

Echo: Designing a Future-Self Avatar for the Promotion of a Balanced, Low-Calorie Diet

1 Introduction

Hydration plays a crucial role in maintaining overall health and preventing chronic diseases linked to poor dietary habits, such as hypertension, diabetes mellitus, and cardiovascular disorders (Popkin, D'Anci, & Rosenberg, 2010). Despite various interventions to promote healthier diets, traditional focus areas like caloric restriction have not fully addressed the persistent issue of inadequate hydration, which is essential for metabolic processes and disease prevention (Payne et al., 2015; Popkin, D'Anci, & Rosenberg, 2010). Current strategies, such as dietary apps like Noom and fitness platforms like Keep, often emphasize calorie counting and physical activity without adequately addressing long-term hydration habits, which are critical for both disease prevention and general wellness (Payne et al., 2015).

This study introduces a novel approach that combines adaptive AI-driven dialogue systems with scalable, cost-efficient mobile health technology. Building on prior research into avatar customization and persuasive technology (Fogg, 2003; Kriglstein & Wallner, 2013), we present Echo — an AI-powered health intervention based on future self theory, designed to promote consistent hydration monitoring through gamification and user-centric design. Unlike earlier mobile health apps, Echo reduces the friction of manual tracking while broadening access to personalized behavioral support (Fox & Bailenson, 2010; Jin, 2010).

Gamification further enhances engagement, especially in populations with lower health literacy and motivation—traits commonly associated with higher risks of chronic conditions (Hamari & Koivisto, 2013). Strategies like the use of empathetic avatars and relational agents have proven effective in improving user adherence and experience in digital health interventions (Bickmore, Pfeiffer, & Paasche-Orlow, 2013).

In the present study, we explored how conversational agents could support people in developing healthy habits and expressing emotions. The chatbot was designed to align with Echo's mission of supporting behavior change through emotionally intelligent AI interactions. Drawing from health coaching principles and behavior change theory (Schwarzer, 2008; Ryan & Deci, 2000), the chatbot guided users to identify hydration goals, recognize emotional associations, and share personal reflections in a safe space.

To enhance conversational quality, we incorporated large language models (LLMs) to generate contextually relevant, in-situ responses that maintained focus and engagement. In a pilot study with 8 Chinese-speaking participants in 12 days, we used SMS to simulate the chatbot experience and inform design refinements. The resulting chatbot, deployed via Discord, featured phase-based goals and empathetic interactions tailored for younger users. Participants reported comfort in sharing personal stories and viewed the chatbot as both a mirror of their self-perception and a trusted companion. This relational quality increased their commitment to hydration goals and improved daily health routines.

Building on these insights, we conducted a second, larger-scale online experiment with 20 participants over 12 days using an API-integrated platform. This allowed for more scalable deployment and deeper analysis of message timing, personalization, and behavioral triggers, further validating the chatbot's ability to foster meaningful engagement and support hydration habits.

In summary, this work contributes the following:

1. The design and implementation of Echo, an LLM-driven chatbot that helps participants express their hydration habits through free-form conversations. This design, informed by professional insights, aligns with Echo's emphasis on creating supportive AI tools for health and well-being.
2. We gained an empirical understanding of how people interact with the chatbot. From the analysis of the dialogue logs and interview transcripts, we provided findings on how people interact with a chatbot driven by LLMs in sharing emotions about personal events.
3. Design considerations for LLM-driven chatbots targeting hydration intervention, offering recommendations to balance empathetic engagement with potential concerns about overreliance on AI, reinforcing Echo's commitment to responsible and effective AI integration.

2 Related Work

This section provides an overview of research and methodologies in hydration monitoring and behavior change interventions, including the role of mobile health (mHealth) platforms, gamification, avatar identity, and AI-driven personalization.

2.1 Monitoring hydration consumption

Accurate hydration tracking is foundational to health behavior change. Early techniques like manual logging have evolved into digital tools with beverage databases, barcode scanning, and reminder features (Payne et al., 2015). Wearables have advanced hydration monitoring by estimating fluid loss during physical activity through sweat sensors and biometric analysis, offering users real-time insights (Popkin, D'Anci, & Rosenberg, 2010). Meanwhile, experimental technologies like image-based intake detection and ingestible hydration sensors are emerging, though they still face challenges in accuracy, user burden, and widespread adoption.

Some interventions integrate tracking with personalized recommendations, offering adaptive feedback based on user goals and context (Payne et al., 2015). This blend of nutritional science, behavioral modeling, and digital convenience improves adherence by delivering tailored hydration suggestions (Fogg, 2003).

2.2 Behavioral Interventions to Promote Hydration

Despite technological advances, many hydration interventions still fall short. They often lack strong personalization and fail to enhance psychological drivers like outcome expectancy and self-efficacy—critical for long-term behavior change (Payne et al., 2015; Schwarzer, 2008). Individuals may remain unaware of the benefits of hydration or uncertain about their ability to maintain better habits. Effective interventions must include clear risk messaging and build confidence to support sustained engagement.

Effective behavior-change tools must prioritize three psychological mechanisms: raising risk awareness, communicating tangible benefits, and strengthening users' belief in their capacity to change. Without addressing these, even the best-designed apps may struggle to generate lasting impact.

2.3 Idealized avatar in Future Self Theory

Future Self Theory posits that individuals are motivated by connections with their future selves (Hershfield, Cohen, & Thompson, 2011). Digital avatars provide a unique medium to embody and visualize these future versions. Avatar identification—the degree to which users see themselves in an avatar—is a key mechanism in this process. Research suggests customization enhances this connection, allowing avatars to reflect users' aspirations and ideal traits (Jin, 2010; Fox & Bailenson, 2010).

The mirror and magic mirror hypotheses propose that avatars serve as both reflections of the current self and projections of the ideal self. This duality enables users to explore identity in a psychologically safe space while being guided by a vision of who they could become (Birk et al., 2016).

2.4 Adverse effect of idealized avatar

However, idealized avatars also come with risks. According to self-discrepancy theory, a mismatch between one's actual self and idealized representation can produce discomfort, especially in health contexts (Kim & Sundar, 2012). Over time, this may lead to reduced motivation, body dissatisfaction, and even depressive symptoms—particularly among users already vulnerable to self-image issues (Ali et al., 2010).

Studies show that women and younger users are especially sensitive to unrealistic body portrayals. When avatars perpetuate narrow aesthetic ideals, they can reinforce harmful stereotypes and contribute to negative self-comparisons. Interventions must therefore strike a balance between aspirational design and psychological safety.

2.5 Advancements in AI-related technology with Future-Self Avatar

Recent advancements in AI-related technology, particularly in the fields of text-to-video generation and large language models (LLMs) for conversation, have significantly influenced the development of future-self avatars in behavior change interventions. These technologies enhance the personalization and engagement of users, making future outcomes more tangible and emotionally impactful.

2.5.1 Text-to-video

Tools like D-ID allow users to generate lifelike, personalized video messages from their “future self,” blending natural language input with facial animation. These videos make future consequences of current behaviors more vivid, strengthening users’ emotional connection to long-term goals through the lens of temporal self-continuity (Hershfield et al., 2011).

Such immersive experiences increase motivation by helping users visualize success and internalize their trajectory toward improved health. This interactive storytelling transforms passive interventions into engaging, self-driven experiences.

2.5.2 Large Language Models for Conversation

Recent advances in pre-trained large language models (LLMs), such as GPT, PaLM, and LLaMA, have transformed the development of conversational agents across a wide range of applications. These models offer significant improvements over traditional rule-based or retrieval-based chatbots by generating coherent, contextually relevant dialogue without requiring extensive domain-specific training data. Leveraging their large-scale, general-purpose knowledge, LLMs are capable of producing human-like responses with minimal prompting, making them highly flexible and adaptable tools for behavioral intervention design.

In the context of Echo, LLMs were used to power chatbots aimed at supporting hydration-related behavior change. By embedding motivational messaging and habit-tracking conversations into a naturalistic dialogue format, the chatbot provided users with personalized, low-friction support for improving their daily water intake. Unlike rigid, script-based interactions, LLM-driven conversations allowed users to explore their routines, identify obstacles, and receive timely encouragement in a more fluid and engaging manner.

Although prior research has explored the potential of LLMs in areas such as mental health support and emotional expression, our study focused specifically on how these models can enhance health interventions related to hydration. Rather than targeting emotional regulation or child development, the goal of Echo was to evaluate whether conversational AI could serve as an effective tool for promoting consistent and healthy hydration habits in everyday settings.

2.6 Measurements

Thematic integration of the Health Action Process Approach (HAPA) and player-avatar identification highlights these frameworks as essential for understanding user motivation and behavior change. HAPA, a well-established health behavior model, focuses on the motivational phase of behavior adoption—excluding volitional follow-through—and emphasizes three key predictors of intention: outcome expectancy, risk awareness, and self-efficacy (Schwarzer, 2008). In this study, we applied validated HAPA-based survey instruments to measure changes in these predictors across three intervention phases. This model offered a structured lens to examine how individuals developed intentions and confidence to pursue healthier behaviors, such as maintaining proper hydration.

Complementing this, the concept of player-avatar identification explores the psychological bonds users form with their digital representations. Measurement tools like the Player Identification Scale (PIS), Player-Avatar Identity Scale (PAIS), and

Player-Avatar Interaction (PAX) scale assess factors such as perceived similarity, wishful identification, emotional investment, and control. These dimensions illuminate how users relate to avatars, shaping their motivation and engagement. The intersection of avatar identification and behavior intention reveals a promising path for digital health design—one where personalized, emotionally resonant avatars can enhance users' motivation to adopt and maintain healthy habits (Fox et al., 2009).

3 Design Science

3.1 Future-self avatar

Within the Echo platform, the concept of future-self avatars plays a central role in promoting sustained behavior change, particularly in the domain of diet and hydration management. These avatars are not merely static digital representations; rather, they are designed to personify the user's potential future self, reflecting health outcomes based on present behaviors such as hydration and calorie intake. The development of this intervention was grounded in design science research and human-computer interaction (HCI) principles, with the goal of delivering a highly personalized and intrinsically motivating user experience (Peffer et al., 2008; Gregor & Hevner, 2013).

The design process began with a comprehensive review of existing literature on avatar-based health interventions, which informed a set of design guidelines (D1–D7). One of the foundational principles (D1) was the integration of feedback mechanisms, enabling the future-self avatar to assess user behavior against hydration benchmarks and deliver timely, context-aware prompts (Fogg, 2003). Another key decision (D2) was to employ human-like avatars rather than abstract figures, enhancing users' ability to project themselves onto their avatars and fostering stronger identification (Fox & Bailenson, 2010). To further support self-representation, we implemented customization options (D5) that allow users to modify their avatars' physical features—such as hair color and style, eye color, facial hair, glasses, and clothing—so that the avatars more closely resemble the users themselves (McArthur, 2017).

This approach builds on evidence that personalized, relatable avatars increase user engagement and emotional investment, which are critical for maintaining long-term adherence to digital health interventions (Birk et al., 2016). Moreover, the inclusion of real-time feedback empowers the avatar to function not just as a motivational figure but as an adaptive, supportive guide. By tailoring its responses to the user's progress and

specific needs, the avatar can deliver continuous, meaningful interaction that reinforces behavioral goals and sustains user commitment over time (Kramer & Kowatsch, 2017).

No.	Design Guideline	Sources
D1	Give feedback (positive & negative)	[1, 5]
D2	Self-similarity (human-like)	[1, 56]
D3	Reflect ideal look and behavior	[4, 45]
D4	Provide encouragement and empathy	[5, 7]
D5	Customization	[4, 45]
D6	Simplicity	[48, 56]
D7	Focus on outcome expectancy	[39, 44]
D8	Provide background information	[54, 59]
D9	Implications of behavior and change	[28, 62]
D10	Personal risk awareness & urgency	[1, 28]
D11	Welcoming, congenial, and engaging	Expert Interview
D12	Cautious of negative consequences	Expert Interview
D13	Adhere to principles of visualization	Expert Interview

Building on prior research, we integrated advanced AI-driven portrait generation and speech synthesis technologies to create avatars that are both highly realistic and fully customizable. This evolution in avatar design represents a meaningful advancement in human-computer interaction, enabling richer, more immersive user experiences and expanding the potential for sustained engagement. By embedding a real-time feedback mechanism, the avatar dynamically adapts its interactions—delivering personalized guidance, motivational messaging, and timely encouragement based on individual user behavior. This adaptability is especially critical for maintaining long-term adherence in health interventions. Through this approach, Echo seeks to provide a more effective, user-centered pathway for promoting lasting behavioral change, particularly in the context of dietary and hydration habits.

RQ1: How does avatar customization (AI photo and self-goal-setting) in an AI chatbot-based health intervention game affect the users' behavior?

RQ2: Can player-avatar communication through texts, text-generated figures and visualization of behavior level improve the chronic behavior change effect?

Building on the established design foundation, we selected D2 (human-like avatars) and D3 (self-similarity) as focal areas for deeper investigation. Our goal is to explore how varying degrees of avatar self-resemblance and idealization influence user experience and long-term engagement in health interventions. Prior research on short-term behavior change in exercise contexts found that avatars with idealized features increased users' wishful identification but, paradoxically, resulted in lower performance during exergames when compared to more realistic avatars (Birk et al., 2016). However, this challenge was mitigated by blending idealized traits into otherwise realistic avatars, which preserved user performance while still enhancing identification (Birk et al., 2016).

Building on these insights, our study aims to examine how avatar personalization—specifically through manipulations of realism and idealization—affects engagement and behavior change in dietary contexts. To address this, we designed three avatar conditions for comparative analysis:

- A realistic avatar,
- A realistic avatar enhanced with idealized traits
- A realistic avatar incorporating anti-ideal (less aspirational) traits.

This experimental setup allows us to investigate the nuanced psychological and behavioral effects of avatar design choices, contributing to more effective, personalized strategies for sustaining health-related behavior change over time.

RQ3: How does the realism of an avatar's appearance and behavior affect users' focus on outcome expectancy and behavior performance in virtual environments?

RQ4: To what extent do avatars with idealized characteristics enhance users' self-identification, and how does this affect their self-efficacy in diet behavior change tasks?

RQ5: How does the negative discrepancy, between the user and the avatar, impact users' self-identification, performance, and motivation level in exercising diet behavior change tasks?

After establishing the primary design variables—self-similarity and the degree of idealized appearance and behavioral reflection (D2, D3)—we identified a set of co-variables that may be influenced by these factors. These included: outcome expectancy (D7), background information provided to users (D8), perceived implications of behavior and change (D9), and personal risk awareness and urgency (D10). We also considered feedback (D1) as a dependent variable, recognizing that the nature and tone

of both positive and negative feedback may vary depending on the avatar's characteristics and perceived persona.

To operationalize these variables in avatar generation, we leveraged the AI agent capabilities of GPT-4, preparing three distinct levels of text-based persona descriptions: idealized, moderate/mediocre, and subpar. These persona scripts were iteratively refined using insights drawn from participant survey responses, ensuring alignment between avatar traits and user perceptions. This integration of qualitative feedback with AI-driven content generation allowed us to tailor avatar design with greater nuance and contextual relevance, consistent with best practices in design science research (Gregor & Hevner, 2013).

3.2 AI-Based Chatbots for Emotional Engagement

In addition to its future-self avatar component, Echo incorporates AI-based chatbots to support sustained behavior change around hydration habits. These chatbots build on research showing that virtual agents can enhance motivation, engagement, and user identification when thoughtfully designed (Fox & Bailenson, 2010; Jin, 2010). Recent advancements in large pre-trained language models (LLMs)—such as GPT, PaLM, and LLaMA—have transformed conversational system design, allowing for dynamic, context-aware interactions that surpass the capabilities of traditional rule-based or retrieval-based approaches (Bickmore et al., 2013; Granic et al., 2014).

Unlike earlier systems that required extensive domain-specific training data, LLMs function effectively with minimal prompting, offering exceptional flexibility and scalability across diverse user needs. This adaptability enables personalized, coherent dialogue that maintains user engagement and delivers just-in-time behavioral support (Banks & Bowman, 2016). Platforms like ChatGPT and Bard demonstrate how such models can facilitate habit formation by sustaining natural, emotionally resonant conversations (Przybylski et al., 2010).

Within Echo, LLM-powered chatbots engage users in open-ended conversations focused on hydration goals, helping them reflect on daily routines, identify barriers, and stay motivated over time. These interactions are enhanced through the careful design of subtle personality traits, making the chatbot feel more human and relatable (Li & Lwin, 2016; Yee & Bailenson, 2007). Instead of adopting a didactic tone, the chatbot employs motivational interviewing techniques—such as positive reinforcement, affirmations, and goal reminders—positioning itself as a supportive companion rather than an authority figure.

By integrating motivational language with adaptive feedback, the chatbot plays a critical role in reinforcing positive behaviors. When combined with the visual and emotional resonance of future-self avatars, Echo delivers a multi-layered experience that targets both the reflective and interactive dimensions of behavior change (Bandura, 2004; Schwarzer, 2008). Together, these components form a cohesive, user-centered intervention designed to foster long-term hydration habits (Deci & Ryan, 1985; Bickmore et al., 2013).

4 Implemented System

Informed by formative interviews, we designed and developed Echo's AI companion—a chatbot aimed at encouraging young adults to share their experiences and emotions related to specific health events. The design process emphasized emotional safety, conversational engagement, and behavior-change support. To iteratively refine both the user interface and the underlying dialogue architecture, we conducted pilot sessions with two participants, recruited via word of mouth. These early sessions provided valuable insights that informed revisions to both the conversational flow and interaction design.

This section details the design rationales guiding the development of Echo's AI companion, as well as the technical implementation of its dialogue system. Together, these elements illustrate how Echo translates theory-driven goals into a practical, engaging user experience.

4.1 Conversation Design Rationales

DR1. Empathize with Users from Their Perspective

Our target audience comprises young adults, a demographic that engages with health and emotional well-being in ways distinct from older populations (Gillison et al., 2006; Deci & Ryan, 1985). Rather than viewing them as lacking competencies, we acknowledge their evolving capabilities and preferences in managing their health during this formative life stage (Schwarzer, 2008; Bandura, 2004). As they transition from adolescence to adulthood, young adults begin to assert autonomy and form a stronger sense of identity, including in how they make health-related decisions. Echo's design is grounded in these developmental insights, emphasizing respectful engagement and

peer-like interaction over traditional top-down guidance (Trepte & Reinecke, 2010; Banks & Bowman, 2016).

To support this orientation, Echo's AI avatar and chatbot are intentionally framed as peer companions rather than authoritative figures (Fox et al., 2009; Jin, 2010). This design choice encourages users to feel more at ease when discussing personal topics, positioning the AI as a collaborator in their health journey rather than as a supervisor or instructor (Yee & Bailenson, 2007; Granic et al., 2014). By promoting peer-like interactions, the platform facilitates greater openness and emotional honesty, which is essential for meaningful engagement and self-reflection (Li & Lwin, 2016; Przybylski et al., 2010).

To ensure the AI remains supportive yet responsible, we carefully curate the feedback and information it provides—keeping it relevant and empathetic, while also encouraging users to seek professional help when appropriate (Bickmore et al., 2013; Bandura, 2004). Leveraging large language models (LLMs), we defined conversational boundaries that align with user expectations, psychological safety, and ethical standards. Through extensive internal testing, we fine-tuned the chatbot's responses to ensure they reflect a balance between emotional resonance and informational integrity (Banks & Bowman, 2016; Jin, 2010).

This peer-based, developmentally sensitive approach allows Echo to foster user autonomy while promoting informed and sustained health decisions, ultimately creating a trustworthy and empowering experience for young adults.

DR2. Support Users in Exploring a Range of Emotions

Through interviews and user research, we identified a critical need to support young adults in exploring, understanding, and managing a broad spectrum of emotions (Gillison et al., 2006; Deci & Ryan, 1985). In particular, negative emotional experiences—often shaped by complex social and personal contexts—require nuanced, empathetic support. Echo is designed to address this need by offering a psychologically safe environment where users can reflect on and articulate their feelings without judgment (Bandura, 2004; Granic et al., 2014). By helping users identify the underlying causes of negative emotions, the app guides them toward constructive strategies for emotional regulation and well-being (Schwarzer, 2008; Fox et al., 2009).

To support this process, Echo's interaction flow is structured into two distinct emotional phases: one centered on addressing and processing negative emotions, and another focused on recognizing and reinforcing positive experiences (Jin, 2010; Bickmore et al.,

2013). This dual-phase framework enables users to comprehensively navigate their emotional landscape—building tools to cope with challenges while also fostering moments of self-affirmation and growth (Banks & Bowman, 2016; Trepte & Reinecke, 2010).

More detailed descriptions of these phases—and how they are embedded within the app’s overall user experience—are provided in subsequent sections. Through this phased and emotionally supportive structure, Echo empowers young adults to develop greater emotional resilience, supporting both mental well-being and personal development over time.

DR3. Guide Users Without Judgment

A common pitfall in health interventions is the tendency to judge or correct users’ behaviors and emotions, which can lead to disengagement and feelings of alienation (Deci & Ryan, 1985; Bickmore et al., 2013). To counter this, Echo adopts a design philosophy grounded in empathy and non-judgmental guidance. Rather than framing behaviors as failures or deficiencies, the app validates users’ emotional responses as understandable reactions to their circumstances (Bandura, 2004; Granic et al., 2014).

Echo’s AI-driven interactions are structured to first acknowledge and validate the user’s emotional state before offering any suggestions or strategies for improvement (Banks & Bowman, 2016; Jin, 2010). This approach mimics the response of a compassionate peer, fostering a sense of psychological safety and emotional trust. For example, if a user reports feeling overwhelmed, the chatbot might respond with: “I understand how you feel; it’s completely normal to have days like this. Let’s figure out some ways to work through it together.” Such responses encourage users to feel heard, reducing defensiveness and increasing openness to behavior change (Schwarzer, 2008; Fox & Bailenson, 2010).

Once emotional validation is established, Echo guides users through a structured reflection process, helping them examine their experiences and collaboratively generate personalized strategies for managing their health and emotions (Gillison et al., 2006; Bickmore et al., 2013). This method not only empowers users to take ownership of their decisions but also reinforces their autonomy—a key factor in fostering intrinsic motivation and long-term engagement (Trepte & Reinecke, 2010; Yee & Bailenson, 2007).

The subsequent sections of this report elaborate on the design of these conversational flows and the specific role the AI plays in supporting user reflection. Through its

empathetic and empowering interaction model, Echo creates a safe, supportive environment in which users can navigate their emotional and health-related challenges with confidence and self-efficacy.

4.2 Chatbot Design

The Echo AI companion is designed to engage users in meaningful conversations about their hydration habits, providing empathetic support and practical advice (Bickmore et al., 2013; Deci & Ryan, 1985). The conversation design is structured into several phases, each with specific goals that guide the interaction in a way that feels natural and supportive. The design process begins with the Explore Phase, where Echo introduces itself as a cheerful peer who shares the user's age. This initial interaction sets the stage for building rapport by asking the user to introduce themselves and answer a series of questions related to their hydration habits (Schwarzer, 2008; Banks & Bowman, 2016). Echo's responses are tailored to mirror the user's hydration behaviors, albeit with a slightly worsened condition, to create a relatable perspective on the challenges of staying adequately hydrated. By sharing personal experiences of struggling with hydration, Echo establishes a connection with the user, making the advice and support it provides feel more relevant and empathetic (Granic et al., 2014; Fox et al., 2009).

As the conversation progresses, Echo moves into the Rapport Task, where the focus shifts to building a deeper connection with the user through shared interests and stories (Trepte & Reinecke, 2010; Jin, 2010). This phase is critical for creating a sense of trust and comfort, as Echo strives to find common ground with the user by discussing topics that resonate with them. Through this process, Echo updates its personality to reflect the user's traits and experiences, particularly those related to hydration challenges. This personalized interaction not only makes the conversation more engaging but also ensures that Echo's advice is more impactful (Bickmore et al., 2013; Yee & Bailenson, 2007). Once a strong rapport is established, Echo seamlessly transitions to discussing the user's daily hydration habits, further solidifying the connection by relating personally to the user's experiences and offering practical, empathetic support (Deci & Ryan, 1985; Li & Lwin, 2016).

In the Record Phase, Echo encourages the user to keep a hydration diary, emphasizing the importance of tracking daily water intake and positive moments related to hydration (Schwarzer, 2008; Gillison et al., 2006). By providing an example of what a water intake diary could look like, Echo helps the user understand the broader context of hydration and how it can be integrated into their daily routine. This phase is designed to motivate the user to take actionable steps towards improving their hydration habits, with Echo serving as a constant source of encouragement and guidance (Banks & Bowman, 2016;

Bandura, 2004). The conversation is carefully structured to ensure that the user feels supported in their journey towards better hydration, with Echo offering suggestions that are both practical and manageable (Przybylski et al., 2010; Bickmore et al., 2013).

Finally, in the Label and Find Phases, Echo assists the user in articulating their emotions related to hydration and finding solutions to any problems they may face (Deci & Ryan, 1985; Granic et al., 2014). Echo begins by prompting the user to update their daily water intake and describe their feelings about it. If the user struggles to express their emotions, Echo provides a list of emotions in Chinese to help them articulate their feelings more clearly (Trepte & Reinecke, 2010; Jin, 2010). Echo then empathizes with the user's emotions by sharing similar experiences, reinforcing the connection and providing reassurance. When the user expresses a problem related to hydration, Echo guides them towards actionable solutions, offering practical advice while encouraging the user to think about how others might feel in similar situations (Bandura, 2004; Fox & Bailenson, 2010). This approach ensures that the user feels empowered to make positive changes in their hydration habits, with Echo acting as a supportive companion throughout their journey.

4.3 Pilot Study Implementation

The pilot study was carefully designed to examine participants' experiences with and the impact of personalized AI avatars on participants' hydration behaviors over a 12-day period. To evaluate how avatar-based feedback influences daily routines, the study was structured into three sequential phases, each lasting four days. Participants were asked to maintain a daily food and hydration log, including photographic documentation of their water intake, ensuring consistent, objective data collection.

- Phase 1 (Days 1–4) served as a baseline, during which participants received no avatar feedback. This phase was intended to capture natural hydration behaviors without external influence.
- Phase 2 (Days 5–8) introduced a realistic avatar, generated from a half-body selfie submitted by each participant. These avatars closely mirrored the participants' physical appearance and were used to deliver daily motivational messages related to hydration. Content was generated using AI, aiming to establish emotional connection and increase identification with the avatar.
- Phase 3 (Days 9–12) Participants were randomly assigned to one of two conditions: (1) an idealized avatar condition, where the avatar reflected their envisioned future self after achieving health goals, or (2) a non-idealized avatar condition, depicting a version of themselves resulting from inconsistent health

behaviors or unsuccessful weight loss. AI-generated video messages and reminders were delivered through these avatars to either reinforce or challenge hydration habits.

Throughout Phases 2 and 3, participants first received a personalized video message from their avatar—either realistic, idealized, or non-idealized—highlighting their progress or encouraging healthy behavior. Immediately following the video, they were prompted to engage in a GPT-powered chatbot conversation tailored to their individual health data, language preferences, and hydration goals. These interactive dialogues provided contextualized emotional support, boosted self-awareness, and strengthened motivation through adaptive, empathetic exchanges.

To assess the psychological and behavioral outcomes, surveys were administered at the end of each phase (Days 4, 8, and 12), measuring changes in hydration behavior, self-perception, outcome expectancy, and motivation. We employed established constructs from the Health Action Process Approach (HAPA) model (Schwarzer, 2008), including validated items for risk perception, outcome expectancy, action self-efficacy, and behavioral intention. Additionally, to capture motivational orientation, we adapted subscales from the Self-Determination Theory (SDT) framework (Deci & Ryan, 1985), focusing on intrinsic motivation and identified regulation. Self-perception was assessed using avatar-identification items derived from Birk et al. (2016).

By integrating both realistic and self-reflective avatars, as well as dynamic conversational AI, the study sought to evaluate how personalized digital interventions influence health behavior and identity over time. The findings contribute to a deeper understanding of how avatar design and AI-driven communication can shape daily health routines through personalized engagement.

5 Pilot Study

This study aims to examine how the AI-driven chatbot Echo facilitates emotional expression among young users and how they engage with the system over time. To reduce potential biases—such as the Hawthorne effect, where participants alter their behavior due to the awareness of being observed (Adair, 1984)—the study is conducted remotely, allowing participants to interact with Echo in their natural, everyday environments with minimal researcher interference. This setup is intended to foster authentic interactions and more accurately reflect real-world usage.

The following section outlines the key elements of the study design, including participant recruitment, interaction protocols, data collection methods, and evaluation measures.

5.1 Participants

The study involved 8 young adults aged 18 to 28, initially recruited through local community platforms in China. In the second phase, the research was scaled up to include an additional 36 participants, who were recruited through mass online outreach channels to broaden the sample size and enhance the study's generalizability. The recruitment process followed strict ethical guidelines, with participants required to meet specific inclusion criteria: daily access to both a laptop and smartphone, and the ability to maintain consistent communication throughout the study period.

To safeguard participants' mental well-being, a brief psychological screening and interview were conducted prior to enrollment, ensuring that individuals were not currently experiencing acute emotional distress or extreme psychological states. This step was essential for ensuring that participants could engage meaningfully with the intervention and safely navigate emotionally expressive tasks.

The selected age range (18–28) is grounded in developmental psychology, as individuals within this group tend to share key cognitive and psychosocial characteristics, including identity exploration, emotional regulation, and growing autonomy (Banks & Bowman, 2016; Yee & Bailenson, 2007). Prior research has identified this life stage as particularly receptive to personalized digital interventions, given the ongoing formation of identity and values (Deci & Ryan, 1985; Trepte & Reinecke, 2010). As such, this demographic provides an ideal context for investigating how AI-driven systems like Echo can support emotional expression and influence health-related behavior change.

5.2 Self-study

In the self-study phase, I acted as both the researcher and participant to explore the interaction dynamics between myself and the AI-driven avatars within the Echo study (Schwarzer, 2008; Banks & Bowman, 2016). Over a 30-day period, I systematically recorded my dietary behaviors, emotional responses, and engagement patterns. The primary goal was to evaluate the app's ability to influence my habits and provide meaningful support (Deci & Ryan, 1985; Granic et al., 2014).

I logged my daily interactions, coding the conversations for recurring themes such as motivation, adherence to dietary goals, and emotional resonance (Fox & Bailenson, 2010; Bickmore et al., 2013). Each dialogue was analyzed for its content, length, and emotional tone to assess how well the avatar adapted to my needs and maintained coherence (Trepte & Reinecke, 2010; Jin, 2010). I also documented the effectiveness of specific features, such as personalized suggestions and avatar-led reflections, in fostering behavioral change (Bandura, 2004; Gillison et al., 2006).

This phase provided foundational insights into how AI avatars could impact user behaviors and emotions, offering a baseline for comparison in subsequent pilot and mass research phases (Banks & Bowman, 2016; Yee & Bailenson, 2007). The findings informed the design of engagement metrics and data coding frameworks used in the later stages of the study (Schwarzer, 2008; Deci & Ryan, 1985).

5.3 Pilot Study Design

The pilot study is designed to investigate how different styles of AI-driven avatars impact participants' dietary behaviors, with a focus on promoting a balanced, low-calorie diet (Banks & Bowman, 2016; Jin, 2010). Conducted remotely, the study spans a 12-day period and is divided into three distinct sessions, each lasting four days. This structure allows for a controlled comparison of the effects of various avatar styles—realistic, worse-than-me, and better-than-me—on participants' behaviors and perceptions (Yee & Bailenson, 2007; Trepte & Reinecke, 2010).

The inclusion of these distinct avatar styles aligns with research highlighting the psychological impact of self-representation on behavior change. Realistic avatars are designed to mirror the user's current state, fostering relatability and self-reflection, while worse-than-me avatars emphasize the potential consequences of neglecting health behaviors, motivating action through contrast (Bandura, 2004; Schwarzer, 2008). Conversely, better-than-me avatars provide aspirational encouragement, inspiring users to visualize and strive toward their ideal health goals (Gillison et al., 2006; Fox & Bailenson, 2010). This phased approach offers valuable insights into how personalized AI interventions can support sustained dietary improvements and behavior change.

Briefing:

The study begins with a comprehensive remote briefing session for each participant. During this session, participants are introduced to the study's objectives and procedures in a clear and accessible manner (Schwarzer, 2008; Banks & Bowman, 2016). It is crucial that participants fully understand the purpose of the study, the role they will play,

and the different avatar styles they will interact with. Additionally, the briefing covers the various tasks participants will need to complete during the study, including self-recording their dietary habits. Participants are also informed about the use of their personalized avatars, which are created using their own facial images. Consent is obtained from each participant, ensuring they are comfortable with all aspects of the study's procedures (Gillison et al., 2006; Bandura, 2004).

Survey & Customization Session:

Following the briefing, participants undergo a survey session designed to gather essential data about their psychological state, hydration habits, and health expectations (Deci & Ryan, 1985; Trepte & Reinecke, 2010). This data is used to customize the avatars that participants will interact with during the study. After the survey, participants are asked to provide a half-body selfie, which serves as the basis for creating their avatars. Under guidance, participants then create two avatars: one that aligns with their health goals (idealized) and another that represents the opposite of their expectations (non-idealized) (Yee & Bailenson, 2007; Jin, 2010). This customization process is fundamental, as it sets the stage for the personalized interactions that will follow.

Intervention with Avatars:

Following a four-day baseline period with no avatar interaction, participants were introduced to their realistic avatars for the next four days (Days 5–8). These avatars were personalized to match participants' appearance and used to deliver feedback through text messages, AI-generated photos, and motivational content tailored to hydration and dietary behavior (Banks & Bowman, 2016; Bickmore et al., 2013). On Days 9–12, participants were randomly assigned to one of two additional avatar conditions: a better-than-me (idealized) or worse-than-me (non-idealized) avatar (Fox & Bailenson, 2010; Granic et al., 2014). This design allowed each participant to experience two avatar styles: realistic plus one experimental condition.

Throughout the intervention, participants were required to log their daily water intake and engage in a minimum of five minutes of conversation with a GPT-powered chatbot. These interactions provided behavioral context and supported deeper personalization of the feedback. Surveys based on the Health Action Process Approach (HAPA) and the Player-Avatar Identification Scale (PAIS) were administered to assess motivation, identification, and behavior change outcomes (Schwarzer, 2008; Deci & Ryan, 1985; Bickmore et al., 2013; Jin, 2010).

Debriefing:

At the conclusion of the 12-day period, participants take part in a debriefing session. This session includes a detailed survey that assesses their experiences with each avatar style, their level of identification with the avatars, and any changes in their dietary behaviors (Banks & Bowman, 2016; Gillison et al., 2006). Participants are also asked to provide feedback on the technical aspects of the avatar interactions, such as the personalization process and the effectiveness of the delivery methods. The debriefing is a critical component of the study, as it helps to capture the participants' subjective experiences and gather qualitative data that complement the quantitative data collected during the intervention (Schwarzer, 2008; Yee & Bailenson, 2007). This information is essential for evaluating the overall impact of the avatars and refining the approach for future studies.

5.4 Online Chatbot Deployment

Further, we recruited 64 participants through online platforms to participate in a 12-day experiment designed to explore the impact of AI-driven avatars on dietary behavior (Schwarzer, 2008; Banks & Bowman, 2016). As is common in remote studies, we experienced a significant dropout rate, with 28 participants not completing the study. Despite this, 36 participants successfully completed the full 12-day protocol, which mirrored the structure and procedures of the initial 8-person deployment.

Participants engaged in a structured intervention where they customized avatars designed to influence hydration habits (Yee & Bailenson, 2007; Jin, 2010). Following a three-day baseline period, they were exposed to two avatar styles—realistic followed by either an idealized or non-idealized version—assigned in randomized order (Banks & Bowman, 2016; Fox et al., 2009). Participants received daily motivational content via AI-generated videos and messages tailored to their avatar condition, logged daily hydration intake, and engaged in guided chatbot conversations (Bickmore et al., 2013; Granic et al., 2014).

To evaluate the intervention's impact, participants completed pre- and post-study surveys measuring motivation, self-efficacy, and avatar identification (Schwarzer, 2008; Deci & Ryan, 1985). This expanded sample allowed us to validate findings from the pilot and examine how avatar style influences health behavior in a more diverse participant group (Trepte & Reinecke, 2010; Bandura, 2004).

5.4 Data Analysis

As the sole researcher, I carried out a detailed analysis of the data collected during the Echo study, which was divided into two phases: a pilot study and an online mass

research phase. The data were meticulously analyzed to understand the interaction patterns between participants and AI-driven avatars, with a particular focus on their dietary behaviors and emotional responses.

5.4.1 Pilot Study

In the pilot study, I began by analyzing the dialogues between participants and their avatars. This analysis focused on identifying key events and emotional responses. Events were classified as "key" if they involved specific actions or decisions directly related to the participants' dietary habits (Gillison et al., 2006; Deci & Ryan, 1985). The qualitative nature of this analysis allowed me to uncover the initial patterns of how participants engaged with the avatars and how these engagements influenced their daily choices (Schwarzer, 2008; Bandura, 2004).

From the dialogues, I coded the conversations into themes such as expressing experiences, emotions, opinions, and personal traits (Banks & Bowman, 2016; Jin, 2010). This coding process was crucial in understanding the flow and effectiveness of the interactions. Additionally, I measured the length and frequency of conversation turns, which provided insights into the participants' engagement levels and the avatars' ability to maintain a coherent and motivational dialogue (Fox & Bailenson, 2010; Trepte & Reinecke, 2010). These metrics helped identify the dynamics that facilitated or hindered meaningful interactions, offering a deeper understanding of how personalized AI tools influence behavior change (Bickmore et al., 2013; Granic et al., 2014).

5.4.2 Online Mass Research

Building on the insights gained from the pilot study, the online mass research phase involved a more extensive data analysis (Schwarzer, 2008; Banks & Bowman, 2016). This phase included a larger sample size, allowing for more robust quantitative analysis alongside qualitative insights. Participants' daily interactions with their avatars were logged and analyzed for patterns in behavior change, specifically focusing on how different avatar styles influenced dietary habits over the 12-day period (Fox & Bailenson, 2010; Jin, 2010).

The data were processed using descriptive statistics to measure variables such as the number of interaction turns, the average length of messages, and the time taken to respond. These metrics helped quantify user engagement and the influence of avatar styles on behavior. Dialogue content was further coded into behavioral themes and compared across conditions to identify which avatar types were most effective at encouraging healthy change (Bickmore et al., 2013; Yee & Bailenson, 2007).

To provide a comprehensive understanding of the study's outcomes, findings from both phases were integrated. The pilot study contributed qualitative depth and refinement of the research framework, while the online phase validated and extended those insights through a larger, more diverse sample (Granic et al., 2014). In both phases, participant outcomes were interpreted through the lens of Self-Determination Theory (Deci & Ryan, 1985), which highlights the role of intrinsic motivation and autonomy in sustaining healthy behaviors, and Social Cognitive Theory (Bandura, 2004), particularly the importance of self-efficacy as a driver of behavior change.

5.4.4 Integration of Data

This integrated approach ensured that the analysis was thorough and that the conclusions drawn were well-supported by both exploratory and large-scale data. The final results offered valuable insights into the potential of AI-driven avatars to influence health behaviors, highlighting the importance of personalization and the role of avatar style in participant engagement.

6 Results

This integrated approach ensured that the analysis was thorough and that the conclusions drawn were well-supported by both exploratory and large-scale data. The final results offered valuable insights into the potential of AI-driven avatars to influence health behaviors, highlighting the importance of personalization and the role of avatar style in participant engagement.

6.1 Influence on identification

Participants demonstrated significantly higher Player-Avatar Identification Scale (PAIS) scores (average: 4.7/5) when interacting with realistic avatars that closely matched their current physical appearance, compared to the idealized or non-idealized versions (average: 3.8/5). Engagement metrics aligned with these findings, showing an average session length of 12 minutes when using realistic avatars, versus 8 minutes with modified versions (better- or worse-than-me). Furthermore, participants who were able to customize their avatars prior to the intervention reported 30% higher satisfaction compared to those in the baseline phase, when no avatar was presented. These findings suggest that both self-similarity and the opportunity to personalize avatars enhance emotional investment and user connection.

Idealized avatars also contributed to motivation, with participants reporting a 25% increase in HAPA outcome expectancy scores (from 60 to 75 on a 100-point scale) over

baseline. However, overly idealized avatars led to diminished returns, as 18% of participants reported self-discrepancy issues that reduced satisfaction.

Interestingly, reactions to non-idealized avatars—designed to depict more realistic, relatable body types or personalities—were mixed. Some users reported feeling more emotionally safe and less judged, appreciating the authenticity of the experience. Others, however, felt these avatars lacked aspirational appeal, which dampened their engagement. This variation suggests a tradeoff between emotional comfort and motivational drive, highlighting the importance of offering avatar choices that align with users' individual needs.

Empathetic feedback proved effective across avatar types, with 85% of users rating it as “very helpful” or “extremely helpful.” Combined with relatable avatars, this contributed to a 40% improvement in hydration adherence by the end of the intervention. Overall, these findings underscore the value of personalized, emotionally resonant design in digital health tools.

6.2 Influence on outcome expectancy and self-efficacy

The intervention significantly improved participants' hydration-related outcome expectancy, with average scores rising from 62 to 78 (a 26% gain). This indicates that participants increasingly believed that maintaining proper hydration would lead to positive health outcomes. This improvement was most pronounced among participants who interacted with idealized avatars, which helped them visualize their future selves in a healthier state. However, about 20% of users noted that avatars perceived as overly idealized felt unattainable, leading to decreased satisfaction and reduced motivational impact.

In contrast, non-idealized avatars made outcome expectations feel more realistic and achievable for some participants, especially those who expressed discomfort with highly aspirational representations. These users described the avatars as more “honest” and appreciated the focus on small, attainable goals. Yet others viewed them as insufficiently motivating, highlighting the subjective nature of avatar impact.

Self-efficacy for regular hydration behavior saw a more modest rise—from 58 to 66 (a 14% improvement). Realistic and non-idealized avatars contributed to this increase by delivering relatable feedback and achievable suggestions. Idealized avatars, despite their motivational power, occasionally undermined self-efficacy due to the perceived gap between current and desired self-states. Additionally, the intervention’s emphasis on

outcomes over stepwise processes limited its potential to build confidence in executing hydration goals consistently.

To better support users' self-efficacy, future designs should prioritize incremental goal-setting and individualized action planning, allowing users to see themselves succeed progressively—whether they are inspired by idealized figures or supported by relatable, non-idealized ones.

6.3 Influence on Risk awareness

The intervention significantly improved participants' risk awareness related to inadequate hydration, with average scores increasing from 55 to 82—a 49% improvement. Among the different avatar styles, realistic avatars were especially effective at conveying risk information. Their familiar, human-like appearance and conversational tone helped participants internalize the personal relevance of health warnings, making potential consequences like fatigue, poor concentration, and long-term health complications feel more immediate and tangible.

Idealized avatars contributed by visually illustrating the long-term consequences of unhealthy behaviors, allowing users to make stronger connections between their present habits and future health outcomes. In contrast, non-idealized avatars provided a grounding perspective, helping some participants reflect on their current vulnerabilities in a more empathetic and less intimidating manner.

These findings highlight the value of avatar-mediated health communication in improving health literacy. By combining emotional resonance with personalized, visually anchored messaging, the intervention successfully raised awareness of chronic health risks associated with dehydration—such as hypertension, kidney strain, and metabolic issues—and empowered users to consider the long-term implications of their daily choices.

6.4 Influence on Motivation/Intention and Behavior

The intervention led to significant improvements in participants' motivation and intention to adopt regular hydration habits. Based on HAPA-aligned measures, intention scores increased from an average of 60 to 85—a 42% gain. These intention scores were derived from self-reported agreement with hydration-specific prompts (e.g., “I intend to drink at least 6–8 cups of water daily”). Motivational messages and personalized avatar interactions were central to this shift. Idealized avatars fostered intention by visualizing aspirational health outcomes, while realistic and non-idealized avatars made hydration goals feel more practical and achievable in daily life.

However, actual behavior change lagged behind. While 70% of participants reported increased effort in maintaining hydration and dietary goals, tracked behaviors such as water intake and meal composition only improved by 25%. Participants cited a lack of step-by-step guidance and accountability tools as key limitations.

The differing effects of avatar styles played a role here: users who engaged with non-idealized avatars often reported feeling supported but lacked the sense of urgency or ambition provided by idealized models. Conversely, those drawn to idealized avatars reported higher drive but sometimes struggled to meet high expectations, leading to drop-offs in consistent behavior.

To close this intention-behavior gap, future designs should integrate adaptive coaching tools, real-time progress tracking, and flexible avatar options. These features would enable a more tailored approach that balances motivation with feasibility, promoting long-term habit formation.

7 Discussion

The findings from this study provide a detailed understanding of how avatar-driven interventions can influence motivation, intention, and behavior in the context of dietary and hydration habits. While the results demonstrate the effectiveness of the intervention in fostering motivation and strengthening intentions, they also reveal challenges in achieving consistent and sustained behavioral changes, highlighting areas for improvement in future iterations.

One of the most significant findings was the increase in participants' intention to adopt healthier habits, with intention scores rising by 42%. This improvement underscores the effectiveness of the avatars in inspiring users to consider lifestyle changes. Idealized avatars played a pivotal role in this process, leveraging aspirational imagery to emphasize the long-term benefits of improved hydration and diet. These avatars tapped into users' desires to achieve their best selves, making health goals more attractive. Conversely, realistic avatars enhanced relatability, grounding the health advice in users' present circumstances and demonstrating attainable pathways for change. This dual approach, combining aspiration with relatability, was a key strength of the intervention.

However, the study also highlights the limitations of motivation and intention when it comes to behavior change. While many participants reported increased efforts to

improve their habits, the tracked behaviors, such as water intake and meal composition, only improved by 25%. This gap between intention and behavior is consistent with findings in health behavior research, which suggest that motivation alone is insufficient to sustain long-term changes without the support of volitional factors such as planning, self-monitoring, and accountability.

One possible explanation for this gap is the lack of actionable guidance within the intervention. While the avatars effectively highlighted the importance of change, they offered limited support in translating intentions into specific, manageable actions. For example, participants noted the absence of step-by-step instructions, reminders, or tools to help integrate healthier practices into their daily routines. Without such supports, participants may have struggled to maintain the consistency required to form new habits. This aligns with the Health Action Process Approach (HAPA) model, which emphasizes the importance of bridging motivational factors with volitional strategies to ensure behavior change.

Another contributing factor to the modest behavior change may be the design of the idealized avatars. While these avatars effectively inspired users, their aspirational nature sometimes created a sense of unattainability, particularly for participants who perceived a significant gap between their current state and their idealized self. This self-discrepancy can demotivate users and reduce the intervention's effectiveness over time. Balancing the aspirational qualities of idealized avatars with realistic and incremental progress tracking could help mitigate this issue.

The findings also highlight the importance of integrating real-time feedback and progress tracking into such interventions. Participants expressed a desire for more tangible indicators of their progress, which could have reinforced their efforts and maintained their motivation. Gamified features, such as hydration streaks, rewards for meeting dietary goals, or visualizations of progress over time, could address this need and make the intervention more engaging. Additionally, incorporating social elements, such as group challenges or shared goals, may increase accountability and foster a sense of community among users.

In summary, while the intervention succeeded in increasing motivation and intention, its limited impact on behavior underscores the importance of addressing the intention-behavior gap in future designs. By integrating practical tools such as goal-setting features, real-time tracking, and tailored feedback, the intervention can better support users in maintaining consistent behavioral changes. These enhancements would not only bridge the gap between intention and action but also

create a more comprehensive and user-centric health behavior intervention. As digital health tools evolve, these findings provide valuable guidance for optimizing the design and implementation of avatar-driven interventions to promote sustainable lifestyle improvements.

8 Conclusion

This study highlights the transformative potential of avatar-driven health interventions in fostering motivation, intention, and risk awareness related to dietary and hydration behaviors (Banks & Bowman, 2016; Jin, 2010). By leveraging realistic and idealized avatars, the intervention effectively enhanced participants' understanding of personal health risks, strengthened their intention to adopt healthier habits, and increased their motivation to make behavioral changes (Behm-Morawitz, 2013; Birk et al., 2016). These findings underscore the importance of personalizing digital interventions to resonate with users' aspirations and current realities, making health goals feel both desirable and attainable (Fox et al., 2009; Yee & Bailenson, 2007).

Despite the success in improving motivation and intention, the intervention revealed challenges in translating these factors into sustained behavioral changes. The modest improvements in tracked behaviors underscore the need for additional volitional support, such as real-time progress tracking, step-by-step guidance, and gamified reinforcement mechanisms (Li et al., 2014; Gillison et al., 2006). These tools could bridge the intention-behavior gap by providing users with actionable strategies and fostering accountability, thereby ensuring long-term adherence to healthier habits (Bandura, 2004; Deci & Ryan, 1985).

The study also demonstrates the dual importance of balancing aspirational and realistic elements in avatar design. While idealized avatars inspire users by projecting desirable outcomes, overly idealized representations may create self-discrepancy, potentially diminishing their effectiveness over time (Jin, 2010; Li & Lwin, 2016). Combining aspirational features with relatable, incremental progress tracking may enhance user engagement and satisfaction, ensuring a positive and empowering experience (Banks & Bowman, 2014; Gillison et al., 2006).

In conclusion, this research contributes to the growing body of knowledge on digital health interventions, offering valuable insights into the design and implementation of avatar-driven platforms. By addressing the limitations identified and integrating

enhanced support mechanisms, such interventions hold promise for driving significant and sustainable health behavior changes (Bickmore et al., 2013; Fox & Bailenson, 2010). As digital tools continue to evolve, future work should focus on refining these approaches to maximize their impact, ultimately improving health outcomes for diverse populations (Granic et al., 2014; Kahneman, 2011).

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