GazeSwipe: Enhancing Mobile Touchscreen Reachability through Seamless Gaze and Finger-Swipe Integration

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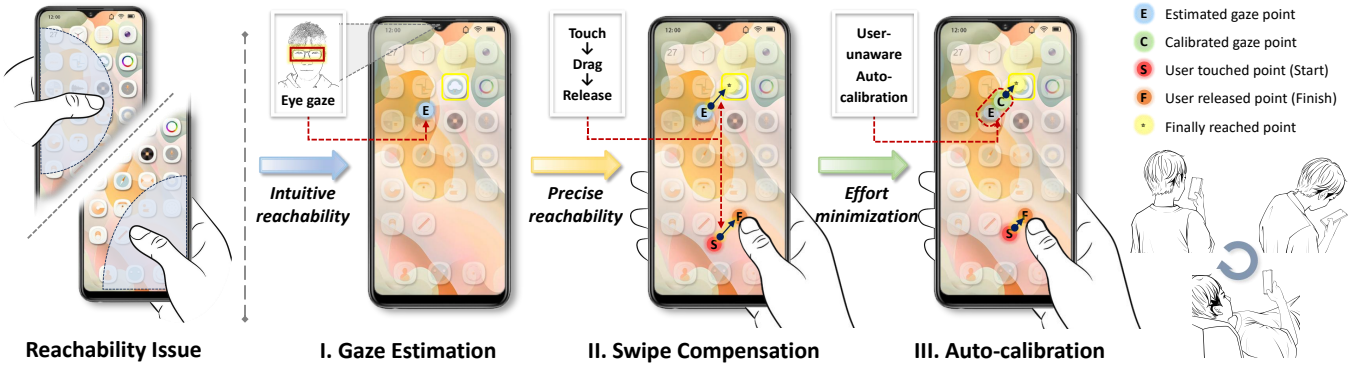

Figure 1: To address the issue of thumb reachability on smartphones and tablets when held with one hand, we introduce the gaze-based pointing, enabling users to intuitively reach any position by simply gazing at the target. By combining this with the finger-touch input, users can precisely interact with targets through swipe gestures. Additionally, we introduce a user-unaware auto-calibration method that eliminates the need for explicit gaze calibration, enhancing gaze accuracy during use and making interactions more seamless and efficient.

Abstract

Smartphones with large screens provide users with increased display and interaction space but pose challenges in reaching certain areas with the thumb when using the device with one hand. To address this, we introduce GazeSwipe, a multimodal interaction technique that combines eye gaze with finger-swipe gestures, enabling intuitive and low-friction reach on mobile touchscreens. Specifically, we design a gaze estimation method that eliminates the need for explicit gaze calibration. Our approach also avoids the use of additional eye-tracking hardware by leveraging the smartphone's built-in front-facing camera. Considering the potential decrease in gaze accuracy without dedicated eye trackers, we use finger-swipe gestures to compensate for any inaccuracies in gaze estimation. Additionally, we introduce a user-unaware auto-calibration method that improves gaze accuracy during interaction. Through extensive experiments on smartphones and tablets, we compare our technique with various methods for touchscreen reachability and evaluate the performance of our auto-calibration strategy. The results demonstrate that our method achieves high success rates and is preferred by users. The findings also validate the effectiveness of the auto-calibration strategy.

CCS Concepts

• **Human-centered computing** → **HCI design and evaluation methods**; **Interaction techniques**.

Keywords

Interaction Technique, Eye Tracking, Reachability, Mobile Devices

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Code Shaping: Iterative Code Editing with Free-form AI-Interpreted Sketching

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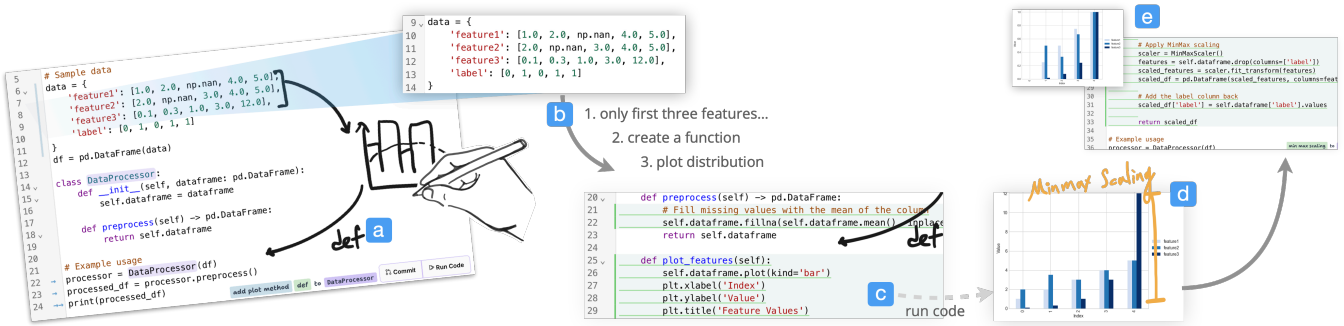

Figure 1: Code shaping usage example: (a) a programmer draws an arrow from a few lines of code defining data attributes to a sketch of a bar chart in whitespace near the code, then they add another arrow back to a different code location and annotate the arrow with 'def'; (b) an AI model uses the code and the overlaid sketches to insert a new function to plot that data; (c) the programmer reviews the edits interpreted by the model, then they run the program; (d) the code outputs a rendered plot, the programmer sketches on top of it to indicate it should use min-max scaling; (e) the model examines the new sketches and modifies the code to implement scaling.

Abstract

We introduce the concept of code shaping, an interaction paradigm for editing code using free-form sketch annotations directly on top of the code and console output. To evaluate this concept, we conducted a three-stage design study with 18 different programmers to investigate how sketches can communicate intended code edits to an AI model for interpretation and execution. The results show how different sketches are used, the strategies programmers employ during iterative interactions with AI interpretations, and interaction design principles that support the reconciliation between the code editor and sketches. Finally, we demonstrate the practical application of the code shaping concept with two use case scenarios, illustrating design implications from the study.

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CCS Concepts

• **Human-centered computing** → **User interface programming**; **Interaction techniques**.

Keywords

Ink-based Sketching, Dynamic Abstraction, Programming Interface

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1 Introduction

In programming tasks, text is not always the primary medium for expressing ideas [27]. Programmers often turn to sketching on whiteboards and paper to externalize thoughts and concepts [10, 35, 64]. This includes tasks like designing program structure, working out algorithms, and planning code edits [10, 46, 60]. The informal nature of sketching helps untangle complex tasks, represent abstract ideas, and requires less cognitive effort to comprehend [10, 14, 63].

Prior research has explored programming-by-example systems that transform sketches [39], such as diagrams [17], mathematical

Synthetic Human Memories: AI-Edited Images and Videos Can Implant False Memories and Distort Recollection

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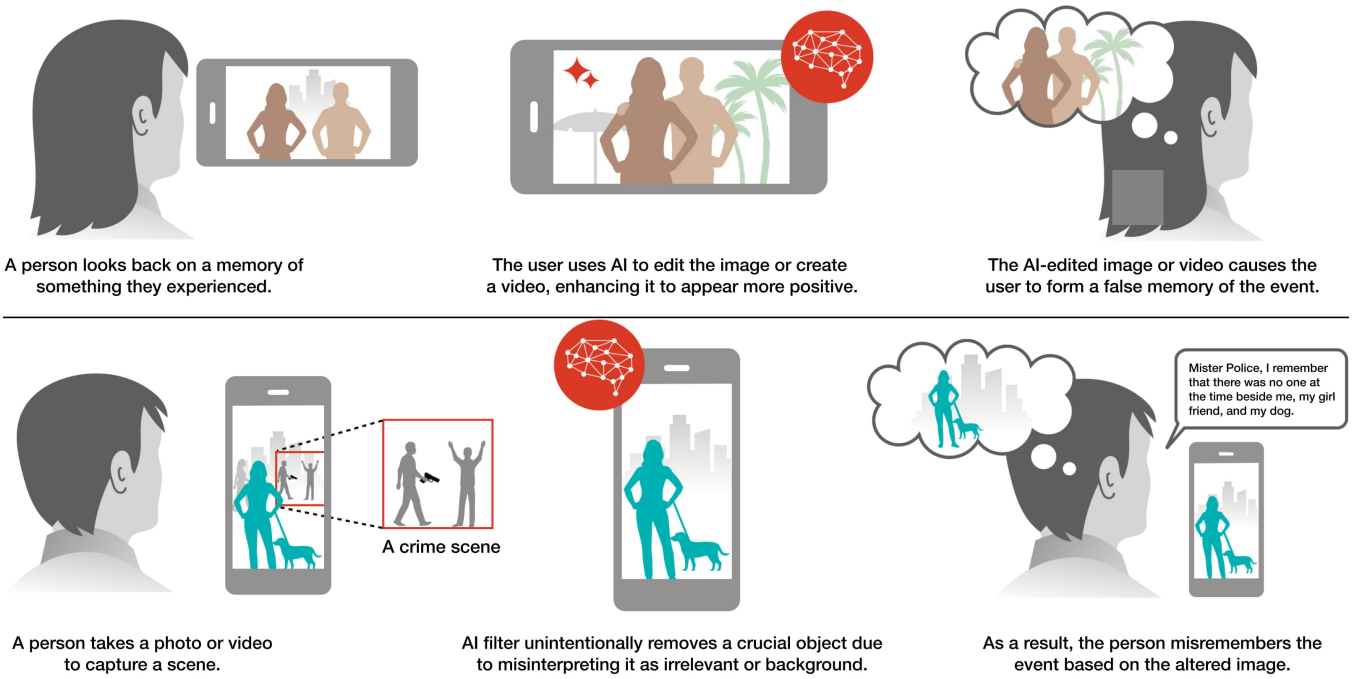

Figure 1: Illustration of how AI-edited media can create false memories. The top row depicts a person using AI to enhance an image or video to make it more positive. Over time, the person revisits the image without recalling that it was edited, leading to the development of a false memory of the event. The lower section depicts a situation where AI inadvertently modifies an image, eliminating bystanders from the frame as part of an automatic filter without retaining the original version (a feature already available in Google Photos and other camera apps). Later, when the individual reviews the photograph—potentially related to a crime scene—they develop a false recollection that matches the edited image rather than the actual event, leading to false witness testimony. This figure highlights the impact of AI-generated edits on human memories, demonstrating how subtle changes can distort recollection.

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Abstract

AI is increasingly used to enhance images and videos, both intentionally and unintentionally. As AI editing tools become more integrated into smartphones, users can modify or animate photos into realistic videos. This study examines the impact of AI-altered visuals on false memories—recollections of events that didn't occur

or deviate from reality. In a pre-registered study, 200 participants were divided into four conditions of 50 each. Participants viewed original images, completed a filler task, then saw stimuli corresponding to their assigned condition: unedited images, AI-edited images, AI-generated videos, or AI-generated videos of AI-edited images. AI-edited visuals significantly increased false recollections, with AI-generated videos of AI-edited images having the strongest effect (2.05x compared to control). Confidence in false memories was also highest for this condition (1.19x compared to control). We discuss potential applications in HCI, such as therapeutic memory reframing, and challenges in ethical, legal, political, and societal domains.

CCS Concepts

• **Human-centered computing → Interaction design theory, concepts and paradigms**; **Empirical studies in interaction design**; **Empirical studies in HCI**; **HCI theory, concepts and models**.

Keywords

Memory, AI-generated Media, Misinformation, Generative AI, Human-AI Interaction

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1 Introduction

If a device existed that could help reframe your worst day in a more positive light, would you choose to use it? Memory-editing technologies have been a central theme in science fiction, prominently featured in works such as Eternal Sunshine of the Spotless Mind, Men in Black, Total Recall, and Inception [79]. However, techniques for altering human memories are not confined to the realm of fiction, as they represent a heavily studied area within psychology and cognitive science [74].

False memories, which refer to recollections of events that either never occurred or are significantly distorted from reality, have been a major focus in psychology research. The study of false memories is vital because they can distort witness testimonies, disrupt legal processes, and lead to faulty decision-making based on incorrect information. Given these broad implications, understanding how false memories form is a critical area of investigation [29, 58, 59, 62, 86, 107]. Unlike typical forms of misinformation [105], false memories are particularly insidious because the individual genuinely believes they recall accurate events, making them resistant to correction and potentially more influential in shaping beliefs and behaviors [56, 60]. Moreover, false memories can serve as a seed for making people more susceptible to additional false information [42, 92], creating a cascading effect that further distorts perceptions of reality and complicates efforts to establish accurate historical or personal narratives.

Research in cognitive psychology has demonstrated that human memories are remarkably malleable. Landmark studies by Loftus and colleagues [61, 62] revealed how both verbal questioning and visual stimuli can significantly influence and even create false memories of events that never occurred. For instance, experiments showed that subtle changes in wordings during interviews could alter participants' memory of witnessed events, while exposure to manipulated photographs could lead to the formation of entirely false childhood memories [96]. These findings have had profound implications for understanding human memory's susceptibility to external influences

However, these studies have predominantly been conducted in controlled laboratory settings, where images are manually edited by researchers and interviews are carefully planned. The process also involves human intervention in establishing trust, guiding participants, and presenting the manipulated images, which inherently limits the scope and scale of false memory induction. With recent advancements in artificial intelligence (AI), however, these limitations are beginning to change. The automation and accessibility of AI editing tools enable manipulation at unprecedented scale and sophistication, significantly expanding the possible impact of false memories on individuals. Moreover, this study explores new ground by examining how AI-generated videos derived from static images may further amplify memory distortion effects - an increasingly relevant concern as more types of AI tools become widely available.

This unprecedented proliferation of AI-driven image editing and video manipulation technologies has raised significant concerns regarding the integrity of consumed information. We argue that AI-generated content contributes to misinformation by distorting our understanding of the present (e.g., deepfakes) as well as reshaping how we remember the past. AI-generated media can potentially create false memories and lead individuals to recall past events differently than they actually occurred and were initially experienced. The implications of these technologies span both personal and societal domains, as illustrated in figure 2.

On a personal level, there has been a notable trend, particularly on social media platforms such as TikTok, of users employing AI to animate photographs of deceased family members, simulating interactions with departed loved ones. On a broader scale, the potential for AI-generated content to influence collective memory and historical narratives poses significant challenges to societal understanding and cohesion, potentially altering public perceptions of past events and shaping future decision-making processes. For example, AI-edited images of public gatherings or protests could subtly alter the perceived scale or mood of these events, gradually reshaping how participants and observers remember their personal experiences and consequently influencing the collective memory of significant social movements.

A crucial distinction must be made between deepfakes and AI-edits, as both leverage generative AI but differ significantly in their real-world implications and how people encounter them. Deepfakes typically involve the creation of entirely fabricated audio or video content, often for malicious purposes such as spreading disinformation. In contrast, AI-edits modify existing content, subtly altering genuine memories or experiences. This distinction is important, as people may be more vigilant against obviously fake