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DIGITAL

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DIGITIZED & DIGITAL-NATIVE MEMORIES

Exploring Futures of Infinite Data Storage through Speculative Design

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Keywords

Research through Design, Forgetting, Digital Storage, Duality of Memory, Ephemeral.

Abstract

Forgetting is often described as an undesirable sin of our memory, depicted as a completely uncontrollable action. If one desires to forget, it is to erase unimportant or unpleasant information. Moreover, the general mental model of memory suggests that we first remember and lastly forget. Thus, the linear memory model suggests a one-way dynamic from remembering to forgetting. This mental model of memory has been projected into the digital space design, where one remembers by acquiring data and forgets by deleting it.

However, the advent of infinite data storage scenarios provides new opportunities to re-establish how we forget and remember using data repositories. I discuss a possible paradigm shift: how forgetting a memory can help remembering in longer terms by presenting a speculative design artefact, the *Horcrux Ear*. It was created using Research through Design approach that develops a new understanding of these processes' temporality and spatial dimension of memory.

This paper aims to contribute to the debate over the relationship between forgetting and remembering, its role in the infinite data scenario, and the relationship between human and computer memory. Further, it illustrates the circumstances in which: 1. Forgetting important memories is a desirable action; 2. Forgetting is a controllable action; 3. Forgetting is data creation rather than data deletion; 4. Forgetting is a means to remembering rather than the last step in the linear memory model.

1. Introduction

The characterisation of perfect memory through digital storage has substantially influenced the perception of the potential relationship between human and computer memory. For example, in 1945, Vannevar Bush described a hypothetical device called *Memex*. Its properties to compress all personal information into one device inspired the *MyLifeBits* project, in which Gordon Bell used a wearable camera to capture records of his daily life, creating a lifetime store of *everything* (Bell & Gemmel, 2009).

Whilst remembering is seen as a virtue in contrast to the vice of forgetfulness, the perception remains that forgetting comes readily while remembering needs effort. This valorisation of the effort to remember has shaped our world and informed our actions for hundreds of years. *Ars Memorativa*, or art of memory, are mnemonic techniques that help in remembering and recalling information, were known and developed in the last millennium BC (Yates, 1966). The desirability of the prospect of an infinite data storage scenario has become prevalent as our computers' memory capacity has expanded, coupled with the ability to upload our ever-growing collection of digital possessions to the *cloud*. Computer server farms, or data centers, worldwide are numbered in millions. With these technological advancements, the aforementioned virtue and vice are starting to change their places as it arguably becomes easier to remember than forget. However, as Samuel Beckett (1965) noted in his book on the work of Proust: "The man with a good memory does not remember anything because he does not forget anything" (p. 29) or as Gabriel Josipovici (2020) rephrased it:

“only he who forgets remembers” (p. 23). The most famous example of these words in literature was the case of *Journalist S.*, the subject of neuropsychologist Alexander Luria’s study. *Journalist S.* happened to remember everything; he was able to memorise long chains of numbers, poems in foreign languages and complex mathematical formulas after hearing them only once. However, his abilities, or what one may call a gift, were a burden. He could not make sense of the world (Luria, 1969). The art of forgetting has not been developed. It seems that in the scenario of infinite data storage, similarly to *Journalist S.*, we are doomed to remember everything.

It can be argued that the notion of an infinite data storage scenario solidifies the notion that the human mind is seen as a lesser version, a smaller capacity box than the memory of our computing devices. This is why research on forgetting related to our digital possessions has emerged in opposition to this trend. However, in many cases, these discussions about the importance of forgetting are still consistent with the idea that infinite data storage is associated with remembering, as forgetting equals deletion of data, and remembering equals possession of data.

This is not necessarily the only way to examine the relationship between human and digital memories. Along with an overview of different assumptions about remembering and forgetting related to data storage, this paper offers a new conceptualisation, using infinite data storage as an axiomatic future scenario. It further introduces the speculative artefact called the *Horcrux Ear*, which concretises these new concepts.

2. Research Approaches

2.1. Research through Design

Frayling introduced the term *Research through Design* (RtD) in his 1993/4 article concerning the difference between art, design, and research. However, RtD has emerged as an approach in the Human-Computer Interaction field (Auger, 2013; Zimmerman et al., 2007) and design leading to the debate around its application in research. Commercial design and RtD projects both practice design but differ in their goals (Frayling, 1994). The former's goal is the design itself, and the latter's is knowledge produced when making an artefact which embodies the understanding (Godin & Zahedi, 2014). This dynamic is visible within the term itself, *Research-through-Design*.

The design is not the goal of this method, just as collecting data is not the researcher's end goal in any other field. Collecting data is the means to understanding. Publishing the data without its understanding is not acceptable in many disciplines. Similarly, presenting a design artefact is not the point of RtD's interest but the knowledge created through the process, that is, research.

However, contentious questions arise from RtD's goal and its reliance on design (Godin & Zahedi, 2014): Is the conceptual work in design an achievement? Does it add to the scientific work, or is the knowledge produced insufficient? As Gaver (2012) notes, the Philosophy of Science and Technology Studies (STS) grounds the nature of theory in science. Many fields have acknowledged theoretical work as it explains the phenomena and extends knowledge.

Nonetheless, continuous pressure exists to create and apply actionable metrics to the RtD methodology and its conceptual contributions (Zimmerman & Forlizzi, 2008; Gaver, 2012).

However, design often deals with *wicked problems* (Rittel & Webber, 1974; Gaver, 2012); problems that are complex and the breadth of their consequences may be unknown. In such cases, RtD proves to be a valuable tool as it can “continually and creatively challenge status quo thinking” (Gaver, 2012, p. 48). Therefore, RtD does not provide predictability (Godin & Zahedi, 2014) and “[t]here can be no expectations that two designers, given the same problem, or even given the same problem framing, will produce identical or even similar artefacts” (Zimmerman et al., 2007, p. 499).

The future of infinite data storage is a *wicked problem*, which calls for approaches like RtD that can help unravel the conceptual understanding of this proposition. Thus, the *Horcrux Ear* is the data I am presenting. The reflective understanding it enables relating to human memory is an epistemic contribution to the design field and the broader understanding of the infinite data storage scenario.

2.2. Speculative Design

Speculations on memory devices in the settings of infinite data storage are not new and can be seen in past and present cultural artefacts. For example, in 1904, Kurd Lasswitz introduced the concept of the *Universal Library*. This library would collect everything, all books that have been written but also books that will be written, might be written, and their counterfeits; thus, infinity turns out to be nonsensical.

A more recent example is the episode of the first season of the Netflix series *Black Mirror*, called *The Entire History of You*, which focuses more on the technological aspect of new memory developments (Armstrong et al., 2011). The memory device called grain is an implant that enables people to record every moment of their lives from the perspective they see. The story explores how this technological development could change how people interact with each other. For example, the protagonist does not trust his wife nor rely on her words that she is not having an affair. On the contrary, the grain enables him to find the truth himself.

These speculative works do not explore the full range of memory technologies that could be developed. They present predominantly dystopian scenarios of technological advances rather than considering more broadly how infinite data storage could impact human memory per se. Speculative Design does not seek to create dystopian or utopian scenarios, but rather its goal is to offer an *Utopian* world (Atwood, 2013) in which many more scenarios can emerge, depending on the usage of the artefact in place. Moreover, Speculative Design does not intend to offer solutions or predict the future. But rather facilitate an inclusive conversation about possible futures and how they might be created (Stead et al., 2018).

The speculations mentioned above are examples of Speculative Fiction rather than Speculative Design. Speculative Fiction is story-driven, whereas Speculative Design is artefact-driven. Whilst examples of the Speculative Designs focused on memory challenges in the infinite data storage

scenario are scarce, some are related to remembering. For instance, Noortman et al. (2019) introduced the design fiction probe *Hawkeye*, in which users could play a role of a caregiver of a person with dementia. A similar design fiction project, *For Good Times and Bad Times*, focused on care recipients. Researchers used pastiche scenarios to evaluate potential users' opinions on well-being health technologies for older users (Ahmadpour, 2019). Although both projects consider the future of memory support technology, neither considers the future of infinite data storage and how digital memory will interact with human memory, themes explored in the design of the *Horcrux Ear*.

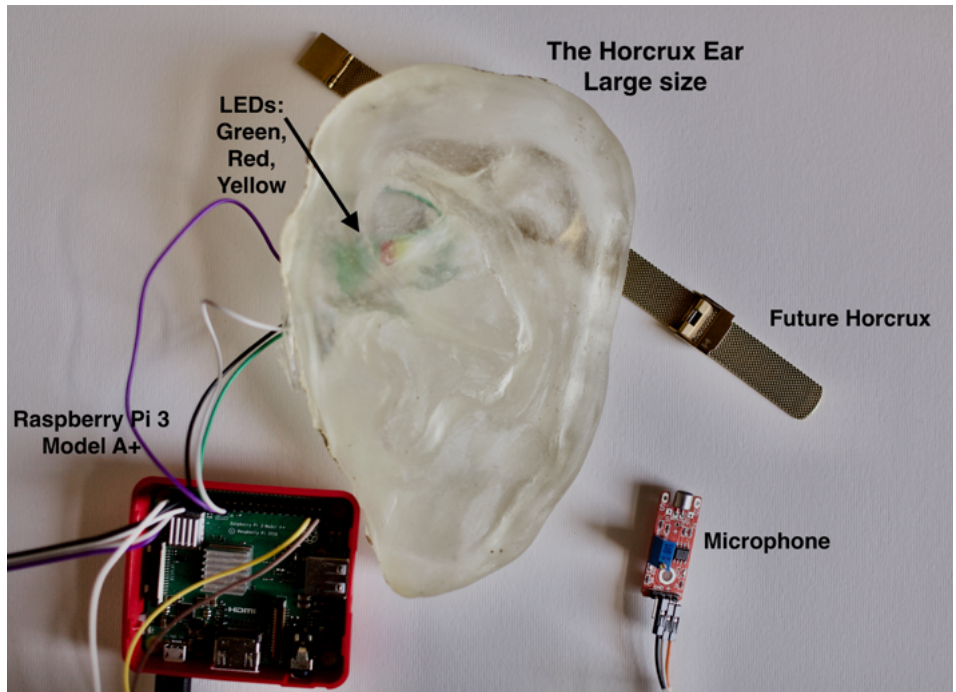
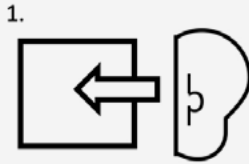


Figure 1. Agnieszka Dutkowska-Zuk, the *Horcrux Ear*, the *Wizard of Oz* prototype of the *Horcrux Ear* model, 2022.

HOW TO USE DIY HORCRUX EAR®



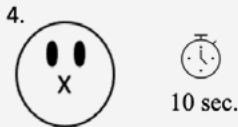
Hold your DIY Horcrux Ear® as close as you can to the object you want to make a horcrux of. Be careful to not cover the microphone located in the entrance of the ear canal.



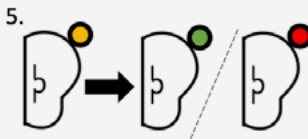
Start talking. Orange lamp indicates that the Horcrux Ear is listening to you.



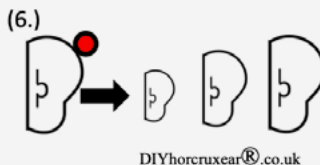
When you have completed your message say: "Horcrux completed"



and wait around 10 seconds in silence.



After around 10 seconds, light will change to green or red .
If it changes to green, the horcrux has been completed successfully.



If you used a secret not suitable for the size of your ear, the light will turn red. You need to use your ear for a different secret. Find different sizes on diyhorcruxear.co.uk

DIYhorcruxear®.co.uk

Figure 2. Agnieszka Dutkowska-Zuk, the *Horcrux Ear*, one of the pages of the *Horcrux Ear* manual with instructions on how to use it and record the message, 2021.

3. The Horcrux Ear

In the book series *Harry Potter* written by J.K. Rowling (2014), the main antagonist Lord Voldemort (also known as *You-Know-Who* or *He-Who-Must-Not-Be-Named*), splits his soul into different objects, named Horcruxes, to make himself harder to destroy. Rowling's work partially inspired this speculation dubbed *Horcrux Ears* which create Horcruxes out of ordinary, everyday objects (Fig. 1). In this case, the part of somebody's soul stored would be a secret which can be recorded and stored in the chosen item with the help of the *Horcrux Ear* (Fig. 2). There may be many reasons somebody would like to store a secret: perhaps they are afraid to forget all the essential details, but they cannot talk about them, and they cannot, or do not want to, refresh their memory every day. They may want to say it to somebody and be heard, but they may be afraid to share it with another person. Moreover, they may only want to store it where it is networked via a computer.

The *Horcrux Ear* acts as middleware between the user and an item. A User's Manual accompanies the *Horcrux Ears*, which explains how to record a personal secret and what can be recorded. There are three sizes to choose from (Fig. 3). The variation in size differentiates kinds of secrets, ranging from those that do not significantly impact someone's life to more profound, perhaps complicated secrets (Fig. 4). It is important to note that while there are instructions on what constitutes small, medium, and large secrets, they are connected to the perception of that secret rather than its content. In their nature, secrets are highly personal.



Figure 3. Agnieszka Dutkowska-Zuk, the *Horcrux Ear*, three different sizes of the *Horcrux Ear* correspond to the heaviness of secrets told, 2022.

The *Horcrux Ear* is an interesting representation of a memory device because it is not made to enhance remembering, like many projects in the Human-Computer Interaction space (e.g. van Erve et al., 2011). On the contrary, it is created for meaningful forgetting. Since people are encouraged to record secrets, these messages already carry significance for users. However, they are stored to forget rather than to remember, as they are not created to be readily used or recollected. They are made to stay safe and forgotten for a considerable period. One can use the *Horcrux Lips* (a device that decodes messages from *Horcruxes*) if they are the author of that secret, they have special permission from the author of the secret, or it has been at least 30 years since the author died to access a small secret, at least 50 for a medium secret and 70 for a large one.

SECRETS GUIDELINES

Different secrets are suitable for different sizes of DIY Horcrux Ear. From very small secrets to unbearably heavy ones, we offer our customers a range of 3 sizes, to meet everybody's needs.

Please, read our guidelines to choose a proper size to your secrets. We encourage you to use your common sense as well.



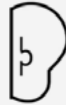
SMALL

The consequences of revealing the secret would not be life changing for you;
White lies



MEDIUM

Information that 1-10 people know, outside of your family;
Information you would not tell your neighbour;
You might have said it once or twice when you were intoxicated*



LARGE

Information that is related to your family history that is not talked about in public/outside of your family;
Information you would not tell your best friend;
Information you avoid thinking about;
Information that no one who lives and may be interested in this information knows about it except you;
Information that is stuck at the back of your head;
Information that shapes your reality and/or your person and your behaviour

* Related to adult users. If you think you have a problem, please contact <https://www.nhs.uk/live-well/healthy-body/drug-addiction-getting-help/>

This encompasses Elsdén's and Kirk's recognition of the current problematic short-term perspective toward data with little consideration as to what happens to data in the long term (2014). In the following sections, I will reflect on how the *Horcrux Ear* offers new insights into our relationship with remembering and forgetting in the context of digital storage.

4. Forgetting Important Memories is a Desirable Action, but not for the Sake of Remembering Other Things Better

Similarly, in *Journalist S.'s* case, the *perfect memory* problem of our digital storage lies in its perfection. It is apparent that forgetting, or deletion, needs to be reintroduced to the design of our external memory, as Bannon (2006) posits, as *a feature not a bug*. Bannon believes that by:

neglecting the duality of memory, in terms of the dual activities of remembering and forgetting, we are unnecessarily limiting our options, in terms of the shape of the design space that is open before us concerning the ways in which technology might play useful roles in our future human and social world. (p. 4)

Indeed, designer Tony Fry (2020) would call it an example of *defuturing*, which stems from the fact that “we do not understand how the values, knowledge, worlds and things we create go on designing after we have designed and made them” (p. 10). In his essay, Bannon makes a crucial statement about the misleading metaphor that equates the human mind to an information-processing machine. It is essential to recognise that these two are not analogous to each other, nor is computer memory an extension of our mind, as the situated cogni-

tive framework would suggest (Clark, 2010). The number of psychological theories about our memory shows its complex nature; the human mind is not simply a box to which we add information. As psychologist Sir Frederick Bartlett (1977) observed, memory is about constructing and reconstructing information rather than their exact reproduction.

By the same token, Sellen and Whittaker (2010) critiqued the usage of lifelogging devices for total capture, as in Bell's previously discussed project, which mimicked Bush's *Memex*. As Bannon (2006) reflects: "perhaps we should re-consider this fetishisation of recording for recording's sake, along with the use of novel sensor networks to collect and collate huge quantities of information about people's activities" (p. 10). In other words, the focus should be on the user, instead of their data. In Brewer's et al. (2017) words, "there is a need to draw on what is known about human memory to create tools that cater for different types of remembering" (p. 3). Bannon (2006) argues that the misleading metaphor of the human mind being akin to an information-processing device gives prominence to the passive model of memory rather than an active model of remembering and forgetting. This is the genuine risk of, and for, forgetting: applying one metaphor of human memory to design our external digital memory further restricts our way of thinking about human memory.

The *Horcrux Ear* embraces the idea of forgetting essential memories but not for remembering other things better by clearing space for other memories. In traditional settings, in which deletion has a function of forgetting in the digital environment,

deleting often works as weeding out unwanted and unimportant content, further enhancing these digital memories that are about to stay. In contrast, the *Horcrux Ear* enables users to take up space for forgetting without the motivation of remembering other memories more clearly, or without the unnecessary noise. The curation of the memories does not happen on the level of remembering, i.e. there is no decision-making process on what needs to be remembered and what needs to stay. It is solely about the specific memory that the user wants to forget. Thus, the curation process is separated from other memories because the focus is on the creation of the *Horcrux*.

5. Forgetting can be a Controllable Action, not through Erasure, but through the Mindful Creation of Digital Input

The Seven Sins of Memory by Daniel L. Schacter (2001) describes our problems with memory. Only one out of these sins is not related to proper access to the original information. Six out of seven issues related to forgetting outnumber those related to remembering. These sins are not a product of our engagement and effort, and we have no or minimal choice over them. For example, the sin of *absent-mindedness*, which explains our problems with locating our keys before we leave the house, does not require any action; we do not pay attention by default. As with other sins, it comes without our intentional effort. After all, that is why Schacter called these *sins*, as they all come easily.

As outlined in the previous sections, researchers are on the quest to reintroduce forgetting into the design of digital devices, even though they treat it as the *fragility of the human mind* (Bannon, 2006).

Intentional forgetting has been an emergent field in Artificial Intelligence (AI) research (Beierle & Timm, 2019). However, if AI starts to *forget* and delete in place of the user, our relationship with forgetting remains uncontrollable and black-boxed. Forgetting does not become a virtue; it remains a vice, as we will decide not to put effort into this action. As Andy Clark (1997) noted: “our brains make the world smart so that we can be dumb in peace!” (p. 180).

Creating the *Horcrux* through the *Horcrux Ear* requires effort from the user in finding words, or sounds, for the secret he would like to forget, choosing the appropriate size of the Ear, and creating data to forget, which is further explained in the next section. Most importantly, the user controls how long that secret is forgotten and who can retrieve it. This process gives the user power over the forgotten memory.

6. Forgetting is Data Creation rather than Data Deletion

The most important contribution of the *Horcrux Ear* is the new representation of forgetting. The common narrative concludes that digital possessions entail remembering, and their deletion entails forgetting (Sas & Whittaker, 2013; Mayer-Schönberger, 2009). Evident in the title of the book *Delete: the Virtue of forgetting in the Digital Age*, in which Viktor Mayer-Schönberger links removing data with forgetting. The comparison seems obvious: we get frustrated more often about the things we forget rather than remember. We are all familiar with the annoyance of the *absent-minded* sin of our memory (Schacter, 2001) by trying to recall where we left our keys before leaving our house and the stress when we cannot recall a person’s name who was just introduced to us.

The link between these bothersome moments and the deletion of information from our external repositories seems evident. We are similarly frustrated (if not more!) when something accidentally gets deleted from our computers, and we cannot retrieve it. In contrast, additional files on our external memories do not bother us. The evolution of our external repositories is dictated by the apparent need to store more, *just in case*. Thus, the conclusion is simple: deleting is the equivalent of forgetting.

This representation provides a limited view of how a digital repository can support human memory. One can look at digital storage as a tool rather than a specular reflection of our organic memory. For example, the contacts folder on my mobile phone is full of numbers I would never say I remember. In fact, my contact folder is an extremely convenient way of forgetting. As Sellen et al. (2007) found, digital possessions can support recall but do not necessarily support remembering. Professor Viktor Mayer-Schönberger (2009), the author of the book *Delete*, calls for forgetting in the digital world, but his calls are not entirely about actual forgetting. He does not oppose total remembering of the owner of digital possessions, like in the case of Luria's patient. He opposes the unwanted recall, usage of information by third parties, and the threat of not being absolved.

Moreover, the infinite data storage affordances allow for hiding information. After all, the saying *to find a needle in a haystack* does not come out of nowhere. However, this is a premise that believers in the total memory metaphor may find doubtful. When smart devices are connected, they are considered part of what Kevin Ashton dubbed the Internet of

Things (IoT) in 1999. They are constantly connected to the Internet and continuously feed it with data (Skene, 2019). Thus, a search engine could find the history of anything with a quick look and clever use of terms typed. However, digital items do not have to be connected to the cloud and thus do not have to be IoT. People may ask themselves a question in the future: Why is everything connected to the Internet? People may want to have the right to decide whether their personal belongings are connected or not. Moreover, if each object could have its data storage but were not connected to the Internet, its data would be unique to this item.

In the case of the *Horcrux Ear*, real-world objects could work as unique, personal storage of secrets that can be kept safe and under the control of its user.

7. Forgetting is a Means to Remembering rather than the Last Step in the Linear Memory Model

In his essay, Bannon (2006) calls for creating *ephemeral technologies* or *ephemeral forgetting technologies*. Such technologies would oppose the current trend of archiving and storing our data. Bannon gives an example of self-destructing tapes, depicted in spy movies, which destroy the message after listening. Indeed, the infinite data storage scenario presages the world in which we capture everything, so we also capture it all the time. The ephemerality of our digital input is a pressing issue. In the Human-Computer Interaction field, Sellen et al. (2009) call this transformation of data hoarding *the end of ephemeral*, whereby the capture of past events will stay with us for longer than the experiences themselves.

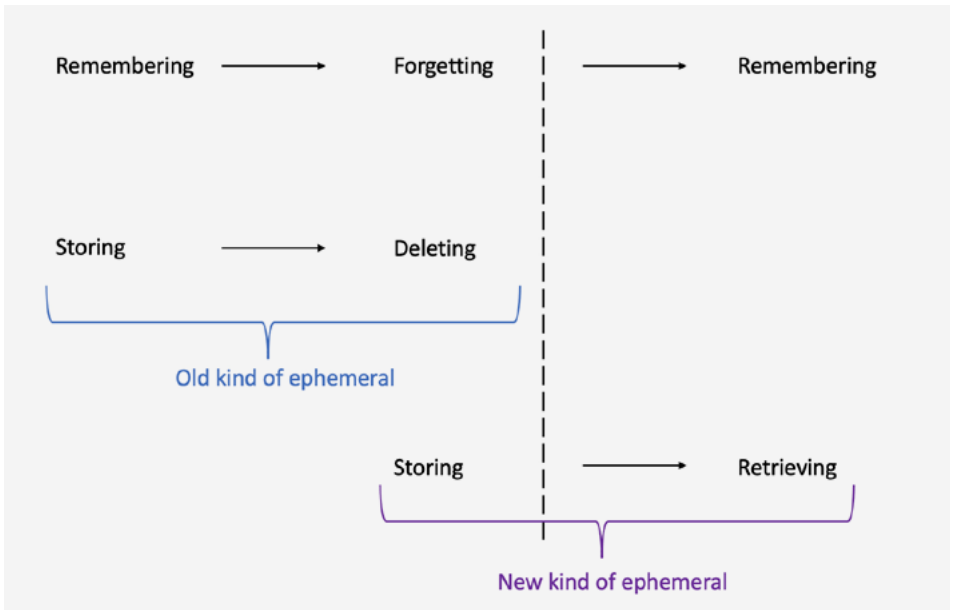


Figure 5. Agnieszka Dutkowska-Zuk, the new kind of ephemerality, mapping the old and new kinds of ephemerality onto the simplified linear memory model, 2022.

Thus, the ephemerality of individual experience would not come to an end, but the ephemerality of the event will need to be designed. The main question around the ephemerality of our data is when different data should be accessed and what data we could meaningfully create for the future. This suggests that ephemeral technologies would not correspond to what Bannon imagined. As outlined in the previous sections, forgetting can manifest itself in the creation of digital input. Thus, later retrieval would correspond to recall or remembrance. This means that the ephemerality of the event would only last for a while, but as long as it is not retrieved. This is not an *old kind* of ephemerality to which Bannon referred, but a *new kind* of ephemerality (Fig. 5).

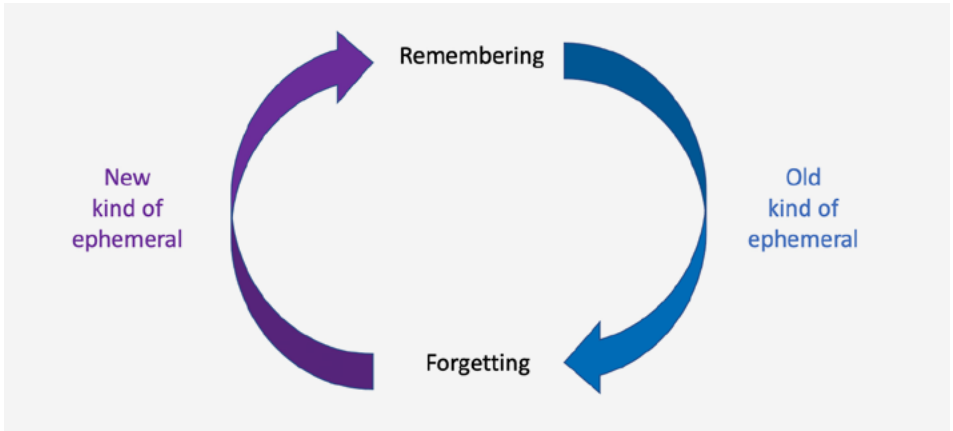


Figure 6. Agnieszka Dutkowska-Zuk, the new kind of ephemerality, the representation of the new non-linear dynamic between remembering and forgetting through the notions of the old and new kind of ephemerality, 2022.

This *new kind of ephemerality* further explains the shift, which shows that forgetting does not entail the end of the memories' life cycle in the digital storage. In fact, forgetting helps in future remembering through the new kind of ephemeral characteristic of the forgotten digital input (Fig. 6).

Some secrets have an expiration date – something embarrassing or dangerous to say today may not be in the future. On the contrary, they could be a piece of valuable information in a blurry history. The *Horcrux Ear* is an attempt to design a *new kind of ephemeral*. Secrets are safely stored for a specific period; thus, their ephemerality does not last forever. The forgotten messages, recorded on *Horcruxes*, can be potentially retrieved in the future. Therefore, forgetting is not the last step in the linear memory model, ending the given information's life. In this case, forgetting can be the guardian of the memory by keeping it safe and sound until it is time to be remembered again.

8. Discussion and Conclusions

Infinite data storage can have many consequences for our memory. Researchers' and thinkers' concerns about how one forgets in such a scenario are sensible and need to be addressed. However, these concerns are based only on one metaphor of human memory: forgetting is a deletion of data and remembering is their storing. Moreover, the dystopian visions of this scenario give an outlook to only one side of the spectrum of challenges and consequences humans may face. The conflated nature of human memory, and the wide range of possible worlds that the future consists of, unravel different relationships between human and digital memory. The artefact presented in this paper, the *Horcrux Ear*, suggests a new perspective on forgetting, which infinite digital data storage could facilitate. This perspective offers four main characteristics of forgetting, which have never worked together in one scenario of forgetting:

1. Forgetting important memories is a desirable action.
2. Forgetting can be a controllable action.
3. Forgetting is data creation rather than data deletion.
4. Forgetting is a means to remembering.

Whilst three (1, 2 and 4) of these new characteristics of forgetting have already been explored by other scholars, they were all based on the idea that forgetting is the erasure of data. This idea is opposite to the third feature from the list above. The *Horcrux Ear* incorporates all these points into one possible scenario of meaningful forgetting, creating a *new kind of ephemeral technology*. It illustrates that forgetting a memory can be a key to remembering it in the future.

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IV

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Her research can be generally described as Speculative Design, through which she strives to understand how people and technology (will) interact with each other.

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Since 2018 he is a Research Fellow at the Free University of Bozen-Bolzano, Faculty of Design and Art.

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After graduating from Sapienza University of Rome with a thesis on the clandestine presses of the Italian Resistance, and after a study period at ENSAD in Paris, he graduated from ISIA in Urbino with a thesis on the historiography of graphic design. He is in the final year of his PhD in Design at Sapienza University of Rome: his research consists of a survey on primary sources for the study of the history of wooden typefaces in Italy.

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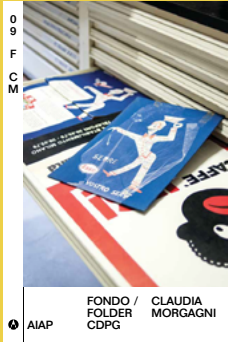
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