Ben Chen

Loughborough University
Epinal Way Loughborough Leicestershire,
UK LE11 3TU

b.chen@lboro.ac.uk
https://www.lboro.ac.uk/departments/compsci/research-degrees/phd/ben-chen/

1 Research interests

My research interests lie at the intersection of Large Language Models (LLMs) and sustainable behavior change. Sustainable behavior plays a pivotal role in tackling the current global environmental and social challenges. With conversational AI becoming an integral part of people's lives, the advent of LLMs has endowed conversational AI with remarkable potential to intervene in human behavior in a manner that is highly personalized. Consequently, the significance of utilizing conversational AI to steer individuals towards the cultivation of sustainable behavior in their everyday lives needs urgent investigation. This research aims to explore the corresponding design methods or principles that empower designers to realize the personalized and contextualized design of conversational AI through the utilization of LLMs. In doing so, it aims to foster transformative shifts in people's daily behavior towards sustainability.

1.1 Advancing Sustainable Behavior Change: An Urgent Imperative

Against the backdrop of intensifying global environmental and social challenges, the importance of sustainable behavior has reached unprecedented levels. Within the realm of social sciences, considerable attention has been devoted to the role of individual and household-level sustainable behaviors and lifestyles in fostering sustainable development (Frank-Martin and Peattie, 2009; Capstick et al., 2014; Welch, 2017). However, despite widespread recognition of the pressing need for sustainable behavior change, many individuals find themselves entrenched in unyielding behavioral patterns, beset by a lack of motivation (Boström and Micheletti, 2016; McEachern et al., 2020). In day-to-day existence, people often find themselves trapped within unsustainable cycles pertaining to consumption, energy usage, waste management, and lifestyles, despite their cognizance of the importance of sustainable practices (ElHaffar et al., 2020). This phenomenon may stem from a multitude of factors, including deeply ingrained habits (Kurz et al., 2015; Schwanen et al., 2012), social and cultural influences (Davis et al., 2018; Goldsmith and Goldsmith, 2011), informational deficiencies (Pearce and Barbier, 2000), cognitive biases (Korteling et al., 2023; Rakitta and Wernery, 2021; Singh and Giacosa, 2019), as well as individuals' psychological and emotional states (Brosch, 2021; Moloney et al., 2010). The complex interaction of these factors often traps people in fixed habits, making them feel powerless or unwilling to adopt sustainable behaviors.

1.2 Designing Conversational AI for Behavior Change

Large Language Models (LLMs), including commercial versions such as OpenAI's ChatGPT (Achiam et al., 2023), Google's Bard and Gemini (Anil et al., 2023; Imran and Almusharraf, 2024), and Meta's LLaMA (Touvron et al., 2023), represent a significant breakthrough in the field of general artificial intelligence. These models seem to show advanced capabilities to understand contextual cues, user intent and generate natural language responses accordingly (Zhao et al., 2023). A growing area of interest is the use of counselling-style mental health and behavior change interventions, where approaches based on LLMs are becoming increasingly common (Meyer and Elsweiler, 2024). Integrating advanced LLMs into conversational AI can be pivotal in promoting sustainable human behavior. This integration may greatly improve the intelligence of conversational AI, enabling a deeper understanding of user needs and delivering more personalized support (Dynel, 2023).

1.3 Development of Conversational AI

This research aims to explore how the existing LLM can be leveraged to design the conversational AI that support sustainable behavior change in different scenarios. By leveraging the natural language processing capabilities of LLMs, the conversational AI will be able to engage in natural conversations with users, comprehend their needs, and provide personalized support. Usability and user-friendliness will be among the core design considerations of the conversational AI, ensuring seamless utilization by a diverse range of users. People will interact with this system through accessible platforms such as mobile apps, web-based interfaces, or smart devices using multimodal formats including both text and speech.
The evaluation process will incorporate both automated

The 21th Annual Meeting of the Young Researchers' Roundtable on Spoken Dialogue Systems, pages 1–3
Aug 28–29, 2025.

metrics and expert evaluation to assess the quality and effectiveness of the conversational AI outputs. To further validate the system's practical impact, future work will include usability testing with real users to examine its effectiveness.

2 Spoken dialogue system (SDS) research

Over the next 5 to 10 years, Spoken Dialogue Systems (SDS) are expected to evolve from task-oriented systems to more context-aware, emotionally intelligent, and personalized agents (López-Cózar et al., 2014). With rapid advances in LLMs, multimodal learning, and memory-augmented systems, conversational systems will become more fluent, more adaptable, and capable of long-term, relationship-oriented interactions in a range of applications, from healthcare and education to mental health and productivity together with sustainability. This generation of young researchers is well-positioned to tackle some of the challenges in the field: enhancing dialogue coherence over extended turns, improving commonsense and emotional reasoning, and developing systems that are not only efficient but also ethically responsible and transparent. The integration of behavioral science – particularly in behavior change support systems – is a promising direction because it opens up opportunities for conversational agents to facilitate real-world impact. Key questions to enable this research are:

- How can future SDS integrate memory-based interactions for deeper personalization?
- How do we embed empathy, motivation, and adaptability in a consistent and explainable manner?
- To what extent can SDS be designed to influence behavior ethically, while preventing their misuse for manipulation?

For users, reliability, trustworthiness, and contextual relevance remain top priorities. Systems must not only understand the user's intent but also be able to adapt to the user's preferences and emotional state over time.

3 Suggested topics for discussion

There are a few critical considerations regarding the limitations and potential risks of using off-the-shelf LLMs for conversational AI to support behavior change. Firstly, current LLMs will not retain memory of past interactions across sessions. As a result, they cannot track a user's behavior change journey over time or personalize support based on long-term context. Secondly, although emotion detection techniques have advanced, the emotional intelligence of off-the-shelf LLMs remains shallow. These models often respond based on surface-level sentiment cues rather than deep contextual understanding, which can lead to generic or even inappropriate responses in emotionally sensitive situations. Moreover, coherence between turns also has some limitations. Off-the-shelf models may generate contextually disconnected responses, which may reduce trust, disrupt engagement and impede behavior change process. Importantly, transparency and trust in behavior change counseling delivered by LLMs should be addressed, given the inherent opacity of their decision-making processes. Hence, in order to address these limitations, the following topics are proposed for further discussion.

- How can future conversational AI systems leverage memory-based interaction mechanisms to deliver personalized, context-aware support that fosters long-term behavior change?
- Besides the current methods for emotion detection, how can the emotional intelligence of conversational AI be further improved to better support behavior change?
- How can the coherence between dialogue turns be enhanced to provide more effective support during interactions with conversational AI?
- How can we guarantee transparency and build trust in behavior change counseling provided by LLMs, considering the inherent lack of clarity in their decision-making processes?

References

Josh Achiam, Steven Adler, Sandhini Agarwal, Lama Ahmad, Ilge Akkaya, Florencia Leoni Aleman, Diogo Almeida, Janko Altenschmidt, Sam Altman, Shyamal Anadkat, et al. 2023. Gpt-4 technical report. *arXiv preprint arXiv:2303.08774* .

Rohan Anil, Andrew M Dai, Orhan Firat, Melvin Johnson, Dmitry Lepikhin, Alexandre Passos, Siamak Shakeri, Emanuel Taropa, Paige Bailey, Zhifeng Chen, et al. 2023. Palm 2 technical report. *arXiv preprint arXiv:2305.10403* .

Magnus Boström and Michele Micheletti. 2016. Introducing the sustainability challenge of textiles and clothing. *Journal of Consumer Policy* 39:367–375.

Tobias Brosch. 2021. Affect and emotions as drivers of climate change perception and action: a review. *Current Opinion in Behavioral Sciences* 42:15–21.

Stuart Capstick, Irene Lorenzoni, Adam Corner, and Lorraine Whitmarsh. 2014. Prospects for radical emissions reduction through behavior and lifestyle change. *Carbon management* 5(4):429–445.

Taylor Davis, Erin P Hennes, and Leigh Raymond. 2018. Cultural evolution of normative motivations for sustainable behaviour. *Nature Sustainability* 1(5):218–224.

Marta Dynel. 2023. Lessons in linguistics with chatgpt: Metapragmatics, metacommunication, metadiscourse and metalanguage in human-ai interactions. *Language & Communication* 93:107–124.

Ghina ElHaffar, Fabien Durif, and Laurette Dubé. 2020. Towards closing the attitude-intention-behavior gap in green consumption: A narrative review of the literature and an overview of future research directions. *Journal of cleaner production* 275:122556.

Belz Frank-Martin and Kenneth John Peattie. 2009. Sustainability marketing: a global perspective.

Elizabeth B Goldsmith and Ronald E Goldsmith. 2011. Social influence and sustainability in households. *International journal of consumer studies* 35(2):117–121.

Muhammad Imran and Norah Almusharraf. 2024. Google gemini as a next generation ai educational tool: a review of emerging educational technology. *Smart Learning Environments* 11(1):22.

Johan E Korteling, Geerte L Paradies, and Josephine P Sassen-van Meer. 2023. Cognitive bias and how to improve sustainable decision making. *Frontiers in Psychology* 14:1129835.

Tim Kurz, Benjamin Gardner, Bas Verplanken, and Charles Abraham. 2015. Habitual behaviors or patterns of practice? explaining and changing repetitive climate-relevant actions. *Wiley Interdisciplinary Reviews: Climate Change* 6(1):113–128.

Ramón López-Cózar, Zoraida Callejas, David Griol, and José F Quesada. 2014. Review of spoken dialogue systems. *Loquens* 1(2):012.

Morven G McEachern, Deborah Middleton, and Tracy Cassidy. 2020. Encouraging sustainable behaviour change via a social practice approach: a focus on apparel consumption practices. *Journal of Consumer Policy* 43(2):397–418.

Selina Meyer and David Elsweiler. 2024. " you tell me": A dataset of gpt-4-based behaviour change support conversations. In *Proceedings of the 2024 Conference on Human Information Interaction and Retrieval*. pages 411–416.

Susie Moloney, Ralph E Horne, and John Fien. 2010. Transitioning to low carbon communities—from behaviour change to systemic change: Lessons from australia. *Energy policy* 38(12):7614–7623.

David Pearce and Edward B Barbier. 2000. *Blueprint 6: For a Sustainable Economy*. Routledge.

Maic Rakitta and Jannis Wernery. 2021. Cognitive biases in building energy decisions. *Sustainability* 13(17):9960.

Tim Schwanen, David Banister, and Jillian Anable. 2012. Rethinking habits and their role in behaviour change: the case of low-carbon mobility. *Journal of transport geography* 24:522–532.

Poonam Singh and Elisa Giacosa. 2019. Cognitive biases of consumers as barriers in transition towards circular economy. *Management decision* 57(4):921–936.

Hugo Touvron, Louis Martin, Kevin Stone, Peter Albert, Amjad Almahairi, Yasmine Babaei, Nikolay Bashlykov, Soumya Batra, Prajjwal Bhargava, Shruti Bhosale, et al. 2023. Llama 2: Open foundation and fine-tuned chat models. *arXiv preprint arXiv:2307.09288* .

Daniel Welch. 2017. Behaviour change and theories of practice: Contributions, limitations and developments. *Social Business* 7(3-4):241–261.

Wayne Xin Zhao, Kun Zhou, Junyi Li, Tianyi Tang, Xiaolei Wang, Yupeng Hou, Yingqian Min, Beichen Zhang, Junjie Zhang, Zican Dong, et al. 2023. A survey of large language models. *arXiv preprint arXiv:2303.18223* .

Biographical sketch

Ben is currently a first-year PhD student at Loughborough University. Ben has a robust background in programming and Human computer interaction. He holds an MSc in Human Computer Interaction from the University of Birmingham and a BSc in Automation from Wuhan University of Science and Technology.

Before commencing his PhD studies, Ben worked as a project manager in Ant Group for one year and he led the successful completion of seven iterative cycles for key initiatives, including Trade Finance products, the SAAS platform, ensuring milestones were met and projects stayed on track.

Afterwards, he worked as an information engineer in Shenzhen University Affiliated South China Hospital, where he undertook operational and enhancement responsibilities for core business systems and played a pivotal role in expediting system procurement processes.