Overcoming Barriers, Achieving Goals: A Case Study of an Older User's Technology Autonomy

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ABSTRACT

Previous research often portrays older adults, especially those with low socioeconomic status, as a technologically disadvantaged population and passive recipients needing tech assistance. However, this overlooks their own technological autonomy. This case study examines how one older user in China with limited education overcame barriers to using Douyin by creatively appropriating its functions and crafting assistive tools like audio commands. Her self-driven technology practices reveal important insights into older adults' innate resourcefulness that can inform more senior-friendly HCI design. Rather than positioning older adults as passive aid recipients, this study highlights their technological autonomy. Gerontechnology accessibility should build on uncovering and leveraging this population's technology creativity and initiative. Spotlighting user autonomy provides vital corrections to deficit narratives. Our study underscores the need to understand older adults' self-created technology practices for inclusive and senior-friendly HCI research and design.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in HCI**.

KEYWORDS

Older adults, Technological autonomy, Senior-friendly, Douyin

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1 INTRODUCTION

In an era dominated by rapidly evolving technology, the digital divide that exists among generations is a widely recognized concern. Older adults, in particular, are often depicted as the technologically disadvantaged population, with a focus on their perceived challenges in technology adoption and usage, especially among those with limited socio-economic resources and limited technology usage skills [11, 14, 34]. Much of the previous research in this domain has concentrated on developing assistive technologies to bridge the gap and enhance older adults' access to digital tools [5, 15, 17, 35] under the assumption that they are passive recipients in need of technological rescue [2, 19, 22, 25]. However, this conventional perspective overlooks a crucial aspect of the aging population's relationship with technology, their own innate technological autonomy [3, 21]. It is imperative to acknowledge that older adults, regardless of their socio-economic status, possess the capacity to adapt and appropriate technology to serve their specific needs and goals [3, 18, 21]. Rather than viewing them solely as beneficiaries of external assistance, it is crucial to recognize their autonomy in utilizing technology to navigate the digital landscape successfully [12, 26, 30].

Recent studies emphasize the necessity of shifting away from the deficit model and acknowledging the potential for older adults to attain technological autonomy [3, 18, 21]. While discussions about technological autonomy for older adults have taken place in this field of research, the primary focus often revolves around empowering older adults from the perspective of researchers and designers. In these discussions, older adults are not always placed at the forefront, and their creative usage behaviors are not given the attention they deserve, consequently leading to an oversight of their own technological autonomy.

This fundamental shift in perspective necessitates a deeper exploration of older adults' technology practices and their ability to overcome barriers independently. To address this gap, we present a case study conducted in China, which illuminates the experiences of an older user as she engages with technology and crosses the barriers through her efforts. In this study, we delve into the unique journey of this technologically less proficient and education-limited older user, offering a detailed account of the barriers she encountered and the innovative workarounds she employed to overcome them. The case study primarily focuses on highlighting the inherent technological autonomy of older adults, specifically by tracing the journey of a user as they learn to use and overcome barriers on the popular short video-sharing platform, Douyin [1]. In China, DouYin,

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[1] A short video-sharing platform, as the Chinese version of TikTok (https://www.douyin.com).

the Chinese version of TikTok, had 400 million daily active users as of January 2020, with about 8% of them being over 50 [2] [24].

Our research seeks to offer a nuanced understanding of how older users navigate and surmount barriers in their technology usage journey through their unique workarounds. Our findings challenge the stereotype that elderly users are technologically disabled. In the case of Lily, she did not abandon the use of technology when faced with technical hurdles but instead demonstrated a strong sense of initiative, making numerous attempts to achieve her technical goals. She overcame these technical barriers by creatively utilizing the platform's existing functions, incorporating voice commands, and seeking advice from similar users, showcasing her technological autonomy.

Our study underscores the significance of older adults' technological autonomy and the necessity to comprehend the practices they develop themselves. By shedding light on their proactive problem-solving, we hope to shift deficit narratives perpetuating the myth of older adults as passive tech recipients. We advocate recognizing their tech practices as essential pillars for designing a senior-friendly, age-sensitive HCI community. The accessibility of gerontechnology should be grounded in the discovery and utilization of the inherent technological initiative present within this population. This understanding is crucial for advancing accessible and empowering senior-friendly designs in HCI.

2 RELATED WORK

2.1 Older Adults: The Population be Thought as Passive Technology Takers

For decades, older adults have been portrayed as the technologically disadvantaged group and passive recipients of technology [2, 19, 22, 25]. Previous studies show that older adults may have more trouble using technology than younger users, due to declines in physiological functions, including vision, hearing, memory, cognitive ability, learning ability, and hand muscle control ability [14, 23, 25, 34]. Based on this, much previous research on aging and technology has focused on designing various support tools or improving the usability of devices and platforms to compensate for older adults' deficits in tech use [5, 15, 17, 35]. For example, to address declines in attention and memory due to cognitive aging, researchers have designed prompts, reminders, and other assistive tools to reduce cognitive load [9]. To overcome older adults' diminished motor control, alternative input methods like speech and touch have been widely explored [7, 8, 27, 29, 36]. Some researchers try to tap into older adults' social resources, such as family members and community, to provide ongoing tech support for older adults' technology usage and adoption [16, 31, 32]. These studies have made valuable contributions to facilitating older adults' use of technology. However, they have some limitations. Depicting older adults merely as impaired users discounts their agency and rich life experience. Overreliance on external assistance can also undermine older adults' intrinsic motivation for tech autonomy.

[2]In China, the current legal retirement age, 60 for men, 55 for female civil servants, and 50 for female workers. Thus, we use this standard to define "older adults" in the study.

2.2 Technological Autonomy for Older Adults

Recent studies highlight the need to move beyond the deficit model and recognize older adults' potential for developing technological autonomy [3, 18, 21]. Reframed as capable learners, older adults can leverage their rich life experience as they actively explore, adapt, and appropriate technology to enhance well-being [10]. For instance, a study of older adults as digital content producers revealed they have the ability to be the digital producers, rather than consumers, and have the creative ability to join the digital creation [33].

Advancing older adults' technological autonomy requires focusing on accessibility and universal design. Technologies should be flexible and adaptable to diverse user needs and capacities. Training programs also need to build older adults' self-efficacy, motivation, and view of themselves as capable technology users. Moreover, older adults can offer valuable perspectives as co-designers of technology. By integrating their input and lived experience, designers can gain deeper insights into their wants and needs. However, although there have been some discussions on technological autonomy for older adults in this kind of research, the main concern is to see how to empower older adults from the perspective of researchers and designers. Older adults are not placed in the most central position, their own creative use behavior is not paid attention to, and their own technological autonomy is thus ignored. In this case study, we focus on expounding and discussing the technological autonomy of elderly users through a case, affirming their own technological subjects and technological creative abilities.

3 THE INTRODUCTION OF DOUYIN

Douyin, the Chinese version of TikTok, was launched in 2016, has recently become the fastest-growing social media application of all time and pioneered the popular short video format in China [20]. As of 2022, it boasts approximately 680 million monthly active users [6]. Users can create, share, and browse personal interests short videos, or live streams of various topics, like comedy, talent shows, and food-making tutorials. Due to its unique video-centered interaction mode, Douyin reduces the need for writing during use compared to other social media. Its interactive swipe-up-and-down interface also simplifies the user experience and lowers operational challenges. As a result, while Douyin's primary user base is youth, it has also gained a substantial older adult following in China [28]. The QuestMobile report in 2021 shows that 36.3% of Douyin users are over 41 years old, and 18.4% are over 51 years old [28]. Short videos are also becoming an important part of the daily life of Chinese older adults. A 2023 survey of more than 5,000 older adults in China found that about 90% watch short videos for a total of two hours a day on average [13]. Given Douyin's popularity and growing older adult user base in China, examining the technological engagement and practices of elderly users on this platform presents an excellent opportunity. We specifically selected Douyin for this study to investigate how older adults in China utilize the platform, the challenges they encounter, and the workarounds they employ to overcome barriers during use. Examining Douyin usage by older adults in China allows deeper insights into how this demographic interacts with technology.

4 THE METHOD AND BACKGROUND OF THE CASE STUDY

This case study, part of a larger research project from June to September 2023 investigating older adults' use of the popular Chinese short video app Douyin, examines the practices of elderly Douyin users in China. It focuses on how they exercise technological autonomy by utilizing workarounds to overcome barriers when using the platform. Lily (pseudonym) was one of the older adult participants in this study. We conducted offline observations during this period to gain insights into Lily's Douyin usage patterns and difficulties faced when using the platform. Additionally, we held three semi-structured interviews with Lily, including one in-person and two video interviews, to further understand her strategies for overcoming the challenges encountered with Douyin. The interviews provided deeper perspectives into her workaround tactics that allowed her to achieve technological autonomy with the platform despite usability issues.

5 WHO IS LILY

Lily is a 66-year-old woman born in 1958 in a rural farming village in southern China. When she was young, as with many in her generation in China, her education was disrupted by the Cultural Revolution [4]. She only attended school for 3 years and did not finish primary education, resulting in limited literacy. As a result, Lily recognizes very few Chinese characters, cannot hand-write many common words, and does not know Pinyin. She cannot type on the smartphone because she cannot input text by handwriting or Pinyin. Like many older Chinese adults in her cohort, Lily relies on speech instead of typing for tech interaction. In 2018 at age 60, Lily obtained her first smartphone. By 2020, she was frequently using the short video platform Douyin, posting her own short-videos at least once each week, and watching short videos and live-streaming, joining the chat groups almost every day. Douyin had become one of the most used mobile applications on her phone and an important part of her daily life for entertainment and learning.

6 OVERCOMING BARRIERS WITH TECHNOLOGICAL AUTONOMY: LILY'S JOURNEY ON DOUYIN

6.1 Crossing Inaccurate Speech Recognition

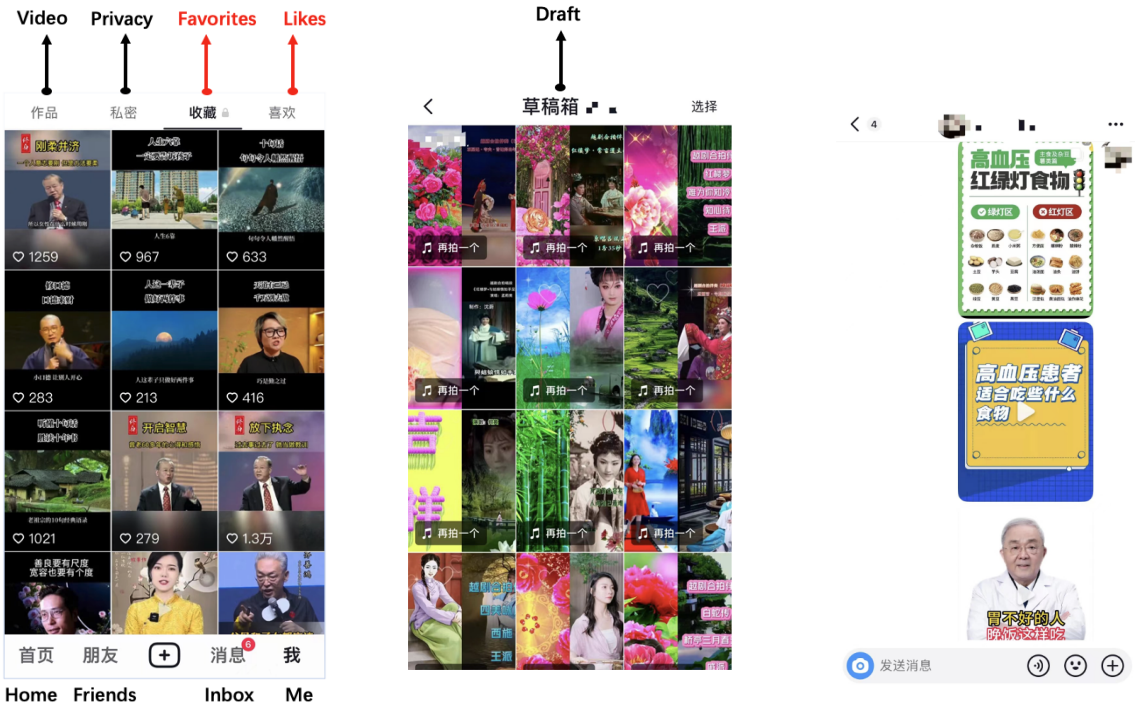
As Lily was unable to interact by typing, she relied entirely on audio interactions when using Douyin. Previous studies have stated that culture and age would actually affect the effect of speech-based interaction [1]. Douyin's speech recognition system struggled to accurately interpret Lily's southern accent. This created barriers for Lily's audio-based communication on Douyin. The inaccurate auto-transcriptions often rendered her voice messages incomprehensible to recipients. This problem was especially pronounced in her interaction in live streams, where streamers could not listen to her original audio and had to rely solely on the inaccurate textual transcriptions of her audio that Douyin displayed on the screen. Lily would frequently post voice messages that were shown to others as nonsensical text, which caused great frustration for her.

Yet Lily persevered in finding solutions to overcome the barriers of speech recognition. At first, she tried listening to videos of people speaking standard Mandarin, attempting to modify her accent. However, changing accents at her age proved very difficult, so this failed. After this try, Lily then asked her granddaughter to record customized voice command clips in standard Mandarin that she commonly used. As Lily was illiterate, she numbered these audio clips to mark these different audio commands. For example, Clip 1 stated, "Could you please repeat the content? I just entered the live-stream room and missed the earlier content." Clip 2 stated, "Sorry, I didn't get what you said, would you please explain it in more detail?" These predefined voice command clips were very useful for Lily. She could reorder and tweak them as needed by reordering, adding, or removing items. Moreover, even if she forgot the exact clip numbers, she could quickly find the right voice command she wanted to use by listening through the short recordings. In addition to creating customized voice commands, Lily leveraged Douyin's algorithm to connect with users who could comprehend her regional dialect. She allowed location tracking and signaled preferences for local content. This prompted Douyin to recommend nearby users and content creators who could understand her voice messages and transcriptions. Through these personalized adaptations, Lily overcame barriers in audio-based interactions.

6.2 Overcoming the Difficulty of Content Management

Another major barrier Lily faced was difficulty organizing and finding specific videos in Douyin's favorites function for saved content. Although Douyin had a function of "favorites" for saving short videos, searching this "favorites" page to retrieve a particular video was very challenging for Lily. Douyin's current favorites function lacks clear categorization or organization tools. The only way to find a saved video is by typing keywords to search the favorites. However, this was impossible for non-literate users like Lily. Without effective search or sorting functions, Lily's sole option was to slowly scroll through all her saved videos one by one to find what she wanted. This laborious manual rummaging was extremely tiresome and ineffective, often failing to locate the videos she sought.

To address the lack of organization tools, Lily devised her own personalized system to catalog and tag Douyin videos for later access. Over time, she found her saved videos fell into four main categories: health informational videos, opera/song performances to rewatch, instrumental tracks to practice singing with, and life philosophy videos. To bookmark impressive singing/opera videos, she used Douyin's "like" function and could find them in her "like" page (see figure 1(a)). To tag the videos that she mostly wanted to follow to practice recently, she used Douyin's function of the "draft" for future access(see figure 1(b)). For the life philosophy videos, she use the "Favorites" function to save them(see figure 1(a)). Additionally, she creatively leveraged the messaging chat box to sort videos. For health videos, she forwarded them to her own chat box, compiling specialized threads to easily find later(see figure 1(c)). For opera accompaniment tracks, she forwarded them to a chat box under her daughter's unused Douyin account. By creatively repurposing Douyin's existing functions, Lily devised her own personalized system for organizing her video favorites.



(a) The Page of "Favorites"& "Likes" (b) The Page of "Draft" (c) The Page of "Inbox"

Figure 1: These screenshots show four existing functions in Douyin, captured in September 2023. This figure shows the four existing functions in Douyin. Figure 1(a) shows the function of the "Favorites" and "Likes". The function of "Likes" is designed to express users' appreciation for the short video. On the page of the "Likes", users can see what they have given like before. The function of "Favorites" is designed to help users save the short video they want to rewatch later. On the page of the Favorites, users can see the short videos they have collected before. Figure 1(b) shows the function of the "draft", which is designed to keep users' unfinished self-produced short videos. On the page of the "draft", users can see the short video they unfinished recently. Figure 1(c) shows the Inbox with the chat function in Douyin. On the page of the inbox, users can see the short videos sent to the chat before. Of these functions, only the "Favorites" is designed for managing preferred content. However, in her usage, Lily creatively leveraged the potential of all four functions to curate her personal video favorites within Douyin.

Through customized use of existing functions, Lily devised a personalized classification system tailored to her needs, overcoming inaccessible native organization tools. She fully leveraged Douyin's storage functions like favorites and likes, while also creatively tapping chat boxes to save videos. By consciously distributing different video types across repurposed channels, Lily achieved effective short video management for her personal Douyin content favorites.

6.3 Overcoming the Lack of Informal Learning Support Tools

Additionally, Lily faced the challenge of lacking tools to quantify her informal learning progress on Douyin. She enjoyed learning Chinese opera and singing, pursuits she had aspired to but lacked opportunity for when young. However, as an entertainment rather than an educational platform, Douyin lacked built-in learning assessment tools to measure outcomes. Yet Lily creatively improvised a simple method to achieve this goal and track her learning.

Lily leveraged Douyin's "hepai" function to create practice videos of herself singing along to accompaniment tracks. She posted these videos not only on her own page but also shared in the group chats and in the comment sections of popular accounts in Douyin. So her practice video can be seen by more people. This allowed Lily to receive external feedback through others' likes and critiques, providing insights into her progress and weaknesses. For Lily, this simple yet effective approach quantified her informal learning on Douyin. By devising this autonomous method, she could self-assess her proficiency gains and improvement in opera singing practice, despite no formal Douyin analysis tools.

Likewise, because Douyin did not cover many users' needs for informal learning and lacked tools for support, Lily found it difficult to take study notes or review important content. However, through practice, Lily explored her workarounds to overcome this limitation. First, for valuable live stream content, she used her phone's screen recorder to save key video segments for later review. Second, since often only certain portions contained the main takeaways within long study sessions, Lily needed to capture the key points. As

she was unable to type, she recorded concise audio summaries of the most important concepts using a separate voice recorder. When reviewing, she could simply re-listen to these personalized audio notes. Through this self-devised workaround, Lily was able to save meaningful content and distill critical knowledge into easily reviewable audio form.

In conclusion, Lily's creative efforts to overcome barriers while using Douyin reveal key insights about older adults' technology practices. Through practices like re-purposing platform functions to classify preservation of her short videos to overcome the challenge of personal short video management, and customize her recorded voice command to overcome the barrier of speech recognition problem, she displayed remarkable resourcefulness and technological autonomy in adapting Douyin to suit her needs. Lily demonstrates that seniors are resourceful users, not just aid recipients. Her story serves as an inspiring testament to older generations' capacity to engage with modern platforms, bridging generational gaps and actively participating in contemporary digital culture.

7 LEARNED FROM THE CASE

This case study provides valuable insights into the importance of acknowledging older adults' technological autonomy. Despite limited technology ability and education, Lily exhibited remarkable creativity in overcoming the usage barriers like, speech recognition inaccurate and difficult in managing personal favorites short videos in Douyin. This challenges prevailing notions that portray older adults as a technologically disadvantaged group requiring assistance due to a lack of technology skills. Whereas previous research focused on their role as passive recipients of technology support [5, 15, 17, 35]. Lily's usage story reveals older adults' capacity for exercising initiative and inventing personalized workarounds. Her resourcefulness and adept problem-solving exemplify how older adults, even disadvantaged ones, can demonstrate technological autonomy. Lily's case highlights four key lessons about respecting and leveraging older adults' technology abilities, ingenuity, and autonomy.

First, Lily's experience exposes existing accessibility gaps in technology that prevent universal access. These gaps especially affect older adults with limited education, such as Lily. Due to constrained education, Lily struggled with Pinyin and written Chinese input, relying instead on audio interaction. However, her rural accent impeded speech recognition, disrupting usage. Despite multi-modal interactions expanding participation, barriers persist. This highlights the imperative of advancing universal design in the HCI community. For instance, enhancing speech recognition for diverse dialects and improving the accuracy of multi-modal inputs can lower thresholds for elderly users. Although alternatives to text input exist, imperfections like inaccurate speech recognition still create usage barriers for users like Lily. It is worth noting that such barriers not only occur among the elderly, but also cause challenges for other users with limited education, disabilities, and dyslexia. Continued efforts are needed to refine accessibility and ensure technologies enable self-determined use regardless of individual situations. Lily's case demonstrates the need to maintain focus on inclusive technology that empowers users through participatory design.

Second, Lily's experience reveals older adults have nuanced, distinct technology needs that may be overlooked by younger researchers and designers. Contrary to the assumption that older adults are low-engagement social media users, Lily actively sought participatory opportunities on Douyin. Her case also spotlights more granular needs, like accurate speech recognition in live stream interaction and finding specific videos without a search bar. While previous research focused on accessibility needs like larger fonts, Lily had deeper desires for self-expression, interaction, and being seen. This highlights the importance of user-centered research that earnestly uncovers older adults' priorities and perspectives. Rather than making assumptions, HCI practice must place their self-articulated desires at the core of design. Older adults have distinct needs that only participatory methods eliciting their voices can illuminate.

Third, older adults' own technological autonomy deserves more research attention, with an aim to analyze their autonomy and agency in surmounting technology barriers. Previous research often depicted older adults as tech-disadvantaged populations lacking initiative - framing them as passive recipients of assistance. Lily's case counters stereotypes of older adults as passive and dependent technology users. Rather than abandoning Douyin or seeking assistance when barriers arose, Lily actively devised her own workarounds. This demonstrates older adults' technological autonomy. They have the capacity as autonomous problem solvers, not just recipients of technical aid. Lily's resourcefulness reveals the flaws in perceiving older adults as devoid of initiative and merely needing support. Designing empowering technology requires recognizing their self-determination and ability to independently overcome obstacles through technological ingenuity. The HCI community could focus more on understanding older adults' technology agency and innate potential.

Finally, older adults' firsthand technology experiences, habitual usage patterns, and innovative workarounds to overcoming barriers can profoundly enrich HCI research with inspirational insights. Lily's novel workarounds demonstrate the creative wisdom older adults accumulate as users in their own right. Lily's usage practice preview the possibilities when aligning design with users' distinct needs. Older adults' technology flexibility embodies the creative spirit of users pioneering new purposes that designers fail to envision initially. HCI researchers and designers should recognize older adults' hard-won technology insights and engage them as co-design partners in creating more senior-friendly technology design. Their lived technology expertise can guide more empowering design when incorporated through participatory co-creation, and will be the key to empowering HCI design for senior futures.

7.1 Limitation

Even though we gained surprising insights from this case study, we must acknowledge that our research still has limitations. First, the findings we discussed revolve around a limited sample - one older adult who was an active Douyin user. So we do not claim our research conclusions apply to all older users. Future research could draw from a more diverse group of older users, examining how older adults from different cultural backgrounds, technology experiences, and skill levels interact with technology. This can provide a more

comprehensive understanding of older adults' user experience. Second, this case study relied primarily on interviews, learning about the user's journey through her own retrospection. Future research could incorporate more observation and experimental methods to understand older adults' technology use processes.

8 CONCLUSION

Lily's case study serves as a reminder that older adults should not be seen merely as passive recipients of technology. Rather, they are important initiative users whose unique usage patterns and workarounds to cross the barriers can offer invaluable inspiration for HCI researchers and designers. Embracing older adults' technological autonomy could enable more inclusive, user-centered innovations benefiting people across age groups. Respecting older adults' technological autonomy requires integrating their experiences into design. Empowering them necessitates shifting from retrofitting technology to co-creating possibilities rooted in lived realities. Amplifying older adults' voices through collaboration will guide us past assistive technologies, toward universal and self-determined participation. The HCI community's future requires partnering users and designers as true co-creators. Integrating older adults as active design partners, not just research subjects, can yield technologies enabling fuller participation through senior-friendly solutions tailored to their priorities. Lily's case highlights the need to recognize older adults' creativity and engage their insights to drive inclusive innovation in HCI.

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