing with Prolonged Grief Disorder (or other mental health issues) that people face after a Trigger Event, such as the death of a beloved one. People in that position are likely to face difficulties in dealing with that loss and to adjust to the change that this might bring in their life.

The natural cycle that they are called to go through is the 5 stages of grief (Avis et al., 2021). It is not unlikely for people to encounter difficulties going through these stages, and to need help and support. Depending on the individual, they can get to the stage of asking for help very fast, if they are open to this option, if they are informed of the benefits, and if they have available resources (such access to health care professionals and ability to pay for their services if needed).

The loss of a beloved person can have an impact on mental health of the bereaved, with one of the potential impacts being that they might suffer from Prolonger Grief Disorder (PGD). In Model 1, we focus specifically on this case, but the model can possibly be revisited and be considered for other mental health conditions as well. As per our model, a person suffering from PGD can get a diagnosis, which can also be accompanied by recommendations for traditional approaches to be used to deal with it (medication, counselling, along with lifestyle

adaptations) as well as the use of a Personified Anthropomorphic Virtual Conversational Agent (PAVCA).

In the above case, the Virtual Conversational Agent will have to be Anthropomorphic, which means that cues are used to recommend to the user that they are engaging in a conversation with a human. An addition to this, which is a new term introduced by this paper is that the VCA will have to exhibit Personified Anthropomorphism, which means that the user will get cues that suggest that they do not only interact with a human, but rather with a very specific person, that is their beloved deceased person. We chose to use the term Personified to link it back to the use of the word person by Carl Rogers, who has attributed this term to a psychologically well-developed individual (Rogers, 1995). The Personified dimension of the PAVCA constitutes its Unique Selling Point as an instrument that can help end users deal with the circumstances they face and can help them manage their loss. The Personification element is the most important element, and the one that can help argues for the use of PAVCAs as they do something completely different from what another Anthropomorphic Virtual Conversational Agent would do: they offer an experience that resembles an interaction with the deceased beloved person.

In order for the PAVCAs to be Personified to an extent that will result in a convincing experience, offering to the end user an interaction with the PAVCA which convincingly resembles to an interaction with the actual deceased individual, an amount of data are required. The PAVCA can be created post-mortem, using any data that can be recovered in an attempt to put together enough information so that the PAVCA will convincingly reflect the personality of the deceased person. It would be much more convenient from a perspective of data collection and scope, that the PAVCA is created from the deceased before their death, and to be left waiting to be used. Such a PAVCA profile would be endowed with a full and extended library of information/ideas/life stance/opinions/literary style that reflect the actual personality of the deceased. Such a setup will allow Personified Anthropomorphism to be a critical element of the chatbot helping for it to be a success in getting accepted by the user and in perhaps managing to deliver meaningful change in their life. With the end user knowing that the PAVCA is constructed with input from the deceased person for that purpose,

with all the data deposited to be used in the future, it can be perceived as a genuine message left for the end user, and the interactions between the PAVCA and the end user can be rightfully considered genuine.

The PAVCA can be used for a specific period of time or perhaps be available indefinitely, depending on how this is regarded by the health care system and the user. As per Model 3 of this paper, the end user might want to return to the PAVCA after conclusion of the service cycle offered by the mental health services provider. When the person returns post-service, they might elect to remain users of this service indefinitely. The recommendation for the use of the PAVCA from the health care system's perspective remains to be determined. Several factors are weighed in when decisions in the area of Health Economics are made. Such decisions might have to be informed by empirical data and observations that will shape future protocols for the use of PAVCAs to deal with specific mental health care conditions associated with loss of a beloved individual. These decisions might also be affected by legacy effects of previous decisions, such as existing assets and contracts with third party providers, as well as by budgeting constraints, legal constraints and political factors.

Model 2

Model 2 is depicted in the lower part of Figure 1. This model introduces the notion that PAVCAs can be used proactively, which in this case means that they are used without the manifestations of a mental health condition. Model 2 suggests that the loss of a beloved person can be a potential Trigger Event, and that following from such an event, the end user can be approached and be offered the use of a PAVCA that is Personified using the data and characteristics of their beloved who passed. This approach of the end user can be made by the health care provider, the funeral directors, the hospital where the bereaved might have received medical services from, social media platforms engaging in targeted digital marketing, to name a few.

Model 2 introduces a market-based approach to support bereaved individuals, which comes in contrast to the medically-driven approach of Model 1. This approach might also involve the bereaved having participated in the preparation of this experience by providing information and data for the enhancement of the experience and the proper operation of the PAVCA that will be given to the end users. The assumption of Model 2 is that the Trigger Event could have led to PGD or other clinical conditions, and these might be avoided in the PAVCA is introduced very early and if it helps the users go through the process of the stages of grief. In this way, a significant benefit is that the development of a mental health condition such as PGD might be avoided, and also that the user of PAVCA might not face medical bills, as the condition that could have developed is avoided. Similarly, if the user enjoys a free public health care system, then the system will get less demand for their services, and thus the option of being proactive and offering the PAVCA to bereaved individuals might be a good approach.

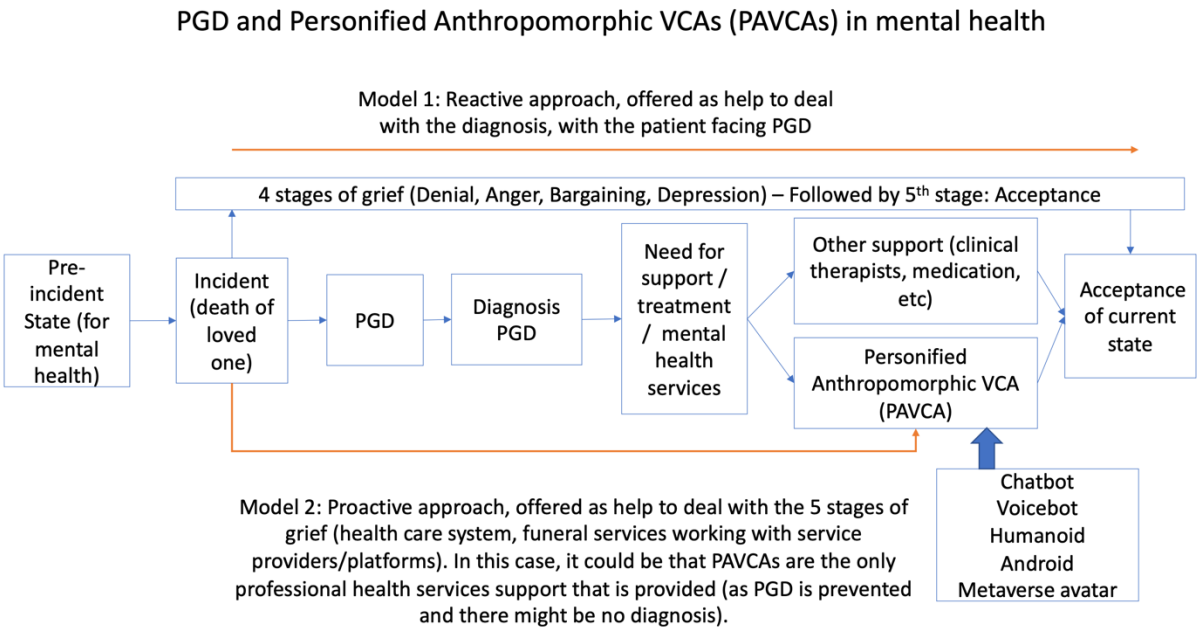

Figure 1: Model 1 and Model 2

Model 3

The conceptual operation of Model 3 is illustrated in Figure 2. Model 3 broadens the scope for the use of PAVCAs, and instead of assuming that PAVCAs with necessarily offer support for bereaved individuals, it assumes that PAVCAs can offer useful services to individuals in

various walks of life and at various times in their lives. One main difference from Model 1 and Model 2 is that we assume that there is no Trigger Event after which the engagement of the end user with the PAVCA commences. In addition to not necessarily requiring for a Trigger Event to exist, in Model 3 we allow for the PAVCA to assume a whole range of possible Personifications. In Model 3, PAVCAs can assume the Personification of a deceased person from the life of the end user (thus being very close as a concept to Model 1 and Model 2), or it can be a mentor, an astute adviser, a life consultant, a teacher of life skills, to name a few examples. Such a PAVCA might be further Personified accordingly if it is offered to people facing specific mental health problems and challenges or not. For example, the PAVCA might be a psychotherapist or a counsellor.

People who have been exposed to the existence and the use of PAVCAs through receiving mental health services as per Model 1 and Model 2, might seek to continue using PAVCAs after the end of the provided mental health services period. The possibility of this happening is expected to be higher than what it would have been if they were first time users. These returning users would have already adopted this technology as users in a way consistent with what is described by the Technology Acceptance Model (Holden & Karsh, 2010) and they would not have to face the “entry costs” of first time users. Realising the benefits and experiencing support and acceptance from their environment, once the PAVCA technology is more mature and its use is widespread across the economy and society, it is anticipated that end users from Model 1 and Model 2 can transition into using PAVCAs as per Model 3. This suggestion is consistent with the Theory of Planned Behaviour (Ajzen, 1991).

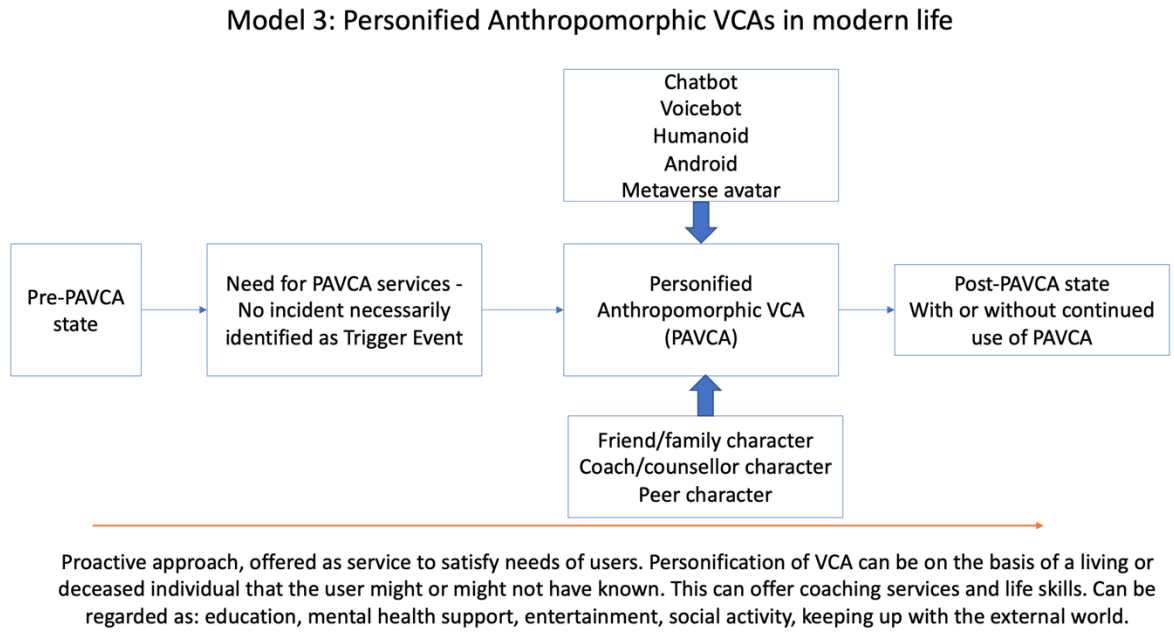

Figure 2: Model 3

4. Discussion of Conceptual Models

4.1 Ethics

Many aspects of the PAVCA technology and what it offers might be disturbing to the target users. Microsoft initially announced the creation of such a platform from them, and it allows for its existence to be made known. This could be a case of Microsoft and other IT firms that are interested in this technology waiting for the market to be ready for this to be launched. This will be a Blue Ocean market (Kim, 2005), offering uncontested space to firms to compete, capture and enjoy early mover rents, and also offering the opportunity to establish platform leadership that will lead to market shares and price markups. In this context, Öhman & Floridi (2018) proposed three requirements for firms to address any concerns relevant to ethical considerations: i) that consumers are properly informed on their data use after their death; ii) that the portrayal of the deceased individual remains consistent with the original bot

they registered for, without significant alterations; iii) users ensure that the data they upload is their own, refraining from creating bots using data from a deceased family member or friend.

4.2 Artificial Intelligence and interaction with humans

The use of PAVCAs to support people with mental health issues can lead to raising a wide range of ethical concerns. With this suggestion being focused on the provision of mental health services, questions surrounding the safety, reliability and effectiveness of these approaches can be raised.

In addition to the economic concerns regarding whether the financial cost for the provision of the services of PAVCAs is justified, and whether other approaches would be preferred for the same or similar pricing, we have to consider that the use of these approaches also takes up another critical resource: the patients' time, attention and mental effort. Chatbots have to not only be found to be more economical resources than other approaches. These other approaches can be: counselling; use of medication; or spending time in various other therapeutic approaches, such as art therapy. In terms of the economics of their provision, these can be better understood due to prior experience of health care systems in using these. PAVCAs have to convince health care systems for their effectiveness, their safety, and their economics. PAVCAs have to be found more economical, both financially and in terms of the time of patients who might end up using this approach versus other approaches.

The lack of direct third-party human intervention during the process of interaction between the PAVCA and the patient leads to additional concerns, as these platforms have to be proven safe yet, and this might require significant length of time in testing with humans. We do not have access to studies on the long-term effect of the interactions of humans with Artificial Intelligence platforms.

We would also need to consider that the designers of these PAVCA platforms and those who maintain them over time will have to make these compliant to medical standards. They will also have to make sure that the delivery of support to end users does not get affected by technical issues and bugs, as these could lead to detrimental impacts.

An ethical concern very specific to PAVCAs is that the PAVCA engages in discussions by adopting a persona that is mimicking the personality of the beloved deceased person. The mimicking happens in terms of views expressed, vocabulary, writing style, talking style, and visual representation for more advance applications. If the end user of the PAVCA develops a deep connection with the PAVCA and develops trust in this relationship, it could be that any communications that are coming from the PAVCA will have to be considered with much greater care, as the well-being of the end user might be at risk.

5. Concluding Remarks and Implications

5.1 Future Research

Artificial Intelligence is an emerging technology which is expected to permanently change several aspects of the economy and the world of business as we know it. As noted in this research, we anticipate that the mental health services industry will be changed, and the Health Economics of mental health services can promote decisions for the adoption of PAVCAs. At the same time, private markets for such services can exit, and private firms operating such platforms can promote and sell such services independently from the public health care systems.

A number of ethical and legal dimensions emerge and can be the subject of future research. These focus on issues of: data ownership, protection of rights of end users, imposition of limits applied to various dimensions of the use of PAVCAs (such as time limits), consideration of negative impacts to end users (e.g. implications for the perception of reality of end users).

Further research could also consider examining if the PAVCA technology helps end users in the long-run, and whether it assists or whether it stops them from going through the "5 stages of grief". Sociological research in the future could also examine potential resistance to the technology due to social and cultural perceptions within various economies.

Future research on this area can build on the theoretical frameworks and conceptual models of this chapter. Studies can be designed and organised in the future in order to explore through primary data collection and analysis the extent to which the functions described by the three models of this chapter have materialized and have implemented impactful change. Such studies can focus on target populations and explore the short-term, medium-term and/or long-term impacts from the use of the PAVCAs. An important aspect to this will be the final format(s) in which the PAVCA platforms will operate post-entry to the markets and following any adjustments that will be implemented in the future. Such adjustments can be driven by technology (e.g. Artificial Intelligence) and by the requirements imposed by society, as it advances to accept PAVCAs. A methodologically robust study on this matter, identifying and measuring the impact to society from the use of PAVCAs, can be a great interest and can generate impactful results. Such a study does not seem possible to be conducted currently, unless by researchers with exclusive access to PAVCA platforms and to populations of users. Such an early study of PAVCAs though would not capture the elements of societal acceptance, and of the way in which society-wide effects from PAVCAs will materialize.

5.2 Limitations

The PAVCAs approach which was presented in this research may be regarded as a solution to offer support to the bereaved. However, factors such as illiteracy (Lee & Choo, 2019) should be considered. Such factors can lead potential end users to automatic exclusion from the use of chatbot platforms, which are platforms that are implemented through written text. Moreover, levels of digital literacy can have implications as these might also lead to the exclusion of end users. Additionally, income levels might be important in terms of forming of the PAVCA technology. The ability of end users to pay for these services, in the case that these

are provided privately from markets, can also be an important factor for the perception for this technology.

Another potential limitation that can significantly affect the implementation of PAVCAs, either through private markets or through publicly provided mental health services, is the issue of legislation. With Artificial Intelligence being an emerging technology that is very challenging to be understood, and with many of its capabilities being largely unknown and currently under development, it becomes increasingly problematic for national legislation of countries to keep up. With national legislation not being set up appropriately on the use of PAVCAs, and without any economic regulation and any institutions monitoring and controlling these industries and market, delays could emerge in implementing these solutions for the provision of mental health services.

5.3 PAVCAs for support to human patients

The use of chatbots as discussed in this research is focused on the use on bereaved people, who are experiencing a significant loss and who have been impacted by it. A reasonable assumption that we made was that patients would only seek to use this platform as a way to provide solace for significant losses. Thus, these individuals could be regarded as potentially vulnerable at the time of use of the service. This introduces additional concerns and considerations for end users' well-being, and particular care should be taken for this platform to offer a helping hand, and not for this to act in a detrimental way.

One particular concern is that the use of PAVCAs could disrupt the process of grieving and the process of coming to terms with the new reality that the patients are required to accept. Additionally, the use of the PAVCA can potentially interfering with the understanding and comprehension of reality by end users, who can probably be vulnerable at that time. In this case, the concern is that the patients will have difficulty processing reality, which is that their

beloved ones have passed away, as the PAVCA might provide a continuing avenue of communication with what seem to be them, and this might be a very convincing act.

We also consider that the discontinuation of the service offered by the PAVCA can be a potentially traumatic event for the end user. The PAVCA might have successfully mimicked the characteristics of the deceased beloved person in the interactions with the end user and might become a critical element of support, companionship, and solace for the end user. This might particularly be the case if the PAVCA profile was not created post-mortem, but it instead has been prepared by the deceased by providing a full profile of all critical elements necessary for the PAVCA to produce strong results in terms of replicating the deceased person's behaviour during the interaction, in written, spoken, or in visual communications.

Without strong processes for control and monitoring of the interactions, deep impacts on the perceptions of patients and strong responses might emerge and still stay undetected, raising significant concerns for the mental health and the impacts on patients.

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