Who Gets to Interpret the User? Processual Contribution and Accountability in EEG-Based AI Body Doubling*

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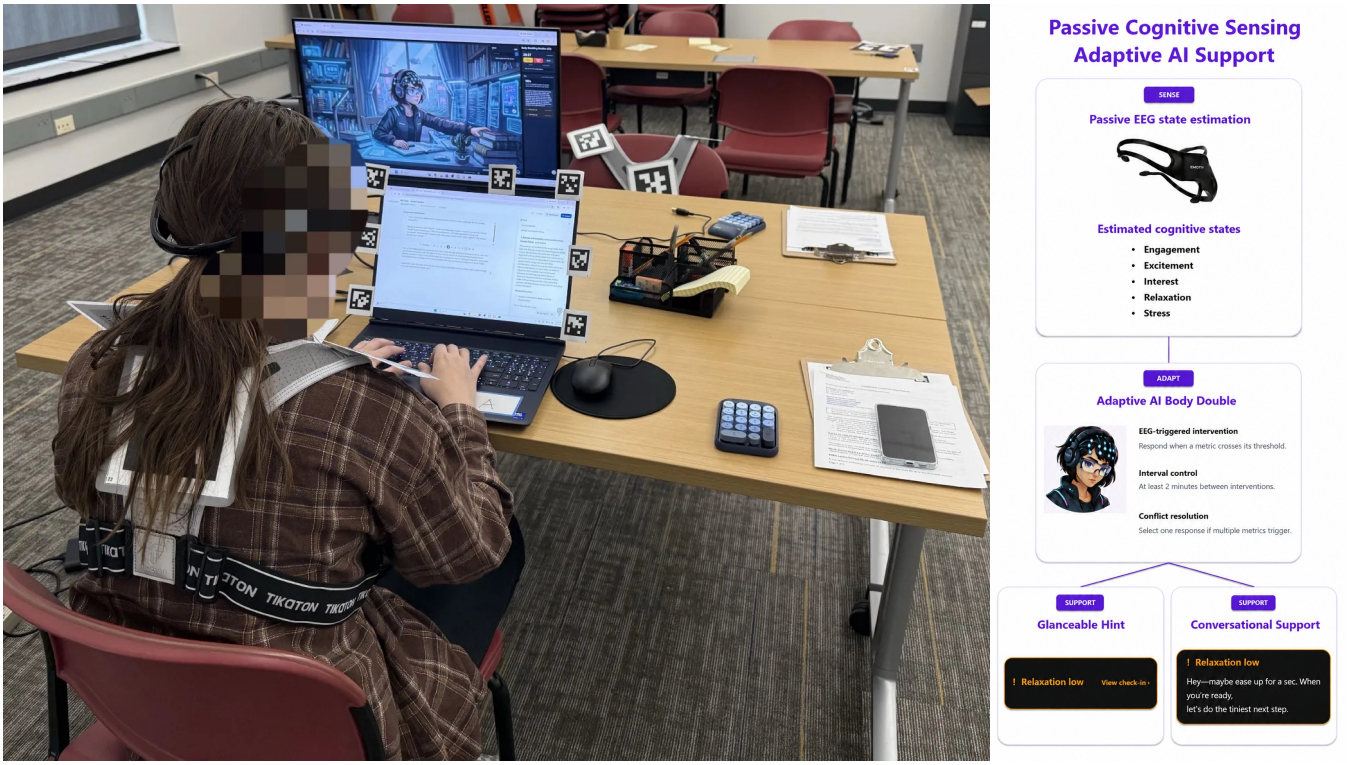


Figure 1: Adaptive AI body-double prototype in use and an overview of its EEG-driven adaptive support workflow.

Abstract

Body doubling, the practice of leveraging another person's presence to support focus, accountability, and sustained task engagement, has emerged as a promising productivity strategy, particularly for people with attention regulation difficulties such as ADHD. However, body double companions are not always available, creating an opportunity for systems to provide body doubling support that can adapt in real time to a person's changing cognitive state. We investigate an AI body double system that combines EEG tracking for cognitive state estimation with proactive LLM support to provide adaptive co-regulation during reading, studying, and writing tasks. In a pilot study with three participants, we found that the AI body double as a social presence, an accountability cue, and a source of behavioral guidance, while participants actively evaluated whether its interpretations and interactions were accurate and helpful. These preliminary findings point to AI body doubles as behavioral productivity supports beyond direct contributors to task artifacts. We conceptualize this influence as *processual contribution*, where AI supports how users carry out their work rather than directly producing task content.

CCS Concepts

• **Human-centered computing** → **Collaborative and social computing systems and tools**; **Human computer interaction (HCI)**.

Keywords

Body Doubling, Passive Brain–Computer Interface, Proactive AI, AI Agent, EEG, Cognitive Tracking

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1 Introduction

Maintaining attention, regulating effort, and sustaining productivity are persistent challenges in knowledge work, particularly for individuals with attention regulation difficulties such as ADHD [2, 5]. Body doubling, in which another person provides a supportive co-working presence, has emerged as an effective strategy for improving focus and accountability without directly contributing to the task itself [3]. Recent advances in AI agents create new opportunities to extend this idea, allowing AI to support users throughout work rather than only co-authoring its outputs [1, 9, 11].

For AI body doubling to provide timely and adaptive support, however, the agent must infer when interaction is needed. Cognitive tracking technologies such as passive EEG offer one promising approach by estimating users' cognitive states during work [12]. Rather than generating task content, an AI body double could use these signals to provide behavioral guidance, encourage self-monitoring, and support sustained attention through context-aware interactions.

We investigate this opportunity through an EEG-based AI body double (Figure 1) that proactively supports users during self-selected reading, studying, and writing tasks. The agent combines EEG-derived cognitive states with notifications, embodied behaviors, and conversational guidance to influence how users regulate their work, rather than directly contributing to the work itself. This case therefore allows us to examine AI contribution that operates by shaping how work unfolds rather than through direct additions to a final artifact. This design also creates an interpretive asymmetry. The agent does not respond to users' subjective experiences directly, but to computational interpretations of EEG-derived cognitive states. It determines which inferred state to surface, how to characterize it, and what recommendation to provide. Yet labels such as engagement or stress are interpretations of physiological signals rather than transparent descriptions of subjective experience [4]. This makes the agent more than a social presence: it can adapt its support based on inferred changes in the user's cognitive state.

Drawing on a pilot study and preliminary interviews with three participants, we propose the notion of AI's *processual contribution* to extend emerging process-oriented accounts of AI contribution that examine how agents shape goals, requirements, and influences beyond direct changes to task artifacts (e.g., manuscripts or code) [6, 8]. Participants described the agent as a social presence, an accountability cue, and a source of behavioral guidance, while also evaluating whether its interpretations were accurate, timely, and useful.

We advance three provocations. First, AI contribution can be *processual*, shaping how work unfolds without directly producing task content. Second, combining body doubling with EEG-derived cognitive states enables adaptive support that goes beyond social presence alone. Third, such proactive support creates a tension: interactions intended to support attention may themselves compete with the task for attention.

2 The EEG-Based AI Body Double

Body doubling broadly refers to using the presence of another person or mediated figure as a social accountability presence that helps initiate, sustain, or complete a task simply by modeling productivity [1, 3]. The body double does not need to perform the same task or interact continuously with the user. It may be physically co-located (*e.g.*, coffee shop, research lab) or remote (*e.g.*, video conferencing), live or prerecorded, and often even take the form of an animated character (e.g., Lo-Fi girl studying[1]) [1, 3]. In conventional body doubling, support therefore primarily emerges from the perceived presence, visible activity, or accountability provided by another entity or group.

Existing forms of body doubling provide social presence and accountability, but offer limited support that adapts to users' changing cognitive states or moment-to-moment needs [1, 3]. We address this opportunity by designing an adaptive AI body double that combines EEG-based cognitive state estimation with an LLM to provide timely, context-aware support. This design enables us to investigate how an agentic body double can support productivity through adaptive co-regulation rather than direct task completion.

We conceptualize the complete embodied system as the AI agent, rather than treating the agent as only a conversational interface (Figure 1). The agent is represented by an animated avatar that remains visible while the user works, displays task-related and regulatory behaviors, and delivers both action and text interactions. Its embodied behaviors include visible working actions and contextually triggered animations, such as deep breathing or stretching, while its conversational component provides notifications, explanations, and suggestions. The avatar, its movements, and its dialogue therefore operate together as different expressions of the same agent.

The system receives five EEG-derived cognitive states from the Emotiv platform:[2] engagement, excitement, interest, relaxation, and stress. Each metric is monitored against a predefined threshold. When a threshold is crossed, the agent initiates an EEG-triggered interaction, with a two-minute interval between interactions to reduce repeated disruption. If multiple cognitive states cross their thresholds simultaneously, one metric is selected for interaction.

Feedback is presented progressively. Users first receive a small, glanceable notification indicating the interpreted state such as low engagement or elevated stress and perform a corresponding avatar animation. Users may ignore the notification, continue working, or open it to receive a more detailed response. When the notification is opened, the agent may provide a behavioral suggestion and invite the user to discuss their current difficulty.

The broader study also included a non-AI comparison condition in which participants viewed real-time visualizations of the EEG-derived cognitive states. Because this paper focuses on agent-mediated contribution and interpretation, we primarily examine the EEG-based AI body-double condition. In this condition, users do not directly observe the continuous trajectories of the underlying cognitive states. Instead, they encounter the EEG-derived information through the agent's selected notifications, embodied responses, and conversational interpretations. The agent therefore functions not only as a visible co-working presence, but also as an intermediary that interprets system-produced representations of the user and translates them into possible action.

[1] https://www.youtube.com/c/LofiGirl
[2] https://www.emotiv.com/

Table 1: Participant characteristics

ID	Gender	Age	Education	Major	Attention profile
P1	Male	25	Graduate	Marketing	No difficulties
P2	Male	19	Undergraduate	Business	Self-report ADHD
P3	Female	22	Graduate	Applied Mathematics	Clinically diagnosed ADHD

3 Preliminary Participant Accounts

We report findings from the pilot phase of an ongoing study of an EEG-based AI body double, focusing on preliminary interviews with three participants (Table 1). Participants completed self-selected reading, studying, or writing tasks in a laboratory setting while wearing an Emotiv EEG headset and working alongside the AI body double. The broader study also includes a non-AI visualization condition, which is outside the scope of this paper. Following the session, we conducted semi-structured interviews about participants' experiences with the system and its perceived influence on their work.

3.1 A Study Buddy and a Real-Time Instructor

Participants described the agent not as a neutral feedback interface, but as a social presence combining companionship with behavioral guidance. P1 thinks, *"it's a combination of study buddy and a real-time instructor" (P1).* P2 characterized it as *"It felt like a robot basically that was just trying to help me accomplish my task while keeping in mind how I'm feeling from the EEG." (P2)* Its youthful embodiment made it feel more like a study buddy than an authoritative professor, while it could still provide suggestions based on the user's current state. P3 similarly described it as a coach *"Like a coach trying to teach me through like how to change or reroute what I was having issues with.".*

These accounts highlight the agent's ambiguous authority. Its companion-like presentation made proactive interactions feel supportive, while its access to EEG-derived states enabled it to evaluate the user and recommend how they should proceed. The agent therefore contributed not by performing the task itself, but by shaping how users interpreted difficulties and regulated their subsequent work.

3.2 Shaping the Process Without Producing the Work

Although the embodied agent did not complete participants' tasks, its presence and EEG-triggered interaction altered how they allocated attention and regulated their work. P1 explained that the body double helped him return to the task more quickly by creating a sense that something or someone cares for his performance. *"I feel like I got the attention and there's something or someone cares for my performance so I can get back to the task relatively more quickly."(P1)* Similarly, P3 described the agent's visible co-working behavior as an accountability cue:*"I think just looking at somebody and seeing them do something, it just immediately clicks something in your head. It's like, okay, it's time to work." (P3)*

The interactions also prompted participants to reflect on their current state. P2 valued being informed that their stress had increased, even when they were uncertain about the usefulness of the accompanying advice: *"I don't know about the advice it was giving me though, but I think that at least it was good that it was letting me know" (P2).* P3 likewise noted that a notification could encourage them to ask, *"It just keeps you accountable overall. Every time it popped up, I was like, okay, I've tried to fix it." (P3)* In this sense, the agent contributed by prompting self-monitoring and problem solving rather than by generating task content.

However, this influence was not uniformly beneficial. P2 found that repeated notifications sometimes created a choice between attending to the task and attending to the agent, making the interaction feel like multitasking.*"It was hard to then focus on my own task as well, because then I was just constantly reading what it was saying." (P2)* This tension echoes prior HCI findings that interruptions can increase perceived effort, stress, and time pressure even when they do not slow task completion [10]. P3 also reported that some repeated suggestions offered little additional help when they were already attempting to regulate the indicated state.*"Maybe I was not relaxed because I was worried about that." (P3)* These accounts suggest that proactive EEG-based support can both sustain and fragment attention. Its contribution lies in reshaping the work process, but the value of that contribution depends on whether an interaction is timely and interpretable.

3.3 Negotiating the Agent's Interpretation

Participants assessed the agent's interpretation by comparing its feedback with their own experience of the task. P2 considered the system "somewhat accurate" when its notifications corresponded with clearly recognizable moments*"I know for sure that I'm feeling bored. And then I see the engagement is low" (P2).* However, they found it more difficult to evaluate smaller fluctuations: *"when I might feel slightly bored, but not really bored, it still might pick up that as a small spike on the metric and then give me another statement."(P2)* This suggests that perceived accuracy depended not only on the underlying signal, but also on whether users could connect an interaction to a subjectively identifiable experience.

The timing and presentation of feedback also shaped this interpretation. P1 found the agent's brief notifications easier to understand than continuous EEG visualizations.*"The EEG waves makes me more confusing. And the Agent right after I feel something and just show me a notice, it is much more clear." (P1)* P3 similarly noticed occasional delays between their behavior and the agent's embodied response,*"I guess, a delay in the second one because I would be taking deep breaths and later the Body double would be taking breaths." (P3)*

These accounts show that EEG-based feedback is interpreted relationally rather than accepted as an objective reading of the user. Its legitimacy depends on whether users can connect the feedback to a recognizable moment, understand its timing, and decide whether further interaction is worth the attentional cost.

4 Discussion

4.1 Processual Contribution

Our findings suggest that an AI body double can contribute to work without directly producing task content. We use *processual contribution* to describe how the agent shaped the way users carried out their work through social presence, accountability, and behavioral guidance. Participants described returning to tasks more quickly,

reflecting on their current state, and adjusting how they worked (§3.2). This form of contribution is therefore less about what the agent produces and more about how it supports the user while the work is being done. Recognizing such contribution broadens attention from AI-generated outputs to the ways agents may shape users' ongoing work.

4.2 Adaptive Support in AI Body Doubling

Traditional body doubling primarily supports users through the presence and visible activity of another person or mediated figure[3]. Our agent combines this form of social presence with EEG-derived cognitive states to provide proactive and adaptive interactions. This allows the body double to respond to changes in the user's state rather than remaining primarily a social presence. Participants' descriptions of the agent as both a "study buddy" and a "real-time instructor" illustrate this expanded role (§3.1). In this form of body doubling, support can shift with the user's inferred state during the task. This raises questions about how much interpretation and guidance a body double should provide while still retaining the lightweight companionship that makes body doubling useful.

4.3 Balancing Support and Attention

Proactive support can help users regulate their work, but it can also compete with the task for their attention. Participants valued notifications that prompted awareness or helped them return to the task, while repeated or less useful interactions could become distracting (§3.2). This creates a tension for adaptive body doubling: interactions intended to support attention may themselves require attention. Beyond what to communicate, effective support hinges on when and how often an agent intervenes. Consequently, adaptive agents must balance proactivity with restraint, remaining unobtrusive whenever engagement risks becoming redundant.

5 Conclusion

Our preliminary findings show how an EEG-based AI body double can support users without directly contributing to task content. We describe this form of influence as *processual contribution*, where the agent shapes how work unfolds through social presence, accountability, and adaptive support. By combining body doubling with EEG-derived cognitive states, the agent can respond proactively to users during ongoing work, but these interactions may also compete with the task for attention. Designing effective AI body doubles therefore requires balancing adaptive support with the lightweight presence that makes body doubling useful.

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