

Smartphones and the Future of Remembering

Frictions, Problems, and Pathways

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This ethnographic case study discusses friction in everyday information-seeking on smartphones and proposes new pathways for addressing these barriers. Our study delves into how smartphones have become integral tools for memory recall and inscription, creating multiple types of mnemonic friction. We draw on Andy Clark and David Chalmers's "Extended Mind Thesis" to situate our case and to emphasize that smartphones are more than just a device we own—they inform who we are and what we are capable of. But smartphones also produce new kinds of social, psychological, and epistemic problems. Our case surfaces how users confront an ever-increasing pool of sometimes interconnected, sometimes incommensurate, and often intractable mobile phone memories. We explore the consequences of this friction for power, capabilities, culture, and the challenges of information overload in an era where people have become inextricably reliant on smartphones for memory, learning, knowledge, sociality, and practical action.

Keywords: Information seeking, Memory, Smartphones, Software, Personal computing, HCI

INTRODUCTION

This case study discusses friction and memory in everyday information-seeking on smartphones. We were tasked with investigating unmet needs, mental models, and emerging marginal practices in iPhone information-seeking. It was a foundational study, and given our wide topic, we were able to generate a host of insights. Here, we focus on the least obvious and most thought-provoking theme we encountered: retrospective information seeking. That is to say, smartphone-based memory tasks.

We begin with the recognition that smartphones have become an integral—ineliminable, even—element of human memory. Along the way, we also discovered that these new memory capabilities create previously inconceivable friction in memory creation, retrieval, persistence, and forgetting. People face an ever-increasing pool of interconnected, incommensurate, and intractable mobile-phone-entangled memories—and are liable to involuntarily forget, or be unable to forget, in hitherto unimaginable ways. We explore the consequences of this friction for power, capabilities, culture, and the challenges of information overload in an era where people have become reliant on smartphones for memory, learning, knowledge, sociality, and action (Haider & Sundin, 2022; Paul, Heersmink, & Clowes 2017; Ward, 2013; Smith 2022; Drain & Strong, 2015).

Memory is far from simple. We can, for example, draw imperfect distinctions between sensory memory, short-term memory, working memory, explicit and

implicit memory, prospective memory, semantic memory, autobiographical memory, collective memory, and episodic memory. To complicate matters further, human memory systems may involve technological aids or partial replacements (Yates, 2013; Clark & Chalmers, 1998; Clark, 2010; Aydin, 2015). Memory and technology are entangled.

No technology has done more to transform and buttress our biological memory than writing (Aydin, 2015; Levi-Stauss, 2011). To writing, we can add photography and film as well as vinyl and now digital audio recordings. Words, sounds, and images (and moving images) can be fixed and pinned down, that is, made immutable (Latour, 1986). This, we should remember, brings about a regime of knowledge and recall that is substantially different from our bare biological capabilities, i.e., just using our brains.

With the introduction and refinement of the smartphone in the last 20 years, all previous mnemonic technologies (often not understood as such) have been scaled down, rendered hyper-connected, and accessed through our smartphones (McLuhan, 1994). Multiple mediums of near-infinite memory recording and recall lie at the tip of our fingers. However, not all stories of technological advancement are straightforward. And this recent history of memory is no whig history. Our smartphone-entangled memory systems constrain our ability to remember in new ways, enable us in many others, lead to confusion, spark creativity, and transform joint inscription and recollection. In short, our smartphone-entangled memories are riven with friction. We understand friction, following Anna Tsing, as “the awkward, unequal, unstable, and creative qualities of interconnection across difference.” (Tsing, 4).

But before we talk about the specifics of this blessing and curse and interconnection across differences of the near-infinite phone-based archive, a few words about how phones relate to brains and how these now-ubiquitous machines have become second nature.

Theoretical Framing of the Problem

Philosophers Andy Clark and David Chalmers have advanced what they call the “extended mind” thesis (Clark & Chalmers 1998). The idea goes that things outside of skin and skull, things outside of the brain, can be—and frequently are—essential elements of cognitive processes, e.g., memory tasks. These extended mind elements are “essential” in so far as if they were removed, overall competence and cognitive performance would drop.

When we use a notebook to remember a fact about the world, such as an address, then, when that notebook is being used to recall such information, the notebook is part of our mind—it is not an aid to cognition, it is part of cognition. Phenomenologically, remembering an address using only our brains is very different from using a notebook. Functionally, however, our brain or our brain plus a notebook can serve identical roles. There is a parity between mind and notebook in

terms of the role it serves in cognitive performance. Therefore, when some object in the world reliably serves a cognitive role that could otherwise have been carried out solely by using our brains, then that object is for all intents and purposes part of our mind, our *extended* mind. Just as a hammer extends the practical use of our arm, so too can a notebook extend the cognitive use of our brain-based memory.

The extended mind theory asks us to look beyond immediate appearances in order to see cognition and mind as broadly extended processes. Clark and others have also put forward the idea that sometimes these cognitive extensions don't simply reproduce or mirror internal cognitive processes, they might also "supersize" and otherwise transform them (Clark, 2010; Latour, 1986; Merlin, 1991; Vygotsky, 1994). Using cognitive tools, we can enhance cognitive processes such as memory in ways that far exceed what is possible with biological, brain-based memory. Today, nobody would deny that the phone has not only taken over many of our memory tasks, but also greatly increased our recollective capacities (Maguire, Woollett, & Spiers, 2006). But, as we will see, this is not a simple story transcending our biological capacities with the help of technology.

In framing our case, we also want to hazard the claim that the essential characteristics of new and ubiquitous technologies will be missed if we merely describe what these things can do *for* us and omit what they do *to* us. Or, better, how phones don't just expand our memory, but alter who we are because they alter how we remember and recall. Phones are not just things, they are one of our sources of self.

Memory is not simple—and smartphones are not entangled with a single subtype of memory. For example, smartphones can help us record and return to pictures, audio, and video; turn to the open web to confirm or retrieve half-remembered facts; toggle to saved pages, chats, games, or documents on our favorite apps; navigate half-recalled places and spaces with the help of maps that include saved, i.e., remembered, locations; jot down, revise, and return to notes; interpersonally communicate and recall these communications in a variety of modes both synchronously and asynchronously; and stave off boredom through reminiscence. But this motley list only expresses what smartphones do for us, not what they do to us, that is to say, what smartphones mean for how we remember, learn, feel, act, and interact. Following Langdon Winner (1986), we propose that smartphones and related technologies bring about a new form of life.

Winner adapted the technologies as a forms-of-life is a concept from Ludwig Wittgenstein's work on language as a form of life (Wittgenstein, 2010). The language we speak engenders, constrains, and informs the world we inhabit. So too, according to Winner, is it the case that the technologies we produce and incorporate into our lives bring about new worlds, not just new things. Remembering a trip entangled with an iPhone by drawing eclectically on iPhoto, Instagram videos, email reservations, Apple Wallet flight tickets, jointly-accessed plans on the Notes app, pins on the Google Maps app, WhatsApp and SMS messages, and so on is unlike

mere biological recollection or even the tech-enhanced recollection of the more recent past using a personal diary, analog photographs, and a video camera. Smartphones have fundamentally altered how we record, recall, and reconstruct our lives.

Technologies that restructure our physical, social, and—we would add—cognitive worlds bring about new ways of living that are often so profoundly different from what came before and ubiquitous that we overlook them (Malafouris, 2013). Internet search (e.g., Google search)—merely one common use case on a smartphone—is a form-of-life engendering technology. It has changed at a fundamental level how and when we find information, not to mention the quantity and quality of information available to us. And yet it is now, only a few decades after its introduction, entirely naturalized and unremarkable (Haider & Sundin, 2022). Similarly, life-altering technologies include the automobile, the telephone, and the electric grid—these technologies have profoundly altered our forms of life.

The new forms of life given to us by smartphones, here focusing only on memory, are both profound and hard for us to recognize. But our case study demonstrates that this transformation is neither straightforward nor categorically beneficial. It's full of relatively novel forms of friction. And recent gains in bandwidth, capacity, media types, and the shift from web to app-based mobile internet accessed on smartphones have led to a situation in which our digitally extended and expanded smartphone memory systems are chaotic juxtapositions of different types of memories used for different ends, accessed and persisting in different ways. The metaphor for smartphone memory is not a library or an archive, but a cluttered labyrinth.

This confusion of digitally offloaded memory leads to friction, understood as “the awkward, unequal, unstable, and creative qualities of interconnection across difference (Tsing, 2005).” The friction of smartphone memories is the subject of this case study.

METHODOLOGY

Our study drew on a set of qualitative research methods to arrive at our findings. These included in-depth in-person interviews, contextual inquiry, diary studies, and a literature review.

The sample size consisted of 20 respondents. We met in person, with 10 people in and around London, UK, and the same number in Paris, France. Each in-person session lasted 2-3 hours. Our participants were a representative mix of age, ethnicity, and self-reported technological literacy. All participants were iPhone users.

None of the methods we employed were groundbreaking. However, our interviews were conducted using a set of questions—a field guide—that made a number of theoretical assumptions we feel were instrumental in opening up a line of

questioning that helped to frame and guide our thinking in key ways. Purely “grounded theory,” this was not.

Incorporating philosophical theories into our research was essential. It was not a matter of begging the question, that is, of making assumptions about what we would find and then, inevitably, finding it. Rather, by being open to and aware of non-obvious ways of framing smartphone functions, we were able to empirically generate new and original findings on the basis of theoretically informed ways of seeing the practices we were confronting. There is no such thing as “immaculate perception,” as Nietzsche put it (2008). Had we not broken with our normal ways of thinking about smartphone use, we would have simply been reproducing our naive ways of conceptualizing user behavior. We agree with Loic Wacqaunt that “grounded theory” is an “epistemological fairytale” which, at best, simply reproduces the tacit theories with which the research unreflectingly brings to their experience (Wacqaunt, 1999).

As such, our field guide and diary studies drew heavily on the extended mind thesis and related work around smartphones, information-seeking, and memory. For example, we had in mind Alexander Luria’s *Mind of and Mnemonist* (1968), from which we knew that perfect, totalizing memory is a sclerotic fetter—so we developed questions to probe this issue (and its opposite, forgetting, misplacing, and otherwise losing memories users wanted to save and return to). We drew on Francis Yate’s classic *The Art of Memory* (2013) to ask questions about what sort of canny systems users have contrived to find the information they wanted to return to. We asked about the role of photographs in respondents’ lives, drawing on John Berger’s *About Looking* (2015). And we probed users about how they think about their own lives—their autobiographical memory—using different apps and media on their phones (Campbell, 1997). Our study was grounded in deep and ongoing conversations in the literature coupled with an openness to novel empirical data, not in “grounded theory.”

With our field guide in hand, we met participants in their homes or at places they frequented in London or Paris, respectively. This allowed respondents to feel at ease and for us to build rapport in order to unlock more insightful data points. We combined our interviews with contextual inquiry aided by laptop computers equipped with the application Zoom (a video conferencing software program). When the session began, respondents were asked to sign into a Zoom call with researchers using their phones and then share their screens for the duration of the interview—even though respondents and researchers were sitting face-to-face. This allowed us to more easily see what respondents were talking about, observe real behaviors associated with information seeking, probe respondents to show us what they were talking about, see the app ecosystem respondents were working with, as well as record audio and smartphone screens in case we wanted to return to them later for further analysis.

When possible, we tried to move from baseline themes revolving around our respondents’ biographies, proclivities, and interests before moving on to see how

this intersected with information-seeking tasks, including those that were backward-looking such as memory recall, persistence, and planning (planning often fell under “prospective memory,” i.e., remembering to perform a future action or see through a future intention). Along the way, we talked about which apps and utilities were preferred for which sorts of tasks, how users drew on other people in their networks to recall and find information, the role of cloud computing in all of this, as well as common problems they encountered. By having a simultaneous interview session over a long period of time in environments that were comfortable with users, we were able to build a very robust picture of how our respondents used their smartphones to find novel and past information, the problems they faced, and the canny epistemological systems and strategies they devised to navigate an ever-expanding world of apps, accounts, connections, and media types.

We supplemented our in-depth interview sessions with a short, 3-day diary study. Over the course of these three days, we asked respondents to report and reflect on information-seeking tasks from their day. The diary questions were sent to respondents' smartphones. They were asked to fill out short answers as well as upload screenshots. Allowing users to complete the diary study entirely on their smartphone helped to ensure the quality, and in many cases, candor, of the responses.

Finally, we analyzed the raw data using a few established techniques. First, we engaged in user storytelling, i.e., researchers took turns introducing respondents to enable the team to form a shared baseline. Next, we engaged in affinity diagramming of recurring and/or salient themes. Finally, we used a dialogical method of inquiry where researchers discussed the non-obvious and interesting themes from our empirical investigations set against a larger series of topics derived from the literature review, the confidential business problem we were tasked with investigating, and stakeholder interviews. The result of these conversations and debates was a set of empirically grounded and theoretically informed findings. Key among them for our purposes there was a set of issues related to smartphones as extended memory systems.

In summary, we relied on a selection of methods that captured deep qualitative understanding by building rapport over a long period of time in a comfortable setting, covering a large number of topics, capturing digital behavior as well as attitudes, and ensuring a slightly more longitudinal angle of comparison by asking respondents to engage in a digital diary over the course of a few days. Together, these methods yielded notable findings.

FINDINGS

Our ethnographic research delved into the storage, persistence, and retrieval of memories among smartphone users, uncovering significant challenges arising from fragmentation, joint creation, and the idiosyncratic nature of memory management.

Together, these relatively novel issues are a clear case of mnemonic friction: differences and clashes of memory types, origins, intended uses, and formats coming together in difficult and sometimes creative ways. Biological memory is complex and still poorly understood. When our memory system is extended into our phones—when part of who we are encompasses our increasingly powerful and feature-laden handheld and networked devices—frictions multiply.

The fragmentation, joint-creation, and idiosyncratic memory systems we discovered should not be understood hierarchically. Fragmentation coupled with an ever-growing quantity of saved information was behaviorally and visually most striking. Joint creation and recall were something that might seem mundane and pedestrian but represents a very intriguing form of technologically aided memory—something that is new and really only possible with smartphone connectivity and related features. Finally, the idiosyncratic nature of memory systems expresses a finding that covers all the others. In short, these findings are interrelated, not mutually exclusive, and rub against one another across their differences—there is friction among the findings.

Fragmentation

Fragmentation emerged as a prominent issue in our study as smartphone users exhibited a strong preference for app-based organization over open web access. In other words, memories were spread across different apps rather than stored in a central place. Consequently, the organization of memories became heavily influenced by the structure of apps and how they facilitated recall and persistence. This resulted in memories being scattered across multiple content and category domains. Moreover, the longer respondents used a particular app, the more memories they tended to accumulate, and, therefore, the more difficult things became. Users don't have an archive on their phones, they have archives—often with different principles of organization. For example, Google Maps affords users the ability to save locations with stars and other icons directly on top of a map. The saved information persists and is only visible when users are surveying the relevant representation of a territory. Compare this with those who used open browser tabs for information that they wanted to return to—and we note that many users downloaded multiple browser apps and associated these different apps with different clusters of domains. For example, Chrome might be for work-related information, whereas Safari was used for school and Firefox for music. Traditional file trees were also employed by some but not others. Using an app like Reddit, people were able to find old posts by going to their user profiles. Using Youtube, people made sets of playlists organized by theme or topic. Generally speaking, certain themes important to users, music, for example, were effectively distributed across many apps and formats.

Different kinds of knowing and remembering (compounded of course, with drivers such as curiosity, norms, and social pressure) led respondents to select different apps and utilities. For example, for crowd-sourced opinions, they might turn to Reddit or TikTok. Expert opinions may lead them to Youtube or Twitter, or

trusted websites. Inspirational images might lead them to select Pinterest. Important long-form opinions may be on Substack, more objective accounts of things on the Wikipedia app. Upcoming flight information on the airline's app, health information on a national health app, tasks on Todoist, saved articles on the news app, and so on and so forth. This covers a kind of library model of information seeking, a village model of information seeking, and an expert model of information seeking, and so on. Fragmentation and friction abound in ever-increasing types of memory, apps used to access them, and media formats in which they are recorded. It's not a mosaic of memory, it's an ever-expanding mixed-medium sculptural collage. An amalgam. An ever-growing mess. Or, better, a maze.

Some users preferred to save important memories on their phone's hard drives in the form of photos or notes. Others eschewed this strategy for fear of losing, breaking, or having their phone stolen, resulting in involuntary oblivion. Instead, they used cloud-based solutions such as cross-device app accounts (e.g., YouTube), iCloud, Notion, or even Microsoft Office. Indeed, we have been talking about memories extending into smartphones, but that's not entirely accurate. In many cases, these memories are stored in fragments on servers all over the world and only accessed via the phone. We also observed a cloud versus local storage pattern that correlated not only with the level of tech-savviness but, more importantly, with income and budget. In other words, those with more income could afford to shelter their phone-based memories from loss. Those without money exposed themselves to a serious threat of forgetting.

Users expressed frustration as they found it challenging to locate specific memories due to the lack of a unifying tool that could seamlessly bring together these dispersed and often incommensurate fragments. As a result, the coherent narrative of personal experiences became fragmented, a sense of memories being at the tip of one's fingers but not discoverable (e.g., forgotten passwords, failed platforms). This impacts the way individuals perceive and reconstruct their memories, which, in turn, greatly informs and influences their sense of self.

Smartphones, in principle, should be a perfect way to store and retrieve information. But the fragmentation of an ever-expanded pool of memories can thwart this promise. Because the information was spread out across many points of access using different systems, it demanded that users recall these pathways in their brains. This was a serious and often unsuccessful cognitive burden. While the content is on the phone, how to get to it is more often than not still in users' heads—and biological memory tends to decay. It is as if users have built a massive memory palace on their phones but misplaced the keys.

Fragmentation of phone-based memories produces friction—as the number of apps and formats increases, memories clash and divide, hide and surface unintentionally, pile up endlessly, and expand across more and more apps and platforms, all while increasing demands on our brain-based memory to recall where things have been saved.

Social Memories

What could be more personal than a memory? And yet, our findings illuminated the growing trend of socially blended and distributed memory practices of creation, curation, and recall. Biologically grounded memories are social in nature, too, to an extent (Hirst & Echterhoff, 2012). Joint experience, conversation, and reminiscence alter and expand narrative and semantic memories. Additionally, collective memories are anchored in shared spaces and widely disseminated narratives (Halbwachs, 2020). But ubiquitous digital tools open up a bevy of new and fundamentally social dimensions to recording and subsequent remembering.

Users are increasingly engaging in sharing and collaborating on memory practices, socially integrating traditionally isolated and individual information. Social media platforms, messaging apps, and collaborative tools and features have become essential channels for sharing and documenting life experiences, leading to the hybridization of personal and group remembrance. For example, Apple's notes program allows for direct collaboration with other users: lists of things to remember become not just shared but jointly constituted—or altered. iPhoto allows folder “owners” to add other “editors” who can add, edit, and delete images. Instagram has become not only a way for people to share photos but also a socially accessible repository of the past (with fairly poor and cumbersome information-seeking features). Finally, users can crowdsource recall of past events, or probe for greater detail and collective evaluation on platforms such as Reddit (Brabham, 2013). The shift towards socially embedded memory practices raises intriguing questions about how individual memories intertwine with group and even larger collective narratives and how they are shaped and influenced by social interactions.

Idiosyncratic Memory Strategies

Novel information-seeking is relatively similar across users. People use Google or TikTok or ChatGPT in more or less similar ways. But backward-looking information seeking—looking for memories and other kinds of previously saved information is far less uniform. Smartphone memory systems are idiosyncratic. The idiosyncratic nature of mobile memories also posed a significant challenge. The rapid accumulation of data overwhelmed users, leading to a vast amount of information that was only theoretically re-accessible, not practically. As a consequence, many memories became involuntarily forgotten, buried in the vast digital landscape within, so to speak, our smartphones.

Some users we spoke to simply remembered the app associated with the memory they were looking for and the age of the item they sought, i.e., when in the past, the memory was encoded. This type of strategy would often lead to endless scrolling through messages or photos using a rough reckoning of time. This strategy was often in vain as the sedimentation of the past (and decay of the exact time in question) became too much for users to find what they were looking for. Indeed, one double-

edged sword of the smartphone archive is that, unlike biological memory, unimportant ephemera are not ephemeral—unimportant memories persist forever unless the tedious task of deletion is carried out.

Other users turned to their search bars. They might search for fragments of what they were looking for within an application’s search feature or, in some cases, they would use the “spotlight” feature on iPhone that searches across their files, photos, and the web. The latter was often very unsuccessful.

Participants expressed a sense of overload in the face of their ad hoc memory strategies, where the sheer volume of information made it difficult to discern which memories were truly worth preserving and revisiting. The prevalence of digital clutter, coupled with the absence of an easy, effective, and unified way to find what users were looking for, posed a significant barrier to maintaining a coherent and meaningful memory archive. Pictures of a cafe Wi-Fi password sat on the same level as important life moments such as a first date with one’s now life partner. Phones can help us to remember everything but not to sort out what’s worth remembering.

The instantaneous capture and storage of every moment allowed users to record a plethora of experiences, yet also raised questions about how these constant records might alter the way memories are constructed and remembered. The always-on nature of smartphones created a sense of continuous documentation, altering the lived experience and influencing users’ sense of presence and immersion in the moment.

Overall, our research sheds light on the intricate landscape of memory management among smartphone users, highlighting fragmentation, socialization, and the idiosyncratic nature of memory as critical factors contributing to temporal friction. Understanding these challenges offers valuable insights into designing more effective memory systems and technologies that cater to the evolving needs of users in this digital era. As smartphones continue to play an ever more central role in shaping how we experience and remember our lives, addressing these challenges becomes essential to fostering a more mindful and purposeful approach to memory preservation and retrieval.

DISCUSSION

The findings from our research shed light on critical aspects of mobile memory storage and retrieval, highlighting the stakes involved, the emerging need for improved tools and interfaces, and the profound impact of our study on existing assumptions and problem recognition.

The exponential growth of re-accessible data presents significant challenges for memory retrieval among smartphone users. As memories become scattered across various content domains, retrieving them becomes increasingly difficult. To address this issue, the development of improved retrieval tools and user-friendly search interfaces becomes imperative. By facilitating more efficient memory organization,

these tools can alleviate the burden of navigating fragmented memories and enhance the user experience.

The socially blended nature of mobile memory storage and retrieval underscores the necessity for more collaborative and social memory tools and interfaces. As users increasingly engage in sharing and collaborating on memories, there is a demand for platforms that support collective reminiscing and co-creation. However, this trend also raises concerns about privacy and data security. The blurring boundaries between local and cloud-based storage, as well as private and public sharing, call for robust measures to safeguard user data and maintain trust in memory-related technologies.

Our research has had an impact on the understanding of memory practices in the context of mobile technology, revealing previously invisible problems and challenging long-held assumptions.

Firstly, prior to our study, information seeking was primarily viewed as a process of discovering new information. However, our research has brought to light the growing significance of past and persistent information. The management and retrieval of memories, which were previously overshadowed by the focus on seeking new content, are now recognized as crucial aspects of the user experience.

Secondly, the issue of mounting smartphone-based memory problems for most users had not been adequately recognized before our research. Our study has successfully drawn attention to this significant issue, elevating it to the forefront of organizations' thinking. By acknowledging and addressing these memory challenges, designers and developers can craft solutions that better cater to users' needs and foster a more intuitive, relevant, and timely memory experience.

Other industry researchers have investigated smartphones, time, and memory (Guth, 2022; March & Fleuriot, 2005; Lander, 2012; Gronmo, 1989; Gibbs, 1998; Rangaswamy & Yamsani, 2011). But the matter of smartphones as memory systems has largely been overlooked. By combining theory and original ethnographic research, we were able to bring this issue to the attention of a large organization such as Google, which is positioned to create solutions for billions of users, improving their memory access and literally increasing their human capacities and sense of self.

In conclusion, our research has contributed valuable insights into the complexities of mobile memory storage and retrieval, which is now, for most of the world, an essential part of memory in general. By highlighting the stakes involved, identifying emerging needs, and challenging conventional assumptions, we hope to inspire the development of innovative memory tools and interfaces that enhance the way users interact with and cherish their memories in the age of ubiquitous mobile technology.

While it was beyond the scope of the current essay, future research would do well to investigate not only memory, but the much more difficult problem of the interplay between past, present, and future in our digitally mediated worlds. Philosophical research can, again, help to provide a foundation for empirical industry

investigations to draw upon (Bergson, 2014; Husserl, 2019; Heidegger, 2010). Additionally, questions about privacy, data, and advertising raise serious ethical concerns related to business models—and opportunities—that rely on leveraging users’ digital memories (Zuboff, 2019; Harcourt, 2015).

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