Meme, Myself and AR: Exploring Memes Sharing in Face-to-face Conversation using Augmented Reality

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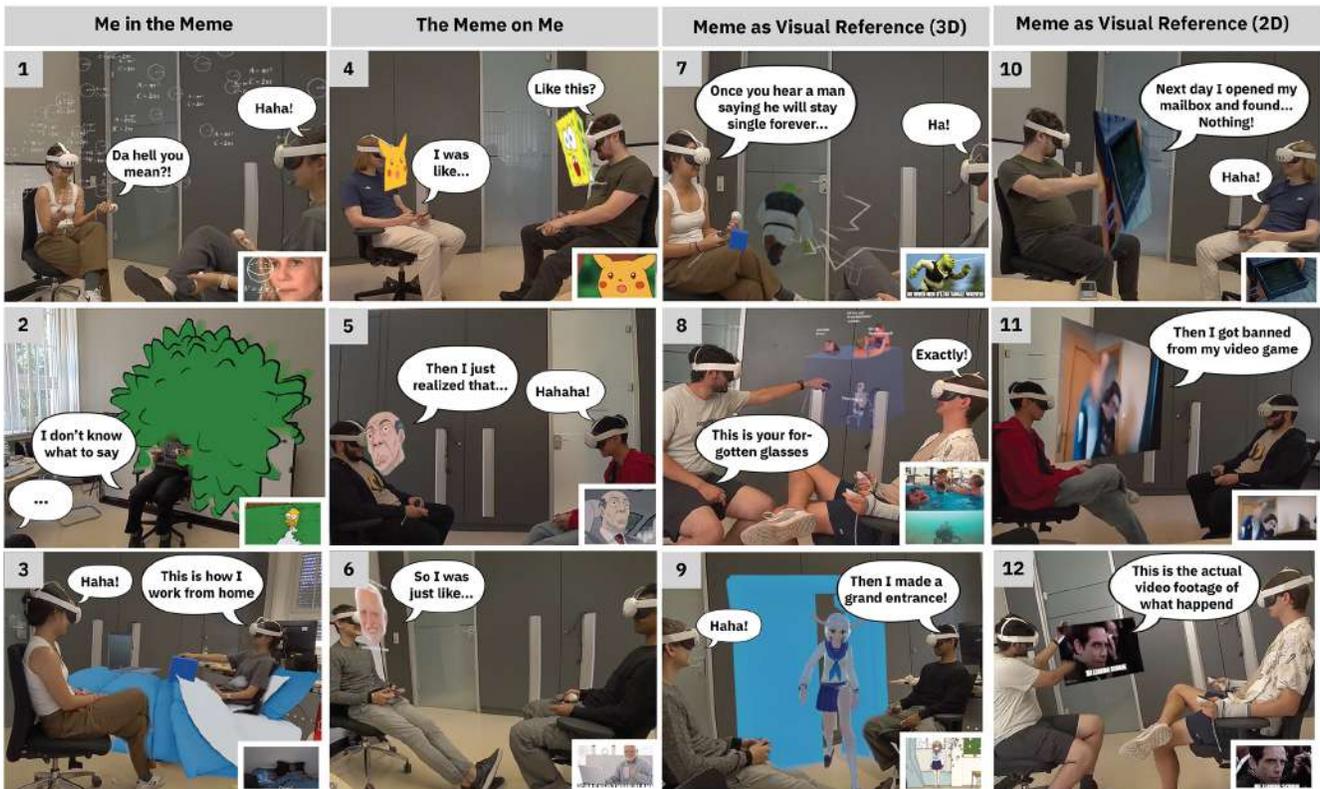jan.gugenheimer@tu-darmstadt.de

Figure 1: We found three archetypes of visualizing memes in face-to-face conversation using AR: Me in the Meme, where the user is placed inside the meme environment (1,2,3); The Meme on Me, where the meme character merges with the user's body (4,5,6); and Meme as Visual Reference, where the meme augments speech by appearing in physical space, either transformed into 3D (7,8,9 or in its original 2D form (10,11,12) or). The examples shown come from video recordings of 22 participants in our study, capturing their real conversations and meme usage behaviors. The bottom-right corner shows the original 2D meme before being transformed into AR.

Abstract

Internet memes are central to online communication, yet their visual humor is often lost in face-to-face (F2F) conversations. Augmented reality (AR) offers new ways to bring memes into F2F interactions, but it is unclear how memes can be integrated into F2F conversations using AR, and how they impact conversational dynamics. We surveyed meme users (N=29) to understand motivations and challenges in visualising memes in F2F conversations. With these insights, we developed an AR meme-sharing prototype and invited 12 pairs of friends to design AR visualizations for their memes and use them in conversations. Our analysis reveals two AR-unique visualizations: merging memes with one's body (The-Meme-On-Me) and situating oneself in meme environment (Me-In-The-Meme). We observed two integration patterns: using speech as setup before a meme punchline, and showing memes simultaneously with speech to amplify humor. We report users' reactions toward AR memes, showing how it enables playful social interaction.

CCS Concepts

• **Human-centered computing → Mixed / augmented reality**; *Collaborative interaction*; **User studies**.

Keywords

Internet Memes, Social Extended Reality, Augmented Reality

1 Introduction

Memes, such as GIFs and image macros, have become a new "dialect" among online communities. They contain rich visual and auditory information, cultural references, and intertextual wittiness, enabling humor and self-expression in digital communication [52, 61]. As more netizens create and share memes, they gradually seep into communication culture and *"pervade both online and offline communication"*[38]. Researchers have found that people start to reference memes in face-to-face (F2F) conversations. Some speak out the catchphrases of memetic videos (e.g., *"you are cooked"*[1])[18] , while others reenact the memes (e.g., mimicking the gesture of

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[1]https://www.youtube.com/shorts/1L4mw8juQy4

Boromir[2])[17]. However, using one's own expressions to reference memes without directly showing them still misses part of their expressive power, since *"good memes are visual art"* and live in being seen[36].

To visualize memes in F2F conversations, the concept of *"Augmented Conversation"* presents a fitting scenario: information is seamlessly accessed and displayed in real-world conversation using augmented reality (AR)[26]. Prior work on augmented conversation primarily uses AR to display referential information (e.g., images, maps, translations) that supports F2F conversations [8, 26, 43, 48]. However, memes differ fundamentally: unlike maps or translations, which serve as supplementary information to assist communication, memes are communicative acts in themselves, conveying stance, tone, and affect [22, 40]. Therefore, bringing memes into AR raises distinct questions about how they can be integrated into F2F conversations and impact communication dynacmis.

To explore **how memes can be integrated into F2F conversations using AR** and **how this influences communication dynamics**, we conducted two studies. First, we conducted an online survey with meme users (N=29) to generate F2F conversation scenarios in which memes can be referenced and visualised, and understand the users' general perception of AR Memes. By analyzing their responses, we found that participants already used Meme references during F2F conversations (20 out of 29), and elicited the requirement of integrating memes in a way to not break the conversational flow. When analyzing their preference of visualization and integration, we identified three AR meme visualisation archetypes. With these insights, we implemented a multi-user AR prototype enabling participants to share and visualise memes. We invited 11 pairs of friends (N=22) to bring their own memes, perform a think-aloud design session to visualize their memes in AR, and use them during a conversation in AR. Using thematic analysis on their memes, design decisions, and conversation behavior, we answer the following questions:

1. How memes are integrated into F2F conversations via AR? We identified three AR Meme Integration Archetypes, regarding how users combine memes, themselves and physical environments to create humor: **(1) Me-in-the-Meme**, which situates oneself in the meme environment, so as to to reenact or improvise. **(2) The-Meme-on-Me**, which merges meme characters with user so as to become meme characther to act same jokes, or let character to be "proxy" for funny acting **(3) Meme-as-Visual-Reference**, where the meme, in its 2D or 3D form, fused with reality to augment the user's talk. Its position and size can add new meaning.

2. How do people integrate and coordinate AR memes in F2F conversations using AR?

We observed two behavioral patterns of how participants orchestrate memes with their own speech: **(1) Sequential Usage**, where speech and meme appear one after the other. The meme

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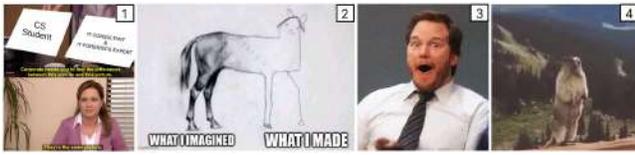[2]https://imgflip.com/memetemplate/One-Does-Not-Simply

Figure 2: Template memes like 1 and 2 contain multiple compositions such as multipanel pictures and personalized captions, making the meme self-contained in storytelling. Reaction memes like 3 and 4 express affective responses with facial expressions and sound.

replaces part of the speech and functions as either the setup or punchline for a joke. **(2) Parallel Usage**, where memes and speech appear simultaneously, with the meme amplifying or reinforcing the spoken statement.

3. How did people perceive AR memes in F2F conversations? From the online study responses, people expressed concerns about AR memes interrupting conversation flow but were still positive towards the concept. In the second lab study, participants used AR memes to converse, compared to a baseline of talking in AR without visualizing memes but verbally referencing them (as was reported by participants to be currently already done). The results of *Percieved Interaction Quality (PIQ)* questionnaire[50] did not show significant differences between the two conditions, suggesting that using AR memes did not impair the conversation in our experiment. Finally, participants reported that they would like to use AR Memes in future conversations (5.77 on a 7-point Likert scale) and saw themselves enjoying AR Memes in the future (5.86 on a 7-point Likert scale).

In this paper, we have three contributions:

(1) Presenting three Meme Integration Archetypes (Me in the Meme, The Meme on Me, and Memes as Visual References), regarding the commuicative methods with which users use AR memes to create humor.
(2) Insights of how people integrate AR Memes in F2F conversations (sequential and parallel) and how it impacts conversation dynamics.
(3) Reflections of what makes a good AR meme in F2F conversations

2 Related Work

Our related work is grounded in the research fields of general internet meme usage, augmented conversation using AR, and current memetic behavior in social XR.

2.1 Internet Memes into F2F Conversations

The term "Meme" originates from the concept of cultural genes, describing behaviors that replicate and mutate through cultural transmission[10, 19]. In the digital domain, a meme refers to viral visual media (e.g., GIF, Image Macro) that people copy and customize to share on the Internet [55, 62, 63]. These memes are often multimodal [16] and include diverse media elements such as images, animated sequences, captions, and audio [16, 36]. Content-wise,

they contain dialogue, embodied visual cues, and cultural references [17, 18, 22, 29]. All these elements collaborate to construct the meme's meaning [16, 61], enabling the succinct expression of complex emotions and humor [39].

As more people share and reference memes online, memes gradually start to become part of offline discourse [17] and impact F2F conversations [17, 18]. Davison et al. showed that the young generation is starting quote meme phrases (e.g., "Let him cook") in daily speech [18]. In addition, Dancygier et al. showed that when users referenced Boromir's gesture from the "One-Does-Not-Simply" meme, it also evoked similar body language in offline communication [17]. However, using one's own expressions to reference memes still limits expressive power. Memes' expressive power stems from their visual presence and the interplay of multiple components[16, 35, 36, 61]. Additionally, F2F communication, which is synchronous and rich with verbal and nonverbal cues, differs from current meme usage channels (e.g., Reddit, WhatsApp), which are mostly asynchronous and text-based[21, 45]. This raises the question of how memes can be visualized and intergrated into F2F conversations, and how it influences conversations.

2.2 F2F Conversation in Everyday Immersive AR

With the rise of AR headsets, Bowman [4] proposed the concept of Everyday AR, envisioning always-on immersive AR with lightweight glasses. Everyday AR contrasts current niche and professional AR applications (e.g., manufacturing), it aims for diverse and mundane scenarios (e.g., grocery planning)[59]. Among the EverdayAR scenario, F2F conversation is a widely explored one, where visual information can be seamlessly displayed in conversations (e.g., show a map when discussing a trip)[8, 26, 43, 49, 51, 57]. Motivated by this, prior research explored AR and AI techniques for information retrievel on-the-fly, such as quicker selection[26, 37, 47], intelligent information query[26, 43]and adaptive content positioning[7, 34, 49]. These provide a technical foundation for integrating memes in F2F conversations. However, current research mainly focuses on displaying instrumental information (e.g., maps, documents) that supplements conversation for efficiency[26, 43]. Such visual aids are external to communication without participating in conversations' meanings. Memes, in contrast, are "speech act" in themselves[16], containing narratives, embodied cues, stance and timing [17, 22, 39]. Sending memes are social actions (e.g., responding with "Confused-Math-Lady" meme to a question) rather than illustrating information[5]. Removing a meme, or presenting it at a different moment, can change or disrupt the conversation's meaning. Built on the vision of EverydayAR, we explore how visualising memes in F2F conversations could create new social interactions, being a novel EverydayAR scenario. This differs from current technique-focused research, which primarily aims to enhance efficiency through visual aids.

2.3 Visualizing Social Cues in XR

Prior work in SocialXR explored visualizing social cues to support social engagement, mainly through two approaches: adding (1) gamified experiences or (2) emotional cues. Gamification includes multi-user XR games (e.g., hide-and-seek in AR) that encourage

colocated users to interact through gameplay[15, 41]. However, this approach redirects users' attention to game interaction rather than conversation itself. Another line of work visualizes emotional cues in conversations, such as visual effects [33], emojis [6, 33, 54], facial filters [12, 32], heartbeats [31], or comic cues [9, 42]. These cues express simple affective states (e.g., anger) with fixed meanings, for instance, one emoji maps to a single emotion. In contrast, memes are multimodal and can be remixed to produce diverse meanings, as Internet users often do (e.g., subtly different captions change memes' meaning from praising to satirical) [27]. Additionally, unlike current SocialXR cues (e.g., emoji) which mainly convey emotion, memes express more meanings (e.g., political satire)[53]. We assume that in F2F conversations with richer contexts (e.g., timing, users' action) and AR's ability to blend memes with the real world, memes may influence conversations in ways that differ from purely emotional cues.

Currently, little research focuses on exploring memes in SocialXR. There are a few meme usage instances in VRChat. For example, users embody the Ugandan Knuckles's avatar[3] and play its iconic sounds [3, 58]. But prior research suggests that current meme use in social VR is motivated by attention-seeking [20, 58] in anonymous VR spaces, rather than using memes's meaning to mediate dialogues. Our work aims to explore how memes, with their multimodal properties and rich narratives, can be integrated into conversations using AR, and influence F2F interactions.

3 Study 1: Online Survey with Memes Users

We aim to **understand the motivation and challenges to visualize memes when referencing them in F2F conversations.** We adopted a scenario construction task, letting participants to create speculated situations to probe potential motivations and concerns around emerging technologies[11, 60]. All our studies were conducted in compliance with our institution's ethics guidelines and regulations.

3.1 Study Design

The study included four parts.

Part 1: General Question. We started with basic information of meme usages including frequency and motivation. We asked them whether they have referenced to memes in F2F communication, and if so, how and why.

Part 2: Introducing AR Memes Concept. We introduced the concept of AR and included a short quiz on its definition to ensure participants understood the technology. To make people have a mental image of visualised memes in AR, we offered three exemplar visualisations: (1) change my face/body as meme character (2) change my surrounding as meme environment (3) 3D memes.

Part 3: Selecting Meme and Generating Meme-Referencing Scenario. We asked participants to select nine memes (three static images, three GIFs, and three videos), respectively from *ImgFlip*[4], *ImgFlipGif*[5], and *Vlipsy*[6]. Participants were asked to choose memes

Figure 3: Responses of Scene Generation Task. Two instances from P1 and P4

they know and like, rather than being assigned specific ones, since meme use is strongly tied to personal familiarity and affection.

(1) Scenario Generation. For each meme, the participant created a F2F conversation scenario in which this meme can be referenced, regarding where, when, and how they want to use the memes.

(2) Communication Method Selection. For each scenario, participant should select how the meme should be referenced either through their own expression or meme visualization. Four options are offered: *(a) Visualize memes in AR, (b) Show memes on my phone, (c) Use word, voice and tone, (d) Use facial expression and posture.* If AR was chosen, participants should specify a preferred visualization method: *(a)face/body swapping, (b) environment changing, (c) 3D memes or (d) proposed your own.* We provided three exemplar visualizations to guide ideation, a method from [24], which helps elicit more thoughtful ideas than complete openness [56]. This is necessary because participants lacked mental model of AR memes. We also included an "Other" option for open dieas. The examples were grounded in AR visualization strategies regarding how content is anchored: on corpus (option a), on environment (option b), or independent (option c)[30]. This is a fundamental and open framework for participants to imagine how AR memes could look during ideation.

(3) Clarify Reasoning. Participants needed explain the reasoning behind their chosen communication methods.

Examples of response are presented in Fig. 3.

Part 4: Wrap-up questions. We created open-ended questions to understand participants' genereal perceptions towards AR memes. Then it ends with demographic questions including age and gender.

3.2 Participants

We recruited participants through *Prolific* with three screening criteria: prior experience sharing memes online, prior experience using XR glasses, and English as primary language. We collected 65 responses in total, with 29 remain valid (F=9, M=20; age: M=30.52, SD=5.72), filtered by response completeness and logical coherence (e.g., select AR visualization then argue why verbal expression is better). Each participant was compensated with 5 currency.

3.3 Data Analysis

We conducted a thematic analysis of data from the *scenario genera-tion task* (as shown in Fig.3), in total 260 instances. Prior to coding, the first author did a trial coding and drafted an initial codebook. Then three researchers together coded all items and iterated the codebook. Finally the codes were grouped into high-level themes.

3.4 Current Meme Usage

Of the 29 participants, 27 reported using memes daily, one weekly, and one monthly. Twenty participants reported that they had refer-enced memes in offline communication: 15 by verbally describing them, 12 by showing memes on a device, 12 by reenacting, and 18 by using catchphrases (multiple selections were allowed).

3.5 Challenge: Interrupting Conversation Flow

Twelve participants noted that visualizing memes requires interact-ing with devices, and this **technological friction** could interrupt conversation flow and cause **missed comedic timing** in F2F inter-actions.

Technological Friction Four participants mentioned that inter-acting devices to **search and select memes** take time and interrupt the conversation flow. As P33 put it, *"It (using my own expression) allows me to act quicker...rather than taking the time to take out my phone, searching up the meme and showing it."* Ten participants said that the action of interacting with devices for memes during conversation felt awkward. As P1 put it, *"having to get my phone out during the situation which is honestly a bit weird because who does that?"*

Missing Comedic Timing. Five participants noted that the time spent interacting with devices and searching for a meme might impair comedic timing, in real-time F2F conversation. As P2 men-tioned, *"In AR, with everything playing out in real time, by the time you find the perfect meme to share, the moment could have passed and the conversation moved on."*

3.6 Why use self-expression without showing memes?

Among the 260 scenarios, there are 72 instances about using self expression (Verbal 44, Non-vrebal 28) Participants mentioned that using their own speech and acting to reference memes are easier and more humorous.

Easy to act. 23 instances mentioned that using one's own ex-pression is easy to referenceing memes, both verbally (P27:*"It's mainly just the audio which can be easily replicated with just saying it out loud."*) and nonverbally (P7: *"It's very easy to mimic the cat's expression so is quicker than displaying the meme,"*). Memes that were easy to replicate often feature iconic cues. One example is speaking out *One-Eternity-Later*. As P9 explained: *"It's short, simple, and easily imitated... very distinct voice and phrase,"*

Humor from self-acting. 15 instances highlighted that the humor came from their personal acting. As P34 put it, *"Cause it's funnier if I act the meme out instead of showing it."* In addition, P7 memtioned bring his personalized traits to his acting, *"My expression is more real time and personal."* Two instances mentioned that self-acting bring the sense of ownership of humor, as P9 described *"saying it with your chest and body means you're owing up to it!".*

3.6.1 .

3.7 Why and how to integrate memes via AR?

188 out of 260 instances use meme visualisation (AR 128, Phone 60). We first analyze what meme elements particiapnts use and motiva-tion behind (Sec 3.7.1). Then we discuss three Meme Integration Archteypes (Fig.4), regarding how to use memes and AR to create humor in F2F conversations (Sec. 3.7.2).

3.7.1 What media content of meme is brought to AR?. We found 8 elements that participants want to reference from memes and bring into F2F conversations, and we explain their communicative motivation behind.

1. Identity from Meme Charcter refers to users taking on a meme character's identity, by adopting features tied to that identity (e.g., face, costume, prop). **Why:** By doing so, users aim to become the characters and mimick their behavior in users' own situation. Humor comes from cultural references to the character's anecdotes. **Example:** P1 mentioned swapping to Bernie Sanders' face (A polit-ican who raised fund) to ask for money and spoke his quote: *"I once again ask for your help"*. P1 highlighted becoming Bernie make it funnier: *"Nothing beats the original Bernie Sanders... It just makes sense!"*

2. Funny Corpus features from Meme Charcter refers to adopting funny body features of meme characters, such as exgger-ated facial expressions and body figure, or hilarious dressing. **Why:** Although this can share simlar visual forms with "identity-sharing" (e.g., face-swapping), the motivation is different: the meme char-acter becomes the user's "proxy" for performing funny reactions that would feel socially awkward to enact themselves. **Example:** P11 mentioned adopting exgerated expression from *Andy-Dwyer-Surprised-Face*: *"It's OTT (over the top) and doing expressions like this wouldn't be the norm in most situations."* (P11)

3. Funny Voices from Meme Character refers to users adopt-ing a meme character's voice to replace their own. **Why:** These voices are hard for participants to replicate with the same humor-ous effect, due to limited acting skills. **Example:** P22 memtioned playing Westbrook's *"What are you talking about?"*[7] to react to stupid words, as he noted, *"Although I think I could replicate...I think his natural voice is more funny."*

4. Hypernatural Action from Meme Character refers to users adopting impossible and hyperrealistic actions from characters, such as vanishing and super-speed running. **Why:** These actions are central to the meme's humor but impossible to perform in real life. **Example:** P4 mentioned she could "vanish" like *Disappearing-Kid-Meme*[8]: *"If I could make it look like I was fading out...to leave a dramatic situation"*

5. Interactive Objects from Meme Environment efers to users borrow objects from the meme environment, so they can interact with them and reenact the meme. **Why:** These objects carry semantic meaning and key humor, and without showing them, acting out the meme loses key meaning. **Example:** P4 mentioned displaying the hedge from the *Homer-Into-Bush* meme: *"I could add an AR hedge for me to walk back into...to leave an awkward situation."*

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[7]https://vlipsy.com/clips/qCmnhFLc
[8]https://imgflip.com/memetemplate/222516354/Disappearing-kid-gif

Here, the bush represents "social concealment", key to this meme's meaning.

6. Special Effects from Meme Environment refers to users bringing in the dynamic visual effects that define a meme's atmosphere, often the backgrounds or foreground overlays. ***Why:*** Other than decoratinos, these effects amplify a certain emotion and evoke the meme's humor. ***Example:*** P2 mentioned displaying floating fomulars from *Confused-Math-Woman* meme, to express confusion, as P2 noted,*"show the numbers and formula surrounding me that would make the experience funnier"*.

7. The Whole Meme Transformed to 3D refers to converting the entire meme – including characters, objects, and environment – into a 3D form. ***Why:*** Here the humor comes from the meme itself, requiring presence of all memes elements. Transforming them into 3D allows memes to better blend with the real world, producing surreal and amusing effects. ***Example:*** P22 noted about having 3D meme characters walking around: *"I think seeing this meme in my own home would be hilarious and make it seem surreal."*

8. The Whole 2D Meme refers to the original 2D form. ***Why:*** Participants mentioned that some memes' humor only exists in original 2D form (e.g., being classic, graphic composition). ***Example:*** P33 noted filmmaking technique contributed to the humor of *Black-Cat-Zoning-Out-Meme*[9], *"The camera angles of the meme zooming in add to the humor, which cannot be recreated..."*

3.7.2 Three AR Meme Integration Archetypes. Based on these eight elements, we identified three "Meme Integration Archetypes" characterizing how users use AR combine meme content, themselves and their physical environment to create humor in F2F conversations: **The Meme on Me**, **Me in the Meme**, and **Meme as Visual Reference**. For each archetype, we describe (1) its definition, (2) involved meme elements, (3) enabling AR techniques, and (4) communicative motivations (Fig.4).

"The-Meme-On-Me" refers to merging the meme character with the participants regarding (1) identity, (2) funny body features, (3) voice or (4) magical actions. They could be afforded by AR through face or body swapping, voice augmentation, or graphiclly manipulating AR view (e.g., Diminished Reality[14] for users to "Disappear".) Users' motivation is to (1) become the memes characters to act the similar jokes as humorous culture reference (2) use meme character as the "proxy" for user to act funny actions, which are challenging to replicate in person.

"Me-in-the-Meme" refers to situating the user within the meme's environment, so that users can reenact or improvise the meme by interacting with the AR meme environment. This is achieved by visualizing in situ either (1) the interactive objects or (2) the special effects from the meme's environemnt. These elements carry semantic meaning that contributes to the meme's core humor. They also provide the interaction affordances necessary for users to physically enact the meme (e.g., a bush for walk back in).

"Meme-as-Visual-Reference" refers to memes serve as funny visual puncuation to augment users' speech, the humor comes from the meme itself, so the meme is not deconstructed like the other two archtypes. They include both original 2D form and 3D transformation, depending on which form contribute better to humor. Some meme's humor is preserved only in its original 2D

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format (e.g., filmming technique). Some memes can be transfromed into 3D form to better fused with physical reality to create sureal humor.

4 Study 2 - Co-design AR Memes and Using AR Memes in Conversations

In Study 1, we explored motivation to use AR memes in F2F conversations through scenario ideation. We found diverse, meaningful cases and see the concept promising. Then, in Study 2, we aim to empirically explore how AR memes are experienced and influence conversation through a lab study, where participants bring their memes and converse. In Study 2, we aim to explore:

(1) How did people perceive AR memes in F2F conversations?
(2) How do people integrate and coordinate AR memes in F2F conversations?

To focus on our research questions, we drew two learnings from Study 1: First, we offer participants four AR variations of their own meme across the three Meme Integration Archtype (Meme-As-Visual-Reference(2D,3D), Me-in-the-meme, The-Meme-on-me) resulted from Study 1. They are *"experience probes"* for participants to use in conversation and generate new design ideas. Second, we needed to minimize technical friction (searching and selecting memes), so that we could observe how the meme's content and humor influence the conversation independently of other factors. Complex searching would distract participants from the conversation itself, but fully solving this problem (e.g., contextual meme recommendations) is a technical research outside our scope. Therefore, we asked participants to preselect relevant memes to reduce search effort, and employed simple selection techniques (pinch and poke GUI).

4.1 Participants

Twelve pairs of participants with established relationships (friends or couples) were recruited. Data from one pair was filtered out due to technical difficulties during the study. Finally, eleven pairs remained (N = 22; 12 female, 9 male, 1 prefer not to say; age M = 25, SD = 4.23) All of them used memes in digital communication; 10 had no XR glasses experience. 15 had referenced memes in physical communications: 7 by reenactment, 1 by verbal description, 5 by showing on devices, and 2 by drawing/printing. Each received 20 currency for compensation.

4.2 Study Procedure

Prior to the on-site study, participants were asked to select three memes they would want to use during the conversation and think of a story they like to tell in which they could integrate them. Then, in the on-site study, they designed AR visualizations of their memes and used them in conversation. The first author used these memes to create immersive variations that could be used as design props (see full pipeline later).

Prior Study: Bring memes Each participant prepared topics for conversation and select three memes they could use, then sent them to the researcher via email. The researcher recreated AR versions of these memes across the three visualization archetypes, for participants to ideate with and use during the study.

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[9]https://imgflip.com/memetemplate/471380686/black-cat-zoning-out

Figure 4: Three archtypes of AR meme visulization: The Meme on Me, Me in the Meme, Meme as Visual Reference.

Step 1: Introduction. In the on-site study, the two participants were introduced to the concept of AR memes and study procedure, then completed consent and demographic forms.

Step 2: Design Session in AR. Two participants wore AR headsets and explored the visualizations of each of their memes provided by the researcher. They took turns presenting their memes, selecting visualizations, and adjusting position and size. A monitor displaying the video feed from the other headset allowed them to see how they looked from their partner's perspective. Participants were encouraged explain their design choices and generate extra ideas.

Step 3: Conversation with AR memes In the conversation, participants began by sharing anecdotes as an icebreaker, then let the discussion flow freely. They were encouraged to use the AR memes they had designed. The conversation lasted around 8–10 minutes. Afterward, they completed an adapted *Perceived Interaction Quality (PIQ)* questionnaire [50], which measures participants' perceptions of conversation quality, rapport, and conversational equality.

Step 4: Baseline Conversation In the baseline condition, participants conversed while wearing the AR headset without using AR memes. If they tried to refer to memes, they were asked to do so as they would in daily life. The order of this condition and Step 3 was counterbalanced across participants. If the baseline came first, participants were told it was to get familiar with AR conversation, starting with casual topics. If it came after, they continued from the previous discussion. Following each baseline session, they again completed the *PIQ* questionnaire in Step 3.

Step 5: Interview. A semi-structured interview was conducted with both participants to discuss their experiences. They also filled in a questionnaire to evaluate the concept.

Figure 5: GUI Interfeace for selecting memes

4.3 Apparatus

We built an AR prototype on the *Meta Quest 3* with *Unity3D*. It enables multiple colocated users to share and physically manipulate memes in real-time. We used the *Meta Depth API* to enable occlusion of AR contents. We included *Unity Netcode* and *Meta Colocation* packages to synchronize memes (e.g., audio, position) across all networked headsets. We offered a graphical user interface (GUI) at the bottom of user's AR viewport for them to trigger and delete memes, using controller clicking, pinch and poke (Fig.5).

4.4 Meme Design

Each meme visualization was created by the researcher across the Meme Integration Archetypes, with up to four versions available to choose from (Fig.6). Some memes did not fit certain archetypes, resulting in fewer than four visualizations (Fig.7). For example, a
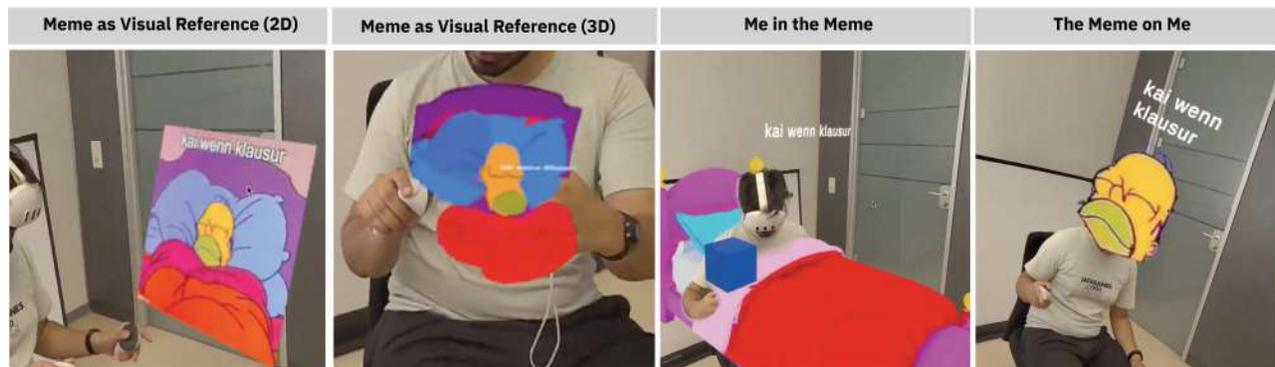
Figure 6: Four visualizations for P21's Homer-Sleeping meme
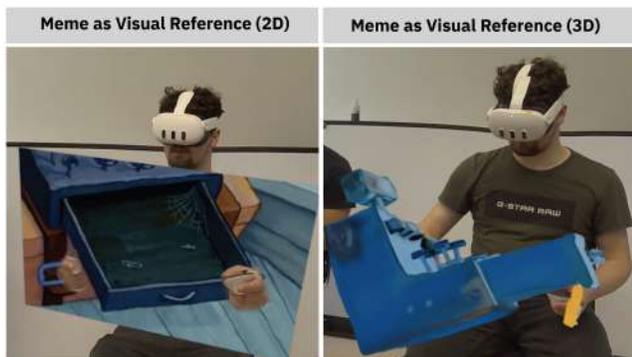

Figure 7: Two visualizations for P3's Spongebob-Empty-Cash-Register meme

meme without a character could not be applied to The-Meme-On-Me.

For the "Meme-As-Visual-Reference" (2D), the original image or video was rendered on a 2D quad. For "The-Meme-On-Me", if we adopted face or body swapping, the face or full body of the meme character was extracted from the original memes and mapped to the headset or full body rigging. We also played meme charecter's audio in AR if there were. For "Meme-As-Visual-Reference"(3D) and "Me-In-The-Meme", we used *TripoAI*[10] to generate meshes, with *Unity3D* and *Blender3D* to add animation. For realistic videos that were too resource-intensive to fully convert into 3D, we cut out each graphic element using *CapCut*[11] and then placed them spatially in a 3D canvas.

Although the given AR memes reflected researchers' interpretations, they are "experience probe" help to reflect on AR meme conversation experience, and inspired design ideas.

4.5 Data Collection

The collected data included four parts:

(1) Original memes: Provided by participants as source material.

(2) Design session: Video recordings capturing participants' design processes.
(3) Conversation session: (a) Video recordings of two conversations, (b) questionnaire responses on *Perceived Interaction Quality (PIQ)* and overall concept evaluation.
(4) Post-test Interview: Audio recordings

4.6 Data Analysis

Two researchers reviewed the original memes, video recordings of the design and conversation sessions, and audio of the interviews. They then conducted a thematic analysis. They jointly coded participants' actions and speech, iterating the codebook. Disagreements were resolved through discussion with a third co-author. Questionnaire responses were analyzed quantitatively.

We will structure our results following three stages: **(1) Understanding and categorizing the original memes, (2) Translating memes into AR during the design sessions, and (2) Using AR memes in conversation sessions.**

4.7 What memes are selected?

We analysed the 64 original memes that participants sent to us before the study (Two were excluded because participants did not elaborate on the design rationale behind them). We discovered 2 types of memes, with the number of instances:

Reaction Memes (32) Reaction memes usually contain facial expressions, actions, and audio to depict one's affective reactions[2] (Fig.2-3,4). They are usually single-panel images or short GIFs The humor comes from the over-the-top emotional action from meme characters.

Template Memes (25) Template memes are reusable pieces of media (e.g., multi-panel images) with a recognizable layout that allows people to add captions for telling their jokes [23, 44] (Fig. 2-1,2). They are self-contained with story and humor, and contain richer contexts and media elements (e.g., multiple captions) than reaction memes.

Other (7) Some memes were not categorized in the two classes above. Their humor comes from participants' own interpretation and shared knowledge with friends, becoming their own inside joke. One example is the *SpongeBob-Empty-Cash-Register* meme from P3, which represents a sad emptiness as dark humor.
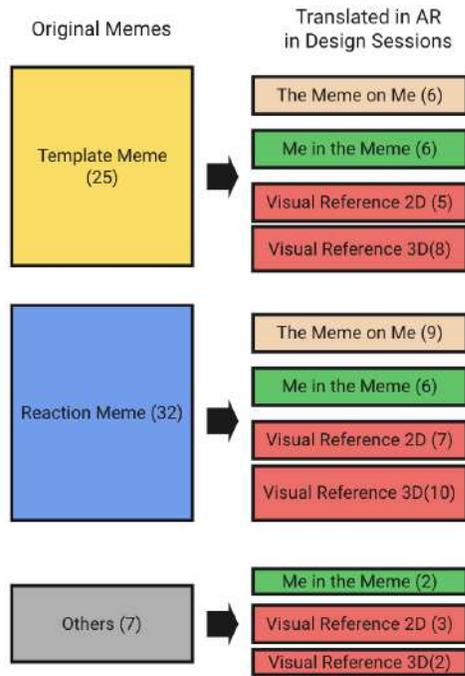
Figure 8: The distribution of visualisation method for each type of meme.
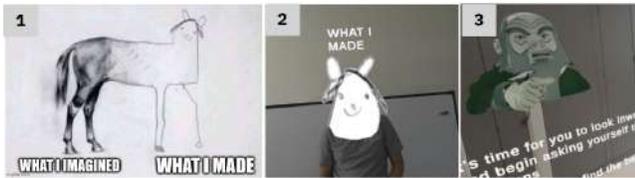

Figure 9: (1) Unfinished-Horse meme from P17, contrasting imagination with outcome; (2) they used only the horse's face for humor even though it did not depict the full story. (3) A 3D version from Avatar-Big-Question meme selected by P12 due to is low quality causing absurd humor.

4.8 How are memes transformed to AR?

Based on participants' practices in the design session, we reported how participants selected visualization methods, designed spatial arrangements, and defined interactions when translating their memes into AR.

4.8.1 Visualisation Method. We report how different types of memes were transformed into visualizations, as illustrated in Fig. 8. Analysing participants' think-aloud protocols during the design session, we found that **humor** was the primary factor guiding their visualization choices.

Humor from self-acting. 14 instances were coded as *Me in the Meme* in which participants wanted to reenact or improvise

with the memes. Here, humor came from personal acting. Participants prioritized their own acting to convey their own expression, which is not exactly the same as the meme character. For example, P23 chose the *Confused-Math-Woman* meme; she only kept the math formulas floating around without the woman's face (Fig.1-1). She explained: *Her face cannot get my emotion across; my own acting is more funny.*" When using the meme, instead of copying the facial expression from the meme character, she used her own acting, shrugging and spreading her hands, and speaking *Dahell, you mean.*"

Humor from Face-Swapping 15 instances adopted face-swapping. 9 instances involved reaction memes featuring humorous facial expressions; participants swapped the face because they could not act same funny. As P19 noted about *Andrew Dwyer*'s surprised face: *"I cannot perform this (surprised facial expression) like him."* For the other 6 instances involving template memes, participants adopted the meme character's face for creative acting. For example, P17 adopted the face from the *Unfinished-Horse* meme with a personal caption contrasting imagination and poor results (Fig. 9-1,2). P17 adopted sketchy horse face for humor, *That's (Swap to the horse's face) basically genius!*" While the horse face only contained part of the meme's original information (a poor result), P17 used his own acting the complete the story: *"I can say how cooked I was, then I suddenly switch to this (the horse face)."*

Humor from the original 2D memes. 15 instances chose original 2D meme because the humor comes from 2D forms, including 2D-only filming techniques or being classic. For instance, P21 chose a video clip (*Zoolander-Staring* meme) derived from the film *Zoolander*. He chose the original 2D version because it is deeply connected to the original film. P21 explained their choice by stating, *"This is the classic one, and imagine the music also on..."*

Humor from "Brain Rot" 3D Memes. As we used AI mesh generation to transform 2D memes to 3D, 5 participants commented on the insufficient visual quality, describing it as "curse" (P21), "creepy"(P7, P17, P18), "scuffed"(P12) . They commented with laughter, suggesting its comedic effects. In 2 instances, participants specifically chose 3D memes for this reason, as P12 noted, *"That's scuffed … [Laughter]...I think that is funny, that's why I chose it"* (Fig.9-3). This mirrors "brain rot" Internet memes[1], which are intentionally low-quality and lead to absurd humor.

4.8.2 Spatial Arrangement. People designed spatial arrangements from two aspects. One focused on conversation efficiency and comfort, while the other considered how position and size shaped the meme's meaning.

Visibility to meme audiences. 24 instances showed that visibility for audience was the key factor informing memes' size and position. When designing the size, participants referred to real-world visualization tools, such as *"poststand"* (P17) and *"screen"* (P5). Participants positioned memes near their own head or chest, so the partner could see them without obscuring the face. As P7 noted, *"then she (my partner) didn't need to move her head to see my meme."*

Reduce Interruption 4 instances point out that interruption was considered to inform meme size. Large memes capture people's attention and distract conversation. As P13 noted, *"(The meme should be) small enough so you don't get overwhelmed."* In particular,

Figure 10: (1) Collaboration-Harrold meme from P10, (2) she recenacted the scene with a 3D Harrold group and replacing one of them. (3) P17 (left) align a Men-Smashing-Desk meme to his partner's head (right) to make a joke of 'hitting' him (4) P20 used a shocked monkey above her head using an analogy to thought bulb

memes with a human figure, when displayed at a large scale, were described as *"scary"* and *"intimidating"*(P8).

Correct Position to Reenact. 38 instances reported that participants positioned and resized AR memes maintain the same relative placement and proportions for reenacting. For example, P10 chose a *Harold-Collaboration* meme to depict her struggling teamwork. She resized the 3D Harolds to human size and positioned them around her(Fig. 10-1,2): *I want to express that I am part of the team, just like this (the meme)."*

Humor and Meaning from Large Size 4 instances indicated that larger size led to humor, as P17 put it: *"The larger, the funnier."* The disproportionately large size could create absurdity for humor or enrich memes' connotations. One example is P22, who selected the *Tornado-Guy* meme with a guy screaming in front of a tornado to express frustration. He selected a 3D tornado to reenact himself, upscaled it, and explained: *"Being larger has comedic effects."* 4 instances highlighted that a larger meme size could intensify the meaning or emotion of the meme. As P22 enlarged the tornado, he explained: *"It (large tornado) also highlights how terrible the situation was."* Another example is P20, who selected the *Talking-to-the-Wall* meme to depict the frustration of communication with friends. She upscaled a 3D brick wall and explained: *"It highlights my frustration."*

Memes as "Thinking Bulb". 3 instances positioned memes above their head to express this meme represents their thoughts or emotions. This draws the visual grammar of comics, where visual symbols placed near one's head carry the connotation of their ideas or feelings, such as "thinking bulb". For example, P20 chose a shocked monkey positioned above her head to express her emotion (Fig.10-4). She explained:"I want to express that I was like the monkey, it is just like the thoughts popping up from the head as we see in the film… "

Create Humor from Semantic Connection between Meme and Reality. In 2 instances, participants strategically placed memes to create semantic connections between the memes' meaning and real-world elements, to generate new humor. P23 positioned a 3D *Running-Shrek* meme to run toward the actual room exit (Fig.1-7). Here, the meme content ("running") was combined with the meaning of "room exit" (leaving), reinforcing the participant's message: swiftly leaving a man who rejects romantic commitment. P17 resized a *Men-Smashing-Desk* meme to human body scale and positioned it above his partner's head, creating semantic alignment between the meme's action (a man is smashing) and the target

(partner's head). This transformed the meme's original meaning (frustration) into a personalized joke, which is "hitting" his partner. His partner then responded, *"You want to hurt me?"*, demonstrating he recognized this joke (Fig.10-3).

4.8.3 Interaction. Participants demonstrated two approaches to how they wanted to trigger and interact with memes during conversations:

Meme Appears Right in Place and Size. In 60 instances, participants wanted memes to exactly appear at their desired final position and size without extra interaction. Here, a meme was a visual punctuation in the conversation, or as a suprise with comdic timing; it should appear instantly and precisely. The physical interaction with memes was perceived as awkward, as P12 noted, *"(If I have to do) a weird movement with my hand, I'm not so sure I will use it."*

Meme being Physically Manipulated. In 4 instances, participants wanted to physically interact with memes during their talk as part of their comedic performance, treating them like physical comedy props with tangible affordances. For example, P21 downscaled a 2D meme as a card in his pocket. When showing the meme in the conversation, he physically pulled the meme out from his pocket, upscaled it by stretching, and then presented to his partner. This physical interaction of "revealing" a meme brought performative humor.

4.9 Conversation

Participants triggered memes 70 times in the 11 sessions (Fig. 12). We observed two main categories: proactive use (58 instances) and reactive use (7 instances), with others that could not be categorized (e.g., accidentally triggering memes without using them). **Proactive use** involved curating memes as narrative elements to tell one's own story. **Reactive use** involved using memes as responses to others' words. In our study, proactive use occurred more frequently. We acknowledged that this is caused by the study design, where we had asked participants to prepare topics, and memes were pre-selected for those topics. In contrast, reactive use occured less, since participants could not anticipate what their partners would say and did not have appropriate memes readily available.

4.9.1 Proactive Use (58). Among proactive meme usage, we identified two chronological patterns of how memes were orchestrated with users' speech and actions: **sequential** and **parallel**.
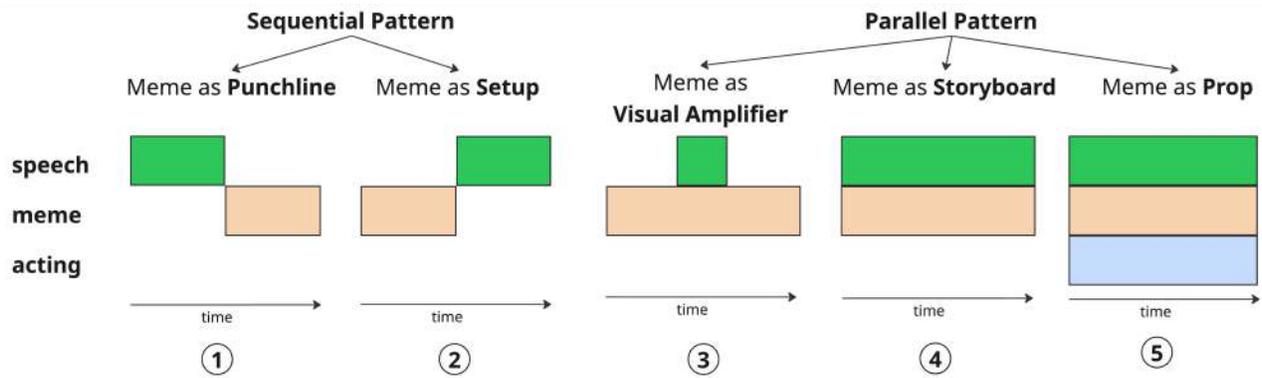
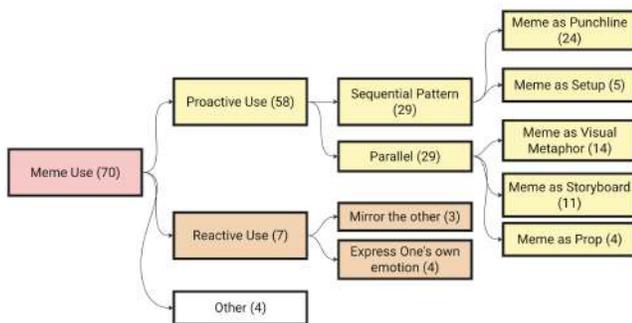Figure 11: The seqential and parallel pattern of how participants integrate memes into conversation.

Figure 12: The distribution of meme usage in conversations

Sequential Pattern. In the sequential pattern, memes and speech appear one after the other, in either order. When participants use memes, there is often a pause in their verbal expression, because the meme "say something" in place of speech. This pattern was observed in participants' curated jokes, which contain two comedic components: **setup** and **punchline**. In this context, the meme serves as either the punchline or the setup, while speech fulfills the complementary role. Since the setup precedes the punchline, speech and memes naturally occur in sequence [46]. We identified two modes:

(1) **Speech as Setup, Meme as Punchline.** Here, participants used speech to build the setup, then suddenly showed the meme as the punchline to land the joke (Fig. 11-1). Showing a meme usually involved a pause, because the meme could narrate the story in place of the speech. One example was shown in Fig.13.

(2) **Meme as Setup, Speech as Punchline.** The meme appeared first to build up familiar context that the audience can recognize, as the set up. Then, the participant delivered the speech as punchline land the joke (Fig.11-2). The speech brings unexpected twists to deliver humor. For example, P12 showed the *Avatar-Big-Question* meme (Fig.9-3) which typically depicts a character contemplating a profound life

question[12]. Instead of following this expectation, P12 delivered the speech: *"What is the best Doppel-keks?"*, which is a German snack. The humor comes from taking a snack preference as an existential dilemma, a type of "geek humor" to over-intellectualize something trivial. In this case, the meme serve as a setup by creating an expectation when a serious question will follow, while then the speech subverts this expectation by introducing a trivial question (picking a snack), thereby creating humor through incongruity.

Parallel Pattern. Participants maintained fluent speech while memes appeared simultaneously. Memes did not replace spoken content, and there were no actual pauses caused by the speech giving way to the memes. If the memes were removed, the conversation would have remained complete and comprehensible. Memes functioned to amplify emotions, add comedic effect, and assist storytelling and acting. Within this pattern, memes served three distinct functions:

(1) **Meme as Visual Amplifer** Memes acted as visual amplifiers of the key concept or emotion in the speaker's narrative. They appeared alongside the corresponding speech to humorously echo participants' specific words instead of replacing them (Fig. 11-3). One example is shown in Fig.14. In this case, P16 use the *Max-Fosh-Uno-Reverse* meme[13] to visually reinforce the idea of turning an action back onto the other person. The meme amplifies the notion of "reversal" expressed in the speech.

(2) **Meme as Storyboard** Memes functioned as storyboards that provided visual references to support storytelling. They appeared throughout the storytelling process (Fig. 11-4). In 10 out of 11 instances, this pattern occurred with template memes as the original 2D version, keeping all the original visual and textual information. While delivering their stories, participants aligned their speech with the narrative structure of the memes. They followed the meme's original storytelling sequence (e.g., narrating their story in line with the temporal order of a video meme). Additionally, participants used pronouns and pointing gestures to connect their stories to
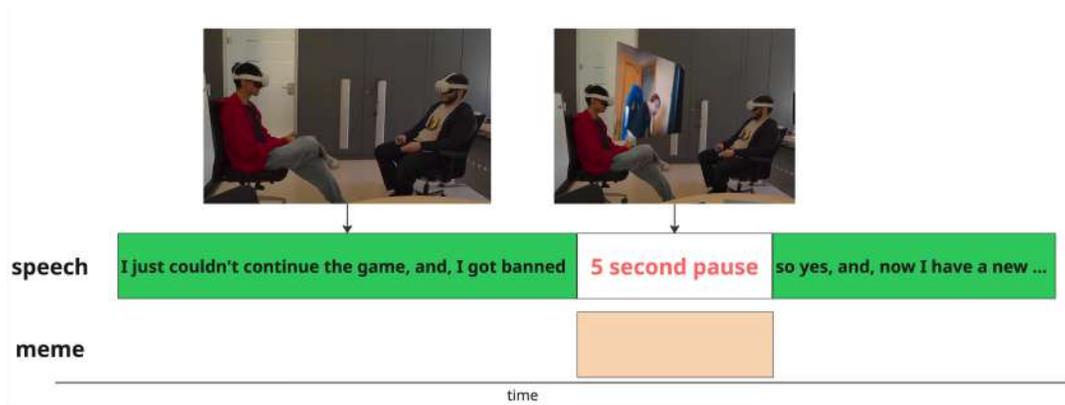
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[12]https://imgflip.com/i/97lwgt
[13]https://imgflip.com/meme/481566844/Max-fosh-uno-reverse

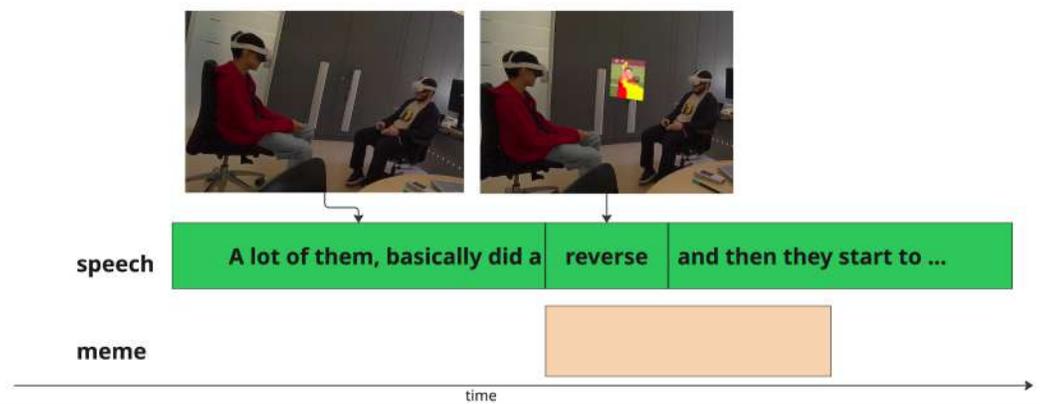**Figure 13: Conversation from P15, using meme as a punchline.**

Figure 14: Conversation from P16, using meme as a visual amplifier.
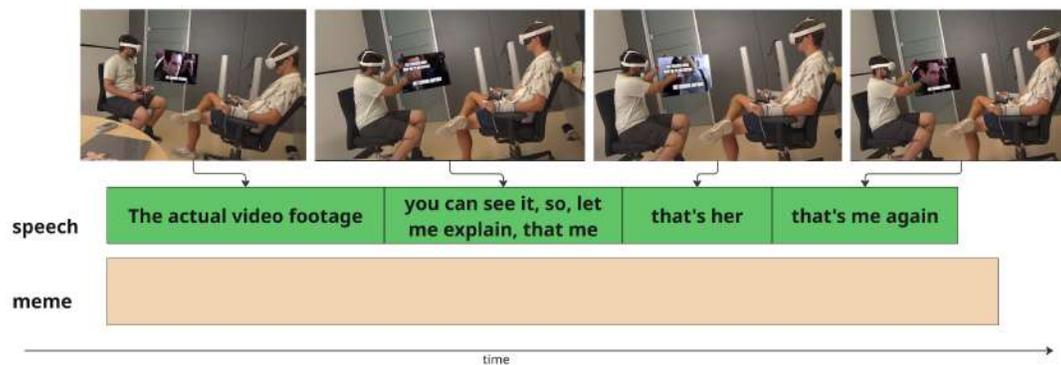

Figure 15: Conversation from P21, using meme as a storyboard.

the meme content (e.g., pointing to a part of the meme and saying, "that's me"). Sometimes, their speech duplicated the meme captions. One example is shown in Fig.15.

(3) **Meme as Performance Prop** Participants used memes as theatrical "props" to reenact the meme scene and perform their story. These props appeared throughout the storytelling process, accompanying participants' acting and speech (Fig.

11-5). For example, P3 triggered the floating math formula from the *Confused-Math-Woman* meme (Fig. 1-1) and then began her storytelling: *"Da hell you mean? Ok, for entertainment, huh? ...[spreads hands]..."* She removed the meme until she finished her story.

Figure 16: (1) P22 used a meme to 'slap' P21, (2) P21 blocked P22's view with another meme, (3) P22 then remixed two memes

4.9.2 Reactive Use (7). This section refers to participants using memes to react to their partner. Among the seven instances, six of the seven instances involved face-swapping memes depicting a certain facial expression. We observed two ways in reactive use:

(1) **Mirroring others' expressions:** Participants used memes to reflect or echo their partner's words. For example:
   P18 was sharing an awkard talk with her aunt
   P17: *"This is how you look at your aunt, right?"* [*Unfinished Horse* meme appeared] (Fig.9-2)
   P18: [Laughter] *"Exactly!"*

(2) **Expressing one's own emotions:** Memes were also used to convey the participant's personal feelings or reactions:
   P7 was sharing serious political topics
   P8: [*Confused-Cat* meme appeared] *"I thought you were going to tell me gossip; why are you telling me this?"*

4.10 Playful Social Interaction using AR Memes

We observed how memes influenced participants' social interaction and conversation.

Trolling with Memes In 4 sessions, we found participants used memes to sabotage each other for a joke. P22 used the 2D meme pictures as a physical plank to slap P21's face (Fig.16-1). P21, P22, P17, P18 used memes to block their partners' view for trolling them (Fig.16-2).

Stealing Memes In 3 sessions, we noticed that participants grabbed and stole their partners' memes. For example, in session 11, P22 looked for his memes and found that it was taken away by his partner, he said, *"you meme thief!"*

Spamming Memes We found in 2 sessions participants spammed memes which were irrelevant to the conversation, deliberately annoying their partners. In the interview, P21 explained that such behavior mirrored his daily meme usage in WhatsApp: *"We just kept sending each other different versions of the same meme..."* P3 also mentioned spamming AR faces to make jokes, noting, *"Pressing a button to annoy someone makes an effect on your face. I think that's going to be used a lot."*

Remixing Memes In session 11, we observed that P21 and P22 remixed their memes to create new ones. P22's meme showed the bed from the *Homer-Sleeping* meme to represent their friend still being asleep during an exam. They then added a struggling face to illustrate their friend's emotions upon waking up and realizing he had missed the exam (Fig.16-3). Later in the interview, they explained why they remixed memes, *"It's (their memes) kind of a one-off, you said it and you've laughed about it, and you know, that's why we try to remix them."*

4.11 Meme's impacts on conversation quality

We compare the results of *Percieved Interaction Quality (PIQ)* responses from both conditions (with and without AR memes) in Fig. 17, on the three subscales:

4.11.1 Quality of Interaction Scale (QoI). We analyzed the QoI scale (Fig.17, left, reversed where applicable and averaged) using a linear mixed-effects model with a fixed effect for *AR memes* and random intercepts for participant and dyad. Model assumptions were satisfied (`performance` package). Random effects captured most explainable variance while the fixed effect of *AR memes* was negligible (Conditinal $R^2 = .543$, Marginal $R^2 = .001$). Variance decomposition showed substantial dyad clustering (SD=.59SD = .59 SD=.59) and smaller participant differences (SD=.31SD = .31 SD=.31). The model showed no evidence that memes affected QoI ($F_{1,21} = .12$, $p = .73$).

4.11.2 Degree of Rapport Scale (DoR). Following the same approach, we analyzed the DoR scale (Fig.17, middle) and found that random effects explained most variance while the fixed effect of *AR memes* was negligible (Conditinal $R^2 = .633$, Marginal $R^2 = .012$). Variance decomposition showed substantial dyad clustering (SD=.48SD=.48 SD=.48) and smaller participant differences (SD=.19SD=.19 SD=.19). The model showed no evidence that memes affected DoR ($F_{1,21} = 1.45$, $p = .24$).

4.11.3 Equal Conversation Scale (EC). For the EC scale (Fig.17, right), the maximal LME model produced a singular fit due to zero dyad-level variance, so we removed the dyad intercept and fitted a model with participant-only random intercepts. The analysis showed negligible main effect influence (Marginal $R^2 = .003$, Conditinal $R^2 = .715$), indicating no main effect of *AR memes* on EC ($F_{1,21} = 0.52$, $p = .48$).

4.12 General Impression

Participants responded to a four-item questionnaire about their general impression of using AR memes (Fig.18). The items yielded means (SD) of 5.77 (1.38), 5.77 (0.92), 2.91 (1.27), and 5.86 (0.83), respectively, indicating that most participants found AR memes relevant and enjoyable for communication, with high agreement on their potential use.

5 Discussion

In our discussion, we focus on three questions regarding meme use in F2F interactions with AR: **(1) Which meme visualization methods does AR enable during F2F conversations? (2) How do people integrate and coordinate AR memes in F2F conversations using AR? (3) What makes a "good" meme in AR-mediated F2F conversations?** We conclude by presenting two potential future integrations based on insights from both studies and our personal reflection.

5.1 Behavioral Basis and Concept Perception for AR Memes

Across both studies, participants already referenced memes in F2F conversations (study 1: 20/29; study 2: 15/22), suggesting a strong
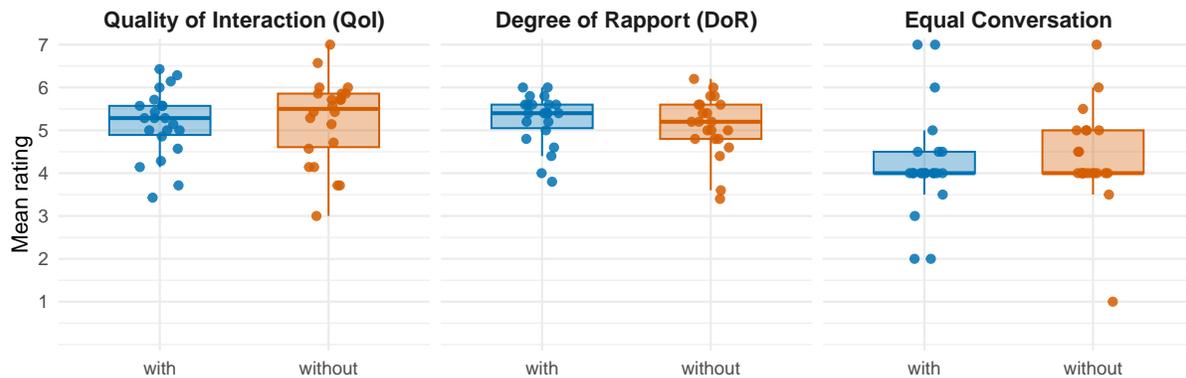
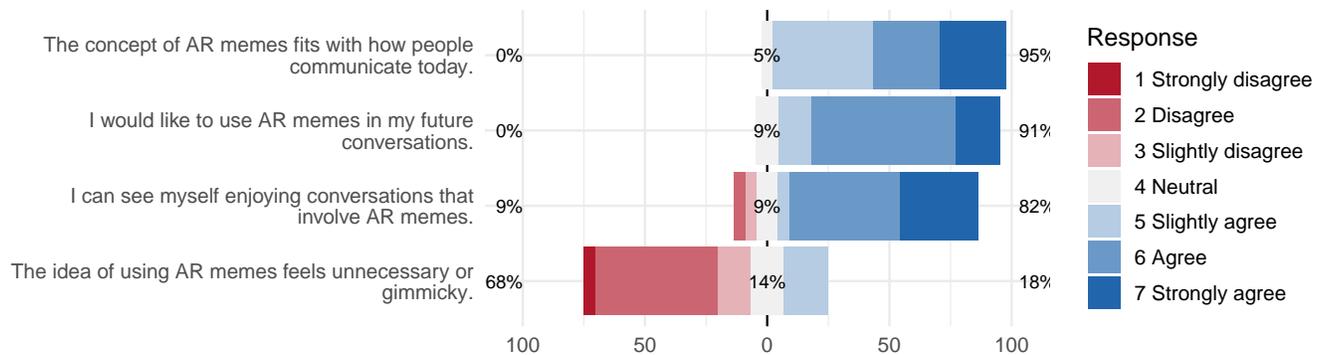**Figure 17: Reponses of PIQ Questionnaire in both conversation conditions with and without AR memes.**

Figure 18: The response of the questionnaire ask participants' general impression on using AR memes.

behavioral foundation for AR memes. In study 1, 188 out of 260 instances expressed motivation to visualize memes when referencing them, while in study 2, participants reported high interest in using AR memes in future conversations (M = 5.77, 7-point Likert scale) and enjoyment when doing so (M = 5.86, 7-point Likert scale). Post-interviews also reflected positive resonance (e.g., P21: *"I imagine if this were, like... everyone had those (AR) glasses, I think that would be kind of a new part of like talking to each other!"*). We also observed frequent laughter in the lab study.

5.2 What makes AR Memes unique?

We begin by discussing how AR meme visualization fuses meme and reality, giving rise to a AR meme genre. We then discuss whether the AR meme can still be considered a meme.

5.2.1 AR meme visualization leads to a new AR meme genre. On public online platforms (e.g., Reddit), memes carry little situational or interpersonal contexts; they are detached from the speaker and locations, and isolated on a digital screen. In private messaging (e.g., WhatsApp), context increases because the sender is known, and shares a history and relation with the receiver, which gives a frame to the interpretation, but the meme is still locked within a picture frame. **In contrast, when memes are used in AR with the speaker present in F2F interactions at a specific location, the**

user's body and environment become part of the "canvas" for the meme. This creates a fusion between self, environment, and meme, resulting in a novel type of AR memes. In *Me-in-the-Meme* and *The-Meme-on-Me* usage types, the user directly participates in the meme, either by merging their body with a meme character or by situating themselves within the meme's environment. In *Meme-as-Visual-Reference*, the meme's connection with the physical environment generates new meaning. Here, the user's body, actions, environment, together with the digital meme content (graphic/audio), co-construct a complete AR meme, shaping its visual form and meaning. Humor can arise from the absurd contrast between real-world environments and meme elements, or from a clever fusion between real-life elements and meme contents. We argue that the coexistence and collaboration between meme, user actions and physical environments make AR memes a unique genre. This also differentiates AR memes from meme usage in socialvVR(e.g.,VRChat), which may employ similar visualization methods (e.g., embodiment), but remain isolated from real-world users and environments.

5.2.2 Can AR memes still be considered a meme? Since the user's actions and physical environment are part of an AR meme and carry rich information, we wanted to understand how much information the digital part of the AR meme can contain to still be

considered a meme, rather that just the performance of the user in their environments.

From the memes submitted by participants and their transformation during the design session, we observed that template memes, with complex narratives and compositions, were often simplified; 12 out of 25 cases were stripped of complexity by extracting the face or environment component (Fig.8). For example, P17's *Unfinished-Horse* meme originally told a story about the gap between imagination and outcome, but in the design session, they used only the horse's face, even though it no longer conveyed the full story (Fig.9 1–2). He decided to narrate part of the story through speech. In the conversation, we saw that participants ignored the captions they had added to their memes, and instead, used their own speech and actions to tell stories more spontaneously. This suggests that they felt the need to simplify memes to fit them into the conversational flow.

This raises another question: **to what extent can a meme be simplified while still being a meme?** We argue that swapping one's face with a well-known meme character (e.g., Surprised Pikachu Face) still qualifies as a meme, since it retains a distinct cultural reference. However, we also observed more extreme cases, such as P21 reducing the *Homer-Sleeping* meme to just a "bed" (Fig. 6). In the interview, he noted *"I think having, like, not just memes, but like, props ... sure, it's the bed from The Simpsons. I think any kind of bed could have done the trick..."* Here, the meme was deconstructed into a "prop"(bed), with less connection to the original cultural reference (*Homer Simpson*).

However, **AR memes are beyond the digital meme content, instead, they also include users and physical environment. All of them co-create the memes' visual form and meaning. This aligns with the definition of memes as "multimodal cultural artefacts".**[16, 53]. For example, in P21's case, the meme was not just the "bed", but included his acting of lying on it, as well as the shared contextual knowledge of the meme audiences (a friend who slept and missed an exam) (Fig.6). Furthermore, memes were originally defined as cultural "genes" that replicate and mutate specific behaviors [19]. This framework corresponds with how people use AR memes: **they replicate memes by reenacting scenes, or create mutations through improvisational performances and creative spatial references that generate new humor.** This keeps AR memes aligned with the definition: cultural replication and mutation[19].

5.3 How do people integrate and coordinate AR memes in F2F conversations using AR?

Due to the collaboration with speech and acting in F2F communication, memes with high narrative complexity could impair the conversation experience.

In Study 2, we found two meme integration in conversation: sequential and parallel. For the sequential pattern, we found that the most frequent integration was using the meme as a punchline (24/70), giving a short pause to let it speak for itself. To achieve this, participants often removed parts of meme content to give space to their own speech and acting (example can be seen in Fig.9-1,2). In contrast, in the parallel pattern, participants used memes as
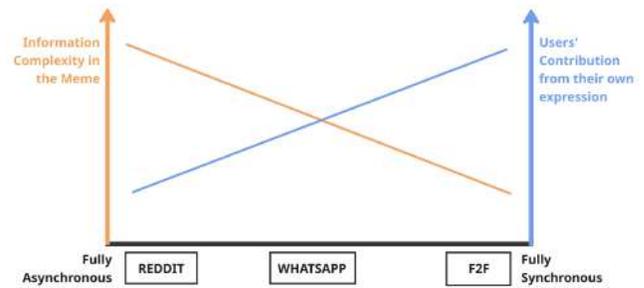

Figure 19: The level of information complexity in a meme and the role of personal expression shift depending on how synchronous the communication channel is.

a storyboard, relying on the full 2D template as a reference for narration (Fig.15), similar to how memes are used on Reddit.

To contrast these patterns, we map meme use across three media: online forums (e.g., Reddit), messaging apps (e.g., Whatsapp), and F2F conversations, along a synchrony dimension (Fig. 19). Online forums represent the most asynchronous context, where memes carry most information (e.g., complete template memes with captions). Messaging apps combine asynchronous and synchronous elements: memes are simplers (e.g., emotional reaction) because they are contextualied in conversational topic and chat timing. In F2F interactions, we argue that this trend continues: the digital component of AR memes becomes simpler, while users' contributions (acting, narration, physical environment) take on a larger role.

5.4 What can be considered a "good" meme in F2F conversations using AR?

Our finding on AR meme integration challenges our initial assumption that we can evaluate a meme purely on its digital content. When starting our research, we expected that we would be able to find the "best" type of memes for in F2F AR conversations. However, our findings indicate that this can not be answered in isolation, because users become an important part of the meme. So the question needs to change to *"What is a good integration of Memes in conversations?"*. Simple memes that seem suitable for F2F use can still be integrated poorly and disrupt the conversational flow, while complex memes can be delivered humorously. Our integration types (sequential and parallel) show two ways integration can succeed through effective collaboration between the meme and the user.

5.5 Prediction of Potential AR Memes We Might Use in the Future F2F conversations

We highlight two meme usage types that stood out in our experiment. This is not based on quantified metrics, as our study focused on overall meme usage rather than the impact of individual memes or visualisations. After observing multiple hours of AR meme interactions, these types emerged as notable: they contain minimal narratives, are easy for people to quickly understand, and do not disrupt conversational flow (subjective observation).

Spontaneously React with Face Swapping. In our study, memes were chosen to support participants in narrating their own

stories. However, some participants spontaneously reused or "misused" their memes to react to their partner, often through face-swapping. This led to genuine laughter and surprise at how well the memes fit. We believe face-swapping leverages XR's spatial capabilities, and when paired with a recognizable character expressing a clear emotion, it integrates smoothly into the conversation and often serves effectively as a spontaneous "punchlin".

Use Reaction Memes to Succinctly Express Complex Emotions. We also found that participants often used reaction memes to replace speech when expressing emotions, typically following a pattern like *"I was just like…"* and then showing a meme. For subtle emotions, reaction memes can convey meaning faster and more effectively than words, illustrating the saying *"A meme is worth a thousand words."* Integration was mostly done via face-swapping, allowing the memes to serve as punchlines.

6 Limitations and Future Work

We also realize the limition of this work.

First, although providing exemplar visualization options in Study 1 was necessary to guide ideation, it might constrain participants' thinking and anchored their ideas to examples. Our goal, however, was not to exhaustively explore all possible AR meme integrations. Instead, Study 1 focused on how users intgrate memes into F2F conversations for what motivations, and how fundamental AR visualization can support that. Future work could use generative visualization tools in XR (e.g., [25]) to broaden the design space.

In addition, in Study 2 we asked participants to prepare topics in advance, which might make conversations partially scripted. However, these prepared topics were icebreakers, participants were free to develop discussions from there. Additionally, having a prepared topic allowed the participants to already prepare appropriate memes and removed the factor of needing to search for appropriate memes in the moment. Our study does not focused on how meme search can be optimized, but on how memes are intergrated into F2F conversations, with regard to conversantional narratives and physical contexts.

Additionally, in Study 2, each participant had only three memes available during the conversation. Some participants indeed mentioned wanting to share more memes. However, unlimited meme choices could overwhelm participants as first-time users in our study, and distract from the conversation. Looking ahead, in future everyday AR, users will freely and real-time generate AR memes from web resources[25]. With larger meme sets, future research should explore contextually recommending memes using AI, building on work like emoji prediction [28] and meme-semantic modeling [27].

Lastly, current AR headsets block users' faces and affected conversation. To address potential bias, we included a control condition where participants wore AR headsets without using AR memes and found no significant difference between conditions. However, we envision that research on less intrusive AR glasses (e.g., Meta Ray-Ban)[59] and facial reconstruction(e.g., Apple Vision Pro)[13] could mitigate this issue.

7 Conclusion

In this paper, we investigate how memes can be integrated into F2F conversations through AR and how they influence conversational dynamics. We conducted two studies. First, we performed an online survey with meme users to explore their motivations and perceived challenges of visualizing memes in F2F conversations. Building on these insights, we developed an AR meme-sharing prototype and invited 12 pairs of friends to design AR visualizations of their own memes and use them inside a conversation. We identified three types of AR visualizations: *The-Meme-on-Me*, *Me-in-the-Meme*, and *Meme-as-Visual-Reference*. Analyzing participants' conversations, we also observed two integration patterns: Sequential and Parallel. Our findings show that AR memes include the user, their actions, and the environment into a composition, resulting in a new type of AR memes being integrated more seamlessly into F2F conversations.

Acknowledgments

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