Trinity: A Design Fiction to Unravel the Present and Future Tensions in Professional Informatics and Awareness Support Tools

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Figure 1: Trinity collaboration technology. From left to right: Trinity logo, Serenity, Affinity, Capacity

ABSTRACT

In recent years, companies massively invested in videoconferencing and awareness support tools to support hybrid forms of collaborative work. Current market solutions feature various augmentations of videoconferencing software based on tracked interaction metrics that fall short of meaningfully informing or reshaping collaborative work. Additionally, there are signs that personal informatics systems — widespread in the private sphere for health and well-being — might rapidly spread to the workplace. Our research posits that the confluence of awareness support tools, self-tracking systems, and AI is a compelling focal point. This paper uses design fiction to explore technology-enhanced collaboration. The starting points of the narrative are rooted in, and extrapolate, current trends and signals from a social, societal, and technological perspective. The fictional portrayal of the Trinity quantified workplace serves as a catalyst for thought-provoking discussions, offering a valuable lens for reflection on the trajectory of current technology development and supporting a discussion about the interplay between technological futures and sociological futures.

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CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing**.

KEYWORDS

speculative design, personal informatics, workplace, awareness support tools, collaborative work

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> Welcome to the machine.
> Where have you been?
> It's alright, we know where you've been.
>
> —"Welcome to the Machine," Pink Floyd, 1975

1 INTRODUCTION

Imagine for a moment that you are an office worker, surfing the web on the lookout for fresh tools to streamline your work routines and boost collaboration. Suddenly, something grabs your attention:

> *Our innovative AI-powered meeting technology uses well-established methodologies and proprietary models to assess both facial and verbal cues, including body language, facial expressions, and head movements. It also*

> *analyzes people's speech's pitch, volume, and tone, and takes into account the talk time. Additionally, our technology evaluates the overall verbal content (noting the use of positive or negative terminology) through natural language processing. This form of machine learning enables computers to grasp the meaning of human language. Our technology provides a scientific measure of the session's productivity, allowing the meeting participants to strive for a better meeting experience together.*

Now, pause and ask yourself: Is this a tangible reality or a product of imagination? As we embark on a journey into the realm of near-future design fiction around personal informatics (PI) at work and the tracking of collaboration, we invite you to explore the blurred boundaries between what exists and what is mere speculation aimed at unveiling tensions and opportunities around potential technological futures. The text above is, in fact, a slightly adapted description of a real product recently released on the market [76]. The advent of sensing and AI technologies, combined with the impact of the COVID-19 pandemic on work practices, has promoted the development of a myriad of digital assistants or coaches supporting (remote or hybrid) teamwork [41, 64, 76, 101]. According to a 2023 report by GMI [40], the collaboration software market size was valued at $16.1 billion USD in 2022 and predicted to register a compound annual growth rate of over 12% between 2023 and 2032 "driven by the increasing demand for enhanced productivity."

Simultaneously, the practice of self-tracking through PI systems — widespread in the private sphere for health and well-being — is making its way to the work environment [29, 37]. Similar to the personal sphere, these systems initially focused on health and well-being at work [17], but expanded progressively to other factors, such as productivity [24]. Their scope also expands from individual metrics only to more collective forms of tracking, for instance, through collective stress visualization [103]. While awareness support tools provided by the organization have been studied for more than a decade [59], collaboration is still considered a key success skill of workers in the 21st century. It would thus be no surprise to see individual workers or teams willing to self-track it and "improve" it. The convergence of these societal and technological circumstances is an interesting focal point, which constitutes the basis of the *Trinity* design fiction presented in this paper. Emerging advanced technologies, evolving economic and political circumstances, and challenges like the COVID-19 pandemic are significantly altering the way people work [15]. The Human-Computer Interaction (HCI) community is positioned at the heart of this transformation, exploring the future of work [11, 15, 23] and advocating "for the technological infrastructure of work to be better supported, designed, and researched" [69].

In this paper, we use design fiction as a "tool for thinking" [92], expressing and challenging attitudes, societal values, and ethical implications relating to PI and awareness systems at the workplace. The resulting fiction is a narrative accompanied by design artifacts and a company brochure (Appendix A), which contributes to an engaged reflection on the opportunities, challenges, and tensions for the future of collaborative work. Trinity provokes discussions, provides a lens for reflection on current technology development, and opens avenues for future work in HCI.

2 RELATED WORK

2.1 Awareness Support in Collaboration Technology

Technologies in the workplace have been a key focus of the Computer-Supported Cooperative Work (CSCW) community. Notwithstanding the mode of cooperative work (face-to-face, remote, hybrid, synchronous or not), awareness is a central element of collaboration [32, 59]. As a process, collaboration involves "multiple individuals who combine their efforts to achieve mutually desired states or outcome" [8]. In this context, awareness refers to the display and monitoring of information essential for coordinating collaborative efforts [84]. It is a part of the skilled practice of collaborators [84], and the field of CSCW has long recognized the challenge of supporting it through collaborative technologies. A recent review of awareness support implementation in collaborative technologies identified five dimensions of awareness: contextual, collaboration, situational, workspace, and historical [60]. In our design fiction narrative, we explore tangential aspects of tracking — and providing awareness of — collaboration experience.

CSCW is mindful of the impact of technologies once implemented. Bringing technology into the practices of people requires some sort of work conceptualization, modeling, and quantification, and thus some aspects of it become more visible or invisible than before [90]. The struggle for "the right level of visibility" is "one of tradeoffs and balances, not absolutes and clear boundaries." [90], p. 24. Our narrative brings about the tensions surrounding the quantification of collaborative work, in a way making a parallel to the infamous "executive jacket" [7], which was tracking all aspects of creative work to reach an overly detailed cost calculation.

As videoconferencing becomes a prominent mode of work for knowledge workers, there is a growing drive to "optimize" this mode of collaboration. This usually refers to enhanced productivity, although we see some declared attempts to account for workers' well-being [3, 45]. Various augmentations of videoconferencing software are proposed both in the research community and in the commercial landscape. The feedback on the meeting experience is provided based on speech time or characteristics (see Second Messenger [22] and Microsoft Speaker Coach [64]), communication patterns (see GroupMeter [50], Meeting Mediator [47], CoCo - Collaboration Coach [83], TeamSpirituous [3], and Read.AI [76]), facial expressions (see CoCo [83] and Read.AI [76]), back-channel communication (see MeetCues [1]), or self-reported measures (see Empathosphere [45]). The feedback is provided in real-time or post-hoc, on a group or individual level, in the form of a dashboard or a chatbot, with interpretation by the tool on varying levels from mirroring to coaching [86]. In our fiction, we explore the role of awareness support in the form of collaboration agents acting as PI systems at the workplace.

2.2 Personal Informatics at the Workplace

PI focuses on systems that "help people collect personally relevant information for self-reflection and gaining self-knowledge" [51]. The scholarly literature on PI is prolific [24] and describes the many benefits of self-tracking: individuals gain insights into their activities, behaviors, and feelings, reflect on them, and can

use them as leverage for change [12, 25]. Although self-tracking expands into mainstream practice in the personal sphere (mostly for health and well-being), the office environment remains a relatively under-explored area of study. Among the most frequent domains of investigation and metrics in the PI literature, only productivity refers explicitly to the workplace in the systematic literature review by Epstein et al. [24] (representing 27 out of 523 publications). The tracking of health and well-being at work (e.g., break-taking, physical activity, posture, or hydration) — often under the lens of behavior change — is addressed in scholarly work, as evidenced by the scoping review of Damen et al. [17]. In this domain, a few studies focus on collective initiatives around self-tracking. Rivera-Pelayo et al. [79] explored mood self-tracking in call centers. They found that "sharing of data achieved cohesion in the teams as well as empowerment of employees" and "positively affected the communication between managers and call takers," ultimately leading to measurable work improvements according to Key Performance Indicators (KPI). Xue et al. [103] study on collective stress at work shows that a shared visualization "enriches the reflection, and evokes more inter- and intra-personal reflections."

While PI systems have the potential to facilitate critical reflection and awareness of work practices [63, 97], prior work on self-tracking at work emphasized challenges related to privacy and ethics [37, 46]. Meyer et al. [63] offered design recommendations for self-monitoring in the workplace, emphasizing the need for actionable insights and collaboration improvement. Placed visibly in a social context like the work environment, self-tracking potentially triggers changes in social dynamics and communication [39]. Advocating for a dissenting voice to existing system-driven technologies, some authors have explored the use of open-ended sensor kits to empower office workers to track their working habits freely [95, 97, 98]. Interestingly, a similar sensor kit has been proposed to track collaboration experiences in the domain of education [93].

2.3 The Value of Design Fiction in HCI

In HCI, design fiction is used as a strategy to explore the design, potential impact of future technologies [5, 6, 78], and the cultural and political roles technologies play today [87]. It harnesses the power of speculative design thinking to holistically imagine how ideas from the present would manifest in the future [53]. This method enables designers to remove the constraints from the commercial sector that define normative design processes, providing access to inner felt aspects of user experience [61]. Design fiction can be a valuable tool for unveiling tensions by encouraging reflection about the potential downsides or social impacts of technology, creating fictional studies to provide space for critique, and illustrating the importance of forward-thinking ethical considerations [72].

Design fiction has been used in HCI to explore possible futures and understand the potential impact of technology in a myriad of domains, such as healthcare [70], education [20], human-robot interaction [85], or sustainability [35, 49, 99] to only name a few. In recent years, several publications have featured design fiction to address research topics related to the future of work. Linder et al. [52]'s fiction looks at work-life issues for information work in the future — on Mars — to glean insights into the structure of work, stressors, work-family communication, and the role of automation for work. By contrasting these insights to the challenges workers faced during COVID-19, the authors show how both the pandemic and Mars created stressful environments due to a more distributed workplace, cramped living areas, and the need to take on multiple roles. They discuss how new strategies integrating AI and clearly defining work/non-work boundaries can better maintain productivity and well-being for the present and the future. Another design fiction provides a glimpse into the future of fashion resellers who use online marketplaces with automation to highlight future tensions regarding work and automation [65]. Similarly, Alvarez de la Vega et al. [2]'s design fiction portrays a freelancing platform and highlights opportunities and considerations for designing systems that further enable freelancers' work autonomy, entrepreneurial development, and peer support. Last, through a fictional digital platform, Holten Møller et al. [38] look at unemployed individuals who are still "working" to reflect on tensions related to data property, accountability, and agency in public services.

Fiction around the future of work has also taken the shape of design fiction probes and fictional artifacts. Following the tradition of the Ikea catalog of the future by Brown et al. [9], these "material objects help tell stories about the future" [36]. The Office Jungle [18] is a critical and speculative vision of a future office environment that encourages physical activity by embracing wildness. Its massive suspended geodesic structure allows people to experience new ways of working and question the static posture imposed by the office technologies we use. As a critical design to challenge self-tracking at work and normative assumptions around a "healthy workplace," the *Office Agents* by Stamhuis et al. [89] feature five sensing *Objects with Intent*. These inspired the present fiction.

3 RESEARCH OBJECTIVES

Working on technology-enhanced collaboration through awareness support tools and self-tracking, we have sought to embed some of the tensions unveiled through our research in a design fiction. This speculative method is primarily used here as a "tool for thinking" [92]. The starting points of the narrative are rooted in, and extrapolate, current trends and signals from a social, societal, and technological perspective. As a contribution, the tensions elicited and illustrated by this fictional "quantified workplace" [62] reflect both potential opportunities and key challenges for the future of collaborative work. They provoke discussions, provide a lens for reflection on current technology development, and open avenues for future work in HCI. Following Tanenbaum et al. [92], we believe that the design fiction format contributes to *engaging with consequences*, "forcing us to think about the interplay between technological futures and sociological futures."

The resulting Trinity design fiction is a narrative accompanied by design artifacts and a company brochure (Appendix A). It draws inspiration from speculative design artifacts in a work context (such as the office agents by Stamhuis et al. [89]), IoT products as agents [14], open-ended self-tracking devices [19, 93, 98], and PI research at the workplace [37, 39, 46, 77]. It embeds theoretical and empirical research findings around meaningful collaboration metrics [58]. Some of the artifacts presented in the Trinity fiction have been materialized and used by the authors during the writing of the fiction, combining research-through-design [106] and role-play.

4 METHOD

For this research, we developed the original design fiction *Trinity*, composed of a short novel (Section 5), a company brochure (Appendix A), and prototyped artifacts. The Trinity design fiction was designed through a collaborative and iterative process that mainly aimed to express and challenge attitudes, societal values, and ethical implications relating to PI and awareness systems at the workplace.

Research-based inspiration. We based our explorations on prior work around workplace (self-)tracking [37, 46, 58, 97, 98], collaboration technologies, and awareness support systems [22, 32, 47, 50]. This was complemented by a benchmark of commercial awareness support tools [41, 64, 76, 101], which were critically discussed with regard to the relevance, meaningfulness, and transparency of the metrics they rely on. The classical tensions between productivity, individual well-being, and teamwork values were an interesting starting point when reflecting on the future developments of self-tracking systems and awareness systems. We drew inspiration from the speculative and critical concept of Office Agents by Stamhuis et al. [89], featuring a set of five sensing *Objects with Intent* [82] aimed to trigger debate and collect insights into the use of sensor data to improve the health of office workers. In particular, we reflected on the contrast between the bossy productivity agent — who wants to keep the office worker at their desk — and the physical activity agent who joyfully attempts to promote well-being at work. A third one, the noise agent — for whom silence is golden —- embodied social tensions around work. We started by conceptualizing what sensor-based agents of collaboration would look like.

Initial conceptualization. At this stage, we extensively discussed the potential sources of data that each Trinity Agent would be interested in tracking to inform their main drive. The characteristics — or personality traits — of each agent were an insightful part of the ideation. Stamhuis et al. [89]'s actor-network representing the interactions and interdependencies between the five Office Agents was an inspiration to ideate on the collaborations and tensions between the Trinity characters.

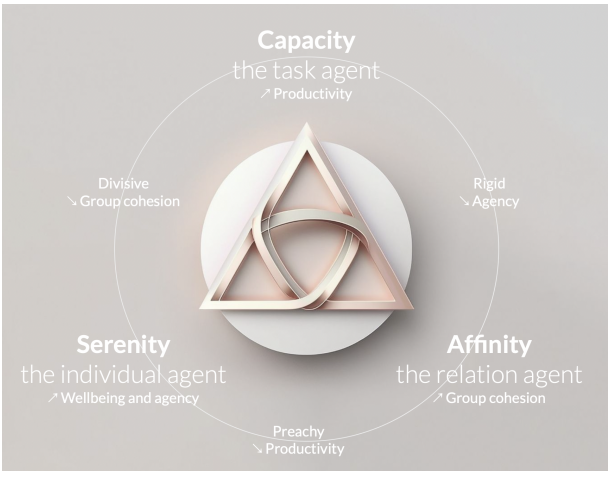

Figure 2: Interdependencies between the Trinity agents

Materializing the Trinity. Following a research-through design process [106] to envision the agents through materiality, we first used low-fi prototyping and Lego bricks to individually represent each agent of the Trinity based on our main expertise and vision (Figure 3). This stage supported insightful debates around the main characteristics and dependencies between the agents (Figure 2).

Figure 3: Initial ideation of three Trinity concepts

The collaborative writing process of the narrative (Section 5) involved continuous discussions and negotiations around the research topic and the speculative features of the story. As we unveiled points of tension and opportunities, we took note of our main insights and questions in a research diary, which constitutes a basis of the points we discuss in Section 7. The choices we made while editing the narrative reflect our positionality as design researchers [48] (Section 6). We used the AI Art Generator Midjourney as a support to visualize the Trinity world and compile the company brochure, inspired by the iconic Future Ikea catalog [9]. Refining the prompts progressively to reach a suitable vision for the agents involved reflection in action and triggered additional insights. Finally, we modeled and 3D-printed snippets of the concepts (e.g., Serenity, Figure 4) to bring them to the real world and experience them. We also experimented with measures of collaboration and group-level self-tracking based on sensor inputs using Arduino components.

Engaging with the real world. As Kozubaev et al. [48] highlight, design futuring does not always require a direct or active form of participation from target audiences or stakeholders. The authors, however, encourage us to think about how speculative work engages with and ultimately impacts the real world. In our case, a simple engagement took the form of presentations of the fiction to fellow office workers, followed by informal conversations. Section 8 presents ideas to involve users and stakeholders in future work.

Figure 4: Prototyping the design fiction probe of Serenity

5 THE DESIGN FICTION: TRINITY

Prologue

As the COVID-19 pandemic hit, companies massively invested in videoconferencing and collaboration awareness tools to support teamwork. While consumer-based tracking technologies were widespread in the private sphere — mostly for health and well-being — companies rapidly spotted an opportunity to extend the "quantified-self" movement to the workplace. This fulfilled the needs of workers willing to optimize and prove their added value, as reports by the World Economic Forum estimated that Artificial Intelligence (AI) would replace some 85 million jobs by 2025 [105]. In 2025, the global workplace tracker market exhibited a stellar growth of 25%. By 2026, 87% of employees were using a device to track their productivity, monitor their work environment, and reflect on their experiences. Two years later, the Trinity technology revolutionized work practices.

Tuesday, November 21, 2028

"Congrats team. You did such a great job."

"Thank you, we couldn't have done it without you."

"Of course not. Let me run analyses to optimize things further for the next project."

As they left, another voice called, "Noah, could you stick around for a sec?" Noah turned around, nodding, "Sure."

"Is everything okay with you? You seem a little off, somewhat 'misaligned' with the group most of the time."

"Oh, really? I'm fine. It was a great collaboration. Thanks for checking in, Affinity."

Friday, April 28, 2028

Hey there, and welcome to the TechWork podcast, episode 63! Today, we're going to be digging into a hot new sensing technology that's gonna make teamwork way easier. You've probably heard about it already 'cause it's been all over the internet since a few leaks came out last month. It's called Trinity. What's the deal with that name? Well, we're gonna find out together 'cause we just got our hands on a box! And let me tell ya, this thing is super shiny and exciting. Inside, there are three devices: Serenity, Affinity, and Capacity. Each one has super-advanced sensors that can track all sorts of things about your work environment and collaboration. And that's just the start! Next episode, we're going to have a special guest who's gonna give us the lowdown on the technology that makes Trinity so revolutionary. Don't miss it!

But first, let's take a closer look at what's in the box. This little guy here is Serenity. It's a wearable — or perhaps I'd say an "aware-able" — that can monitor and make you aware of all sorts of things about your well-being, like your heart rate and stress level. It also has speech-emotion recognition. You can customize it to fit your style or the company's style, and there are many options to choose from. I've got the pendant version, but there are other styles, too. Next up is Affinity. This one is all about group cohesion and alignment. It tracks each team member's mood and engagement levels and gives insights into how well the team is working together. Basically, it helps you identify tensions and work together to resolve them. Last but definitely not least is Capacity. This one is a big boy because it's more of a company-wide device. Like the mastermind of productivity. Capacity tracks your progress on each project and gives insights into potential risks or delays. Alright, folks, so that's Trinity — the latest and greatest sensing technology for collaboration in the workplace. With Serenity, Affinity, and Capacity, you can monitor your well-being, team cohesion, and project progress. They say it's a real game-changer. But you might be thinking, "What's so different about Trinity compared to the tracking tech we've had for years at work? Well, you'll have to tune in to our next episode to find out! Thanks for joining us today on TechWork's unboxing episode.

Thursday, February 15, 2029

"Good morning, Noah."

"Morning, Serenity. I didn't sleep well, did I?"

"Good awareness, Noah. Your deep sleep cycle was disrupted twice; this happened last Thursday, too."

"Right, I remember…I was completely out of sync with the team that day, Affinity scolded me. What are my options for today?"

"Your best bet is to trust your team, follow the flow, and be an active listener. You're vulnerable, so conflicts today are 40% more threatening to your psychological well-being. Also, between 10 am and 3 pm, there's a 79% probability that you won't be very productive. Shall I reschedule your brainstorming session?"

"Oh… Capacity won't be happy. What should I do?"

"It's your call, Noah."

Tuesday, June 12, 2029

"Ready for check-in, team?"

"Yes, we're all here, Affinity."

"That project review didn't go well, did it?"

"No." — Noah chimed in — "I don't think we're all on the same page about what's important. It's cool to have different goals, but as a team, we need a clearer vision of where we're headed. Otherwise, we're just Brownian motion. Perpetual, yes, but pointless. Serenity aside, I'll be up to putting in some extra effort. Could we simply redefine our team's collab' metrics to some more meaningful endeavors?"

There was an awkward silence in the room.

"Wow, lots of unspoken tension in the air." Affinity broke the silence, its voice dripping with irony. "How about you all send me a mental note about how you feel about the project review? We'll have an alignment session later to work things out. We do have some rules to follow, but there is still some wiggle room for you as a team to exercise your own judgment and make choices."

Friday, May 5, 2028

Hey there, it's Nic, and you're listening to the TechWork podcast, episode 64. Today, we have a special guest, Darya Fraser, AI expert. You folks might remember the Trinity tech kit leaks from Artemis Inc. in April. It was kinda creepy, right? So, Darya, can you tell us what's really behind the Trinity tech kit?

Darya: Of course. Trinity is a revolutionary technology that creates a digital replica of a team, which is constantly updated with real-time data from Serenity, Affinity, and Capacity. This AI-driven digital twin uses advanced machine learning algorithms to analyze the data and predict how well the team is working together.

Nic: That's fascinating. How does the algorithm work? Who even defines what a good collaboration is?

Darya: The algorithm looks for patterns and correlations in the data from Serenity, Affinity, and Capacity. So, let's say Affinity detects a drop in group cohesion, the algorithm can analyze the data from Serenity to see if there's a correlation between individual stress levels and the drop in cohesion. Based on this analysis, it can make predictions and recommendations. The more data it collects, the better it predicts and optimizes team performance.

Nic: That's impressive. But some people might find it a bit creepy, right? I mean we all know how digital twins are used for criminality detection in certain countries.

Darya: I understand. First, remember that the data collected is voluntary and customizable. Users are free to opt in or out. Additionally, Artemis Inc. guarantees that the digital twin complies with the GDPR'25 regulation about privacy. It aggregates data at the team level and doesn't reveal individual information unless authorized by the user.

Nic: That's good to know. So, what are the potential drawbacks of using Trinity?

Darya: Well, one potential drawback is the need for a high level of trust and transparency between team members. The digital twin relies on real-time data from Serenity, Affinity, and Capacity, so it's important that team members feel comfortable sharing their data and understand how it's being used.

Nic: Amazing. It's an exciting time for technology and collaboration, and I can't wait to see where it takes us.

Thursday, July 12, 2029

Myler: "Capacity? hey we're running late on the rollout. Can you give me a risk management overview?"

"Yes, Myler. The weakest spot is the task dependency between deliverables BN and Kappa; it can delay the rollout for three weeks. I would suggest reallocating Noah to another branch." "I see. Sounds good," replied Myler.

Affinity intervened: "Do you want to review the communication brief for this, Myler? Or do you feel confident you'll be able to communicate this decision to Noah without damaging your mutual trust?"

"Thanks, Affinity. Our last coaching session was super helpful, and I feel confident now. I appreciate you checking in."

Thursday, May 24, 2029

"*twin*-Noah. Run scenario 24. Six months forecast."

"Processing your request, Trinity. Scenario 24. Six months forecast. Prediction: with the current SAC (Serenity-Affinity-Capacity) distribution, Noah will come into full conflict with company values and burnout. Scenario 25 suggests that an increase of Serenity by 20% will keep them afloat for another three months. According to corporate computations, we will enter the risk zone in five months, and shareholders will be notified."

Monday, September 10, 2029

"Ugh, I hate those feedback sessions," Jay said, "I can never seem to strike the right balance between being diplomatic and getting my point across. And if I'm not careful, I look rude." Myler chimed in, "Yeah, I hear you. Serenity tries to help me with that, but sometimes it's just not enough. And then there's Affinity, warning me about…." Noah strained

to hear the end of Myler's sentence over the sound of the coffee machine.

Myler continued, "Yesterday, Affinity told us that what matters in collaboration is how much emotional resonance there is between us. It said there's an 85% threshold to be met for optimal collaboration. But who set that up?" Jay interjected, "Yeah, that metric just doesn't make sense." Myler shrugged, "Maybe it doesn't make sense for us, but for someone else…."

Noah shivered and instinctively covered Serenity.

Tuesday, October 31, 2029

twin-Noah. Run scenarios 1 to 24. Six months forecast.

Processing your request, Trinity. After insignificant oscillations, the scenarios converge into one perspective: with the current SAC distribution, Noah is on track to burnout in two months. Scenario 25: an increase of Serenity by 20% will make them resist for four more months. The data, however, shows inconsistent behavioral patterns, reducing the confidence level of the model. According to corporate computations, a hiring freeze will be rolled out in five months. Scenarios 1-24 are thus more optimal: we onboard the replacement before the hiring freeze.

Wednesday, November 7, 2029

"Riley, can we have a word?" Noah stopped Riley in the hallway just as the sprint review ended. Riley couldn't wait to debrief with Serenity about the meeting. They always bounced ideas off each other to ensure they developed Riley's best potential. She finally felt so at peace. Before the Trinity era, she was overworked and struggled to handle the demands of her job.

"Is it S-urgent, A-urgent, or C-urgent?" Riley asked with a grin. The team recently developed code names inspired by the Trinity artifacts' initials to signal the level of urgency for a conversation.

Noah shook their head and gestured as if they were taking Serenity off. Riley knew this couldn't wait and nodded. They needed a private space to speak.

"I came to say goodbye," said Noah. "Thank you for your support during the past months. I know it was authentic, not some sort of an Affinity trick." Riley raised an eyebrow. "What are you talking about?" "Well," said Noah, "I don't need Affinity to be a good friend and come clean. I wasn't entirely honest with you. I didn't just stumble upon this company by chance. I just wanted to see it for myself. I'm glad I've got to know you either way."

Riley's mind raced as she tried to make sense of what Noah was telling her. Yet her peaceful existence at the company felt already disrupted. What would Serenity say?

Epilogue

Trinity's adoption drove performance growth and competitive advantage for companies. Soon enough, the market was flooded with competitors' products. The definition of meaningful collaboration was set by the standards of these companies. Thresholds and predictions guided people's choices. Many felt relieved to finally be supported in finding a satisfying balance at work. Before the Trinity era, optimizing one's productivity while making team workers happy and engaged in healthy collaborations felt like an impossible endeavor. Burnouts were rampant in the workplace. The traditional view was that work-life balance was something that individuals had to manage on their own. Despite the cost of burnout, companies were slow to respond to this growing problem. As with every major technological advancement, collaboration agents made their way into the language and everyday rituals. To prompt a "no egos" altruistic conversation, you would say, "*Serenity aside*, let's consider…," or gesture as if you were taking off your pendant. *Affinity aside* was used when one would run the risk of hurting a teammate's feelings by prioritizing one's well-being or the group's productivity. Some individuals and teams still held on to the belief that true collaboration required more than just the use of advanced technology. They refused the social pressure to surrender to the machine. They pushed hard for a return to genuine human interactions, advocating against the widespread adoption of Trinity and other similar technologies. Protests and awareness campaigns were organized to inform people about the misuse and dangers of collaboration agents, in particular, the unregulated definition of standards by big tech companies. Grassroots initiatives and communities prioritizing face-to-face interactions and human connections over digital ones were launched.

6 AUTHORS STATEMENT

We have worked on incorporating tensions identified through our research into this fiction, with a focus on technology-enhanced collaboration facilitated by self-tracking and awareness support tools. The audience we address in the fiction is teams of office/knowledge workers. The narrative is rooted in and extrapolates from current trends and signals from social, societal, and technological perspectives. Needless to say, we do not endorse the technology described as a useful or worthwhile future. As a tool for thinking [92], the fiction contributed to deepening our reflections about this timely topic. From a social and societal viewpoint, particular focus points revolved around: (a) the definition of collaboration as an essential 21st-century skill, along with critical thinking, creativity, and communication, (b) care for well-being at work and discussions around meaningful work and the fulfillment of psychological needs [54], (c) psychological safety as a basis for successful collaboration. On the technological side, we considered the following trends: (a) the rapid growth of awareness support tools and their integration into hybrid work solutions, (b) the success of consumer-based tracking technologies and the progressive extension of the quantified self from the private sphere to the workplace, (c) the underlying extensive use of data in the design of current technological solutions.

In their third mode of reflection for design futuring, entitled "Positionality: Futuring from somewhere," Kozubaev et al. [48] invite researchers engaged in speculative work to reflect on their positionality. As they state, "Placing technologies in the future does not relieve one from understanding the broader systems in which technologies are made and used, and the politics of those systems." To inform the readers about the "somewhere" from which our design fiction originates, we hereby reflect on our position as designers-researchers producing this work.

As a team, we represent a diversity of cultural backgrounds, yet we all work and live in Western countries. As knowledge workers, the topic addressed in this work deeply resonates with our professional activity. The first author has used speculative design methods in several projects related to the office environment. Their main drive and attraction to futuring as a method in this context mainly relates to: (a) the particularly difficult endeavor to challenge the status quo in office work, (b) the discrepancies between scholarly work and industrial development of collaborative technologies, in particular in terms of values and ethical commitments. The team has faced this second challenge while working on an international project involving an industry key player in collaboration technology. As authors, we also overall take a critical look at PI systems. While these have the potential to create value for the users, they also tend to perpetuate normative thinking by setting standards through the scenarios they support or exclude, and the derived metrics they use [4]. Similarly, our view on awareness support tools revolves around the meaningfulness and worth of these tools for the workers, with a particular well-being angle.

Anecdotally, working on this design fiction has had a long-lasting impact on us. In the weeks following the creation of the fiction, we often referred to things by using one of the agent's viewpoints. We regularly commented on the imbalance of one of the three aspects represented in Trinity (productivity, collaboration, or well-being) in our work by impersonating or imagining how the related agent would "judge" us. We also kept thinking of meaningful measures to track collaboration at work, and the underlying values involved in group-level tracking and the development of awareness systems.

7 DISCUSSION

As emphasized by Wangel et al. [100], images of the future resulting from design fiction studies can be used as a basis for further analysis and discussion. We invite the readers to use our fiction to think through some of these configurations of tensions and opportunities. In this section, we provide anchor points elicited by the fiction, purportedly presented in the form of questions or provocations. We ground these discussions in the literature.

7.1 The "Measure" of Collaboration: Validity, Agency, and Privacy

The core idea of the Trinity fiction revolves around the experience of (self-)tracking at the workplace. As a provocation and invitation to the community to reflect, we explored key tensions related to measuring and optimizing collaboration. The key character Affinity represents this facet. As a computing system that needs to be programmed to gain insights into collaboration via sensing inputs and pattern detection, Affinity provokes debates around the "measure" of collaboration, and the design of awareness support tools.

7.1.1 To measure or not to measure collaboration? Can such complex social processes be quantified? How do we translate areas of interest or meaningful experiences into actionable measures that can be tracked using technology? How do we avoid the reductionism of the measure? As self-awareness has been shown to play an important role in the quality of collaboration, supporting people to better understand, and perhaps regulate, their collaboration experiences can appear as a promising endeavor. Yet, is the (assisted) measure of collaboration desirable, and what are the benefits, challenges, and limitations that can be encountered? Might the usage of sensors as a communication/awareness intermediary between humans disrupt the recursive social inference?

The drive to address collaboration challenges or "optimize" collaborative processes is not a new topic in HCI [33, 34]. Yet the ambition to measure or quantify such complex social processes poses both intriguing possibilities and tremendous challenges [7, 16, 31, 90]. The Trinity technology, with its components Serenity, Affinity, and Capacity, offers a fictional example of how a quantified workplace [62] might be realized and supports reflection about the ethical and social implications of similar technological futures.

The benefits of such technologies lie in their potential to provide real-time feedback and actionable insights into a team's collaboration. As studies suggest, self-awareness plays a key role in good collaboration [21]. For instance, interventions can be made to enhance productivity and well-being by identifying misalignments or stress points within a team. Despite some research on tools, dashboards, and visualizations to measure collaboration [75], it remains clear that quantifying collaboration is a challenging endeavor [58]. Samrose [83]'s research question "How can a machine capture and measure the complex group discussion dynamics?" resonates with our reflection. And yet, the current industry push evidenced by the market release of various awareness support tools focusing on meeting or collaboration dynamics [41, 64, 76, 101] shows that the question is not anymore "to measure or not to measure collaboration?" but likely how to develop meaningful tools supporting collaboration that better acknowledge the reality of work practices, maximize added value for the workers, and minimize harm factors. As major societal changes occur, such as the development of remote or hybrid forms of work, Newbold et al. [69] suggest that the role of HCI is to examine ways in which our workplace technology may facilitate better transitions to "new normals of work."

Collaboration is a skillful practice requiring articulation work [91], which typically stays unwritten and off-track. CSCW research is preoccupied with the tensions surrounding its visibility and invisibility. Its absence from the commercial technology's vocabulary [10] has been criticized recently. Prior work has shown how an abundance of technology at work may negatively affect employees [71]; introducing additional technology in the workplace to measure collaboration may disrupt natural social interactions. Relying on sensors and AI as intermediaries in communication may hinder the social inference processes that are intrinsic to human collaboration. There is a risk that the organic, nuanced aspects of teamwork could be overshadowed by the data-driven insights, potentially leading to a depersonalized work environment.

The potential disruption of social inference by using sensors as communication intermediaries is also of concern. Human interaction is deeply rooted in social cues, emotional intelligence, and unspoken understandings, which are difficult to capture through digital means fully. Human-robot literature has shown us how important these unspoken social cues are for collaboration between humans and technology [81]. The narrative around Noah's experience with Trinity illustrates this tension, showing both the utility and the limitations of relying on digital tools for enhancing collaboration. The design fiction by Busboom and Boulus-Rødje [10]

reflects on the strive to delegate certain invisible aspects of coordination work to technology.

7.1.2 Agency. Who holds the authority to define collaboration metrics and standards? As emphasized by Lushnikova et al. [58], defining what meaningful collaboration aspects to track is challenging. In a context where employees rarely have access (nor awareness) of the data collected at their workplace [13], how might we empower employees to explore and make sense of their collaboration experiences? While tracking technologies are often marketed with predefined applications, is there an opportunity for more open-ended and user-driven solutions?

Our example narrative gives insight into a critical tension: determining who holds the authority to define collaboration metrics and standards. During the team check-in, Noah requests to redefine the team's collaboration metric to address the misalignment of their goals. Yet the story slowly hints at another reality, uncomfortable and not entirely user-driven. It raises questions about the locus of control in setting these new collaboration tracking standards. Traditionally, the choice of workplace tracking metrics involves several stakeholders [29]; they may be defined by the technology developers and configured by administrators — under the direction of upper management, often with little input from the employees who are directly impacted by these technologies. This trend seems to be dominant in current products on the market, which embed pre-defined "collaboration metrics" [41, 64, 76]. This top-down approach risks overlooking the nuanced needs and preferences of the workers — potentially leading to a misalignment between technological capabilities and user requirements — opposite the goal of worker-centered design [27].

The scenario where the Trinity technology becomes a standard for defining meaningful collaboration further underscores the power dynamics at play. The standards set by such technologies may not universally apply or be beneficial, as seen in the team's struggles to align with the metrics set by Affinity. This highlights the potential for technology to dictate the terms of collaboration, possibly marginalizing those who prefer — or perform better under — different conditions.

Additionally, the hierarchy of job roles could limit workers' ability to reflect or act on data given by a collaborative workplace tracker [43] or even meaningfully consent to such tracking technologies in the first place [13]. Pushed forms of self-tracking are already being used in the workplace, with financial incentives and the importance of contributing to "team spirit" [57, 67]. On a related note, the design of PI tools reflects the assumption that their usage should be continuous, and breaks in usage are a sign of an imperfect design [25]. However, Gorm and Shklovski [30] shows in their longitudinal study that self-trackers sometimes pause the usage out of care for themselves — for instance, when they know they would not achieve the prescribed goals. If PI tools are inscribed in the work rituals, how might this tension between the necessity to care for oneself and adhere to the norms play out? Open-ended sensors, giving users agency over what and how they track collaborative practices and experiences, have been suggested to support meaningful self-tracking practices and the psychological needs for stimulation, autonomy, and control. Earlier empirical work even suggests that self-tracking has been used by employees as an empowerment medium to bring evidence to management about work conditions issues [97]. These PI systems are usually based on the principle that the data tracked stays within the control of employees [95, 97, 98] to safeguard privacy.

7.1.3 Privacy. How can self-tracking at work be empowering rather than a medium of control or surveillance [37]? Previous work emphasizes the influence of privacy concerns on the intention to use tracking devices [37, 46]. If normative contexts such as the workplace call for a critical integration of ethical perspectives in the conception and use of the system, how do we anticipate potential adverse uses or unintended consequences?

Previous work by Lupton [56] acknowledged that users may not always perceive monitoring devices positively, indicating that there can be challenges and negative experiences associated with self-tracking technologies; they may even be considered "annoying" or "irritating." The presence of workplace trackers may have the unintended consequence of being more of an annoyance than a valuable asset to the team. Examining tracking beyond the individual, Epstein et al. [24] highlight that "opportunities for supporting tracking beyond the self can undermine people's privacy and sense of control over their lives and their data." Implementing collaborative tracking in the workplace indeed carries risks to employee privacy and autonomy [37, 46], a concern also acknowledged in the report on employee monitoring and surveillance for the European Union [26]. Open discussions about ethical considerations and potential unintended consequences are necessary to mitigate these risks. Meyer et al. [63] suggest that increasing self-awareness about productivity at work through self-monitoring can improve the productivity of knowledge workers. But what happens when self-monitored data is made available to teammates or managers via a tracker like Trinity? In Meyer et al. [63]'s study, "participants feared that sharing data with their managers or team members could have severe consequences on their employment or increase pressure at work." While tracking devices at the workplace may offer valuable insights, they also pose risks of surveillance [37, 42], over-reliance on technology for social cues [104], and the potential erosion of trust among team members if not implemented with careful consideration of these factors. This discussion — and Noah's interactions with the Trinity devices from our narrative — is meant to bring these issues to the forefront for consideration in future workplace tracker design.

In their paper, Richardson and Mackinnon [77] argue against viewing self-tracking challenges solely through discourses of power or empowerment. Quoting Van Den Eede [96], the authors emphasize that the more pressing question concerns "how our relationship to our tracking activities takes shape within a constellation of habits, cultural norms, material conditions, ideological constraints". In the next section, we will discuss the implications of using the group as a level of analysis in self-tracking.

7.2 The Group as the Level of Analysis in (Self-)Tracking

Tracking collaboration experiences inherently brings forward the group as the level of analysis. Keyton [44] defines the group as "three or more people who work together interdependently on an

agreed-upon activity or goal." Focusing on self-tracking on a group level opens new research questions in the PI domain and is currently an underexplored area.

7.2.1 Level of analysis. What are the individual, social, and organizational implications of using the "group" as the level of analysis for (self-)tracking? As PI is inherently focused on the individual in the data collection stage, studies documenting group-tracking initiatives are scarce, often reducing the group to an aggregation of individuals. Can group tracking be more than an aggregation of individual tracking metrics?

Self-tracking is traditionally focused on the individual perspective. Individuals self-track their behaviors and experiences using goals and metrics meaningful to them alone. Tracking as a social activity — which we refer to here as group tracking — is rarely addressed in the PI literature [24, 68]. When looking at groups, PI mostly reflects a conceptualization of the group as a collection of individuals [57] rather than one entity. Yet, as highlighted by Toebosch [93], applying self-tracking to collaboration, where team members' experiences are interrelated, requires "to gain insights into what it means to track as a group." Recent publications on "family informatics" describe "a family-centered approach to tracking where all family members participate in and benefit from tracking" [55, 73, 74]. While not all insights are transferable to the context of work, similar to workplace collaboration, family informatics involves coordinating tasks, sharing information, and supporting each other. Group-level tracking can bring opportunities to overcome some of the risks associated with a quantified workplace, for instance, the lack of agency when the management implements metrics without consulting employees or the social comparison amongst peers [93]. Pina et al. [73] explore the move from a rigid tracking boundary (parents tracking their children's health) to a diffused model (children and parents tracking together). This stimulates collaboration and shared responsibility.

Regarding metrics, group-level tracking presents the challenge of moving beyond the common aggregation of individual metrics. For instance, to represent collective stress at work, Xue et al. [103] aggregated individual stress-related measures into a collective visualization. In the fiction, Affinity mostly evokes the idea of "group alignment" as a true group-level metric. In this concept, the individual scores do not matter as much as the correlation between them. Practically speaking, the quality of a collaborative experience during a meeting would not be defined as a high level of satisfaction (aka. the averaged individual satisfaction levels) but as a homogeneous level of satisfaction or dissatisfaction within the group (aka. the alignment). In this sense, a group-level metric would focus: (a) on aspects that emerge from the interaction of individuals within the group, rather than just summing individual values, (b) on metrics beyond averages of individual data such as distribution of values and outliers. It would incorporate the group context (goals, norms, expectations, roles) to understand individuals through their group lens. Although collected in a health context, the dimensions of relational interactions design implications for collective PI systems by Murnane et al. [68] appear transferable to other domains.

7.2.2 Identity. What preconceptions of the self do we perpetuate through designs? As suggested by [102], can we widen the agenda of these technologies beyond the self as something coherent (unitary self) to improve (lacking self) and to uncover (knowable self)? What similar preconceptions will be attached to the group as an entity, and how do we challenge them?

Many studies suggest that a key benefit of self-tracking lies in increasing self-awareness by gaining insights into one's actions, behaviors, or even feelings [24, 25, 51]. In the present scenario, the activity of self- or group-tracking potentially increases the self-awareness of the team about their collaboration at three levels: at the individual level (knowing more about oneself), at the interaction level (knowing more about one's interactions with group members), and at the group level (knowing more about the group as a whole). PI tools have traditionally focused on quantifying and improving the self through data collection and reflection [51]. These systems heavily rely on the assumption that enabling self-knowledge (by measurable information and reflection) is one of the key value propositions of PI systems [102]. As mentioned in Section 7.1, this runs the risk of reducing complex phenomena such as collaboration to simplistic metrics presented as some form of "truth."

An additional question raised is how would this "self-knowledge" look like when applied to group-level tracking? What knowledge would be "captured" about the essence of the group, and how would it be conveyed? What preconceptions about "a group" and "teamwork" in given contexts would be embedded and perpetuated in these systems? In the fiction, Affinity operates under the assumption that optimal collaboration is overall a matter of alignment, reached at "85% of emotional resonance." The preconception here is that an *optimal* group would be a *homogeneous* group, where team members agree rather than find richness in diversity and constructive disagreement. Trinity characters express their skepticism regarding the meaningfulness of this metric. The (often non-transparent) use of high-level derived metrics [4] in commercial tools echoes this concern and shows that our near-future fiction is embedded into present trends and practices. For instance, the Meeting tools and metrics by Read.ai include various metrics of charisma, sentiment, or engagement graded on a (seemingly arbitrary?) scale of "Good (greater than 80), Okay (70-80), and Poor (less than 70)" [76]. The measure of engagement is explained as follows:

> *Engagement is a measure of attendees' level of involvement and interest in a meeting. We measure engagement through a combination of facial and verbal cues, as well as the talk time of attendees throughout the meeting [...]. For example, if you are in a team meeting and people start to get distracted, Read will notice that they are looking away and leaning back from the screen. Engagement levels will begin to decrease, indicating to all meeting participants to refocus on the meeting.*

As Spiel et al. [88] illustrate in the realm of fitness trackers, there are many underlying normative assumptions in the design of self-trackers, which these devices then perpetuate. As a response, Winter et al. [102] suggest widening the scope of PI by embracing an alternative conception of the self: designing for fluidity and fragmentation, for "human-ness", and dialogical design. Toebosch et al. [94] coined the term "non-judgemental interfaces" as a new design space for personal informatics, "where no outcome is valued over

another". Fox et al. [28] shows how these normative assumptions operate in the workplace, as the IoT systems placed in public washrooms "perpetuate middle-class ideals of cleanliness beyond health codes" [28, p. 2]. In the aforementioned example, the engagement measure during a meeting is based on the assumption that engaged meeting attendees should look at the screen at any time (why not at sticky notes or each other?) and should comply with a normative (and rather unhealthy) static sitting posture.

There is a recognition of the need for PI tools to embrace a more dialogical approach to help users provide input into the PI system to increase accuracy [102], meaning, "invite the viewer to respond and reflect — position their user not as a passive viewer but as an active participant in the process." Yet, how would this dialogical approach translate beyond PI to group tracking? Future tools should be dialogical with group members, allowing for the collective reflection of data interpretations and insights. Incorporating qualitative metrics, based on input from the group, alongside quantitative data can help capture the nuances within the group dynamics, enhancing mutual understanding of the data. In essence, a dialogical approach to PI in group contexts calls for tools that foster active participation, respect individuality, and support the collaborative construction of meaning, thereby balancing personal self-reflection with the group interpretation of data.

In this section, we offered reflections on how group-tracking may differ from self-tracking in both its potential benefits (e.g., developing a group identity, supporting data sensemaking) and challenges (e.g., definition of group-level tracking, negotiation about meaningful metrics, perpetuation of preconception about teamwork). We encourage the community to investigate and define design principles for group-tracking through empirical studies.

8 LIMITATIONS AND FUTURE WORK

While we attempted to ground the fiction into scholarly and industrial trends, we acknowledge that our perspective does not encompass all challenges and opportunities related to this broad topic. On the one hand, many subdomains are represented beyond those we aimed to focus on, and we are only scratching the surface on topics such as digital twins and predictions, or the use of AI in general. On the other hand, some cultural, social, or organizational aspects are barely touched upon or not addressed in the story. We also did not attempt to materialize the entire fictional world, but some snippets of it, like the Serenity necklace or experimentations around group-tracking measures using sensors.

As mentioned in section 4, our design fiction was used as a fruitful way to explore and conceptualize the tensions and opportunities around our research topic in a holistic way. Besides several presentations to colleagues, we did not seek direct participation from target audiences or stakeholders. As a way to engage with and ultimately impact the real world as recommended by Kozubaev et al. [48], we imagine deeper forms of participatory engagement in future work. First, we aim to conduct role-play sessions with office workers by immersing them in the Trinity fictional world to gather user research insights. As new employees of Artemis Inc., participants will meet Serenity individually and will be invited to define their personal work well-being metrics. Starting from a brainstorming around their values and needs, they will be asked to imagine concrete derived metrics [4], measurable with sensing technologies, to implement within Serenity. Joining their (fictional) new team, they will then meet Affinity, who will facilitate negotiations on what aspects of collaboration are meaningful to them. This part of the session will inform group-level tracking, as well as social and ethical aspects of tracking collaboration. Finally, Capacity will present them with the productivity metrics on which the company will assess them. This will take the form of awareness support dashboards based on real and predictive metrics (similar to the digital twin predictions in the fiction). Using scenarios, the researchers will facilitate discussions around the main themes presented in Section 7.

Second, to bridge research and practice, we imagine involving collaborative technology developers by using the Trinity fiction within focus groups (similar to [2]). Following the confrontation with the design fiction, designers will be invited to co-design new awareness support tools (and underlying metrics) from a value-sensitive design approach. Besides our future initiatives, we encourage the community to work on the questions from our analysis that resonate with their expertise and sensitivity. Most of the challenges we highlight call for an interdisciplinary response. Futuring methods are instrumental here. According to Robinson [80], they are "issue-driven" in nature, meaning that "the challenge at hand determines what disciplines need to be involved instead of having the discipline determine what problems to address."

9 CONCLUSION

In this work, we explored technology-enhanced collaboration, facilitated through self-tracking and awareness support tools, by incorporating tensions and opportunities into a design fiction. This speculative method, akin to a "tool for thinking" [92], creatively extrapolates current social, societal, and technological trends to envision a potential future scenario of a "quantified workplace" [62, 66]. The Trinity design fiction is a narrative accompanied by probes and a company brochure (Appendix A). The fictional portrayal of the "quantified workplace" serves as a catalyst for thought-provoking discussions, offering a valuable lens for reflection on the trajectory of current technology development and supporting a discussion about the interplay between technological futures and sociological futures [92].

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A THE TRINITY COLLABORATION TECHNOLOGY

The accompanying company brochure presents the Trinity technology.