Chapter 48

Agentic AI for Sustainable Behaviour: A Coaching Framework and Workflow

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Abstract

Addressing the climate crisis requires individuals to adopt and maintain multiple low-carbon behaviours across diverse aspects of everyday life. Traditional behavioural interventions, although effective in specific contexts, often lack the scope and longevity needed for transformative lifestyle change. This article proposes a novel approach: an agentic AI workflow designed to coach individuals towards sustainable behaviour by operating across key high-impact domains, including food, transport, energy, and consumption. Unlike conventional tools that offer static prompts, agentic AI systems demonstrate autonomy, adaptability, and goal-directed reasoning. They perceive user behaviour, diagnose psychological barriers, and dynamically tailor evidence-based interventions using behavioural science frameworks. The proposed system comprises 12 interdependent AI agents, each responsible for functions such as data collection, behavioural diagnostics, personalised coaching, and continuous evaluation. Together, they deliver an adaptive and context-aware coaching experience that supports behavioural change and maintenance over time. This agentic AI framework provides a scalable and personalised solution to help individuals reduce their carbon footprint and support a broader societal shift towards sustainability.

Keywords: *Sustainability, Transformation, Agentic AI, Behaviour, Intervention*

Introduction

Behavioural science has generated many interventions that can successfully encourage specific sustainable behaviours, from reducing meat consumption to recycling[1]. However, such interventions are often context-specific and rarely add up to the scale of lifestyle transformation needed to meet climate goals[2]. Achieving a sustainable society requires individuals to adopt multiple low-carbon practices across several areas of daily life and to sustain these changes over time[3]. To address this

[1]Linda Steg, "Psychology of Climate Change," *Annual Review of Psychology* 74 (2023), https://doi.org/10.1146/annurev-psych-032720-042905.

[2]Lorraine Whitmarsh and Sam Hampton, "Are Radical Changes to Lifestyles Necessary for Mitigating Climate Change?," *Dialogues on Climate Change* 1, no. 1 (2024): 23–29, https://doi.org/10.1177/29768659241293215.

[3]Dario Krpan, "Agenda for Psychological and Behavioural Science of Transformative Behavioural Change," in *Behavioural Public Policy*, ed. Adam Oliver (Cambridge University Press, 2024), 1–26.

challenge, this article proposes an agentic AI workflow: a system designed to coach people toward comprehensive, long-term lifestyle change by guiding behaviour across high-impact domains (e.g., food, transport, energy, consumption) and suggesting low-carbon alternatives for high-emission activities.

What Agentic AI Is and How It Goes Beyond Traditional Interventions for Sustainable Behaviour

Agentic AI refers to artificial intelligence systems that do not merely respond to inputs but actively pursue complex goals with autonomy, adaptability, and self-directed reasoning[4]. Unlike conventional digital tools or nudges, which deliver static information or one-off behavioural prompts, agentic AI systems can perceive user behaviour across contexts, diagnose underlying psychological barriers, and dynamically select and adapt interventions based on behavioural science evidence[5]. This goes beyond traditional interventions that often rely on generic messages or isolated tactics, which can fail to sustain long-term change. By combining continuous learning, personalisation, and proactive problem-solving, agentic AI offers a powerful framework for helping individuals not only adopt but also maintain sustainable behaviours, making it particularly suited for addressing high-carbon lifestyle domains where lasting behavioural transformation is needed.

Agentic AI Workflow

The main idea that underpins the workflow is that high-carbon behaviours over which people have some control, and which they can therefore change, can be grouped into Domains 1-5 described in Table 1[6]. Therefore, by learning to adopt lower-carbon behaviours within those domains, individuals can reduce their carbon footprint. As indicated in Table **1** (Domain 6), it is also assumed that, in some cases, reducing undesirable behaviours (e.g., shopping less) is difficult unless individuals are offered a suitable alternative (e.g., reading). This idea is informed by research on smoking, which shows that quitting is more successful when a replacement behaviour is introduced[7]. Therefore, Domain 6 does not target behaviours that should be reduced or changed, instead, it focuses on providing suitable replacements.

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[4]Deepak Bhaskar Acharya et al., "Agentic AI: Autonomous Intelligence for Complex Goals—A Comprehensive Survey," *IEEE Access* 13 (2025): 18912–36, https://doi.org/10.1109/ACCESS.2025.3532853.

[5]Eric Yang et al., "From Barriers to Tactics: A Behavioral Science-Informed Agentic Workflow for Personalized Nutrition Coaching," *arXiv Preprint arXiv:2410.14041* (2024).

[6]Christophe Lembregts and Romain Cadario, "Consumer-driven Climate Mitigation: Exploring Barriers and Solutions in Studying Higher Mitigation Potential Behaviors," *International Journal of Research in Marketing* 41, no. 3 (2024): 513–28, https://doi.org/10.1016/j.ijresmar.2024.04.001.

[7]Patricia M. Goelz et al., "The Association between Changes in Alternative Reinforcers and Short-term Smoking Cessation," *Drug and Alcohol Dependence* 138 (2014): 67–74, https://doi.org/10.1016/j.drugalcdep.2014.02.007.

Table 1: Key behaviour change domains for sustainable lifestyle transformation that inform the agentic AI workflow.

Domain	Description
1. Transport	Reducing reliance on high-carbon transport by shifting to lower-emission options such as public transport, cycling, walking, and more efficient travel modes.
2. Food	Lowering the carbon footprint of diets through more plant-based meals, less food waste, and choosing seasonal and locally produced foods.
3. Energy & Resources	Cutting unnecessary energy, water, and material use with efficiency measures, renewable energy choices, and correct recycling practices.
4. Consumption	Minimising high-impact purchases by buying less, choosing durable or second-hand products, and supporting circular, low-waste options.
5. Ethical Alignment	Aligning financial choices and consumer voice with sustainable providers, responsible investments, and ethical standards.
6. Leisure	Promoting enjoyable low-carbon activities and hobbies that can substitute for higher-impact pastimes while maintaining quality of life.

In a nutshell, the agentic AI system is designed to coach individuals to adopt more environmentally friendly lifestyles across Domains 1–5 (Table **1**), while also helping them find suitable replacements for high-emission activities they previously enjoyed (Domain 6). More specifically, the agentic AI system needs to: (a) identify domains where individuals underperform, using data from sources such as self-reports, smartphones, and smart home devices; (b) determine the main behavioural barriers contributing to this underperformance; (c) propose targeted behavioural interventions that directly address these barriers, informed by behavioural science literature; (d) suggest appropriate low-carbon activities to replace high-emission behaviours individuals may wish to reduce; (e) continuously track and evaluate the effectiveness of interventions to improve outcomes; and (f) provide individuals with estimates of their carbon footprint to support awareness and monitor progress.

The proposed agentic workflow consists of 12 agents described in Table **2** that work together to achieve these goals. The system begins by collecting and processing relevant data from multiple sources (Data Collector Agent), which is then used to estimate the individual's carbon footprint (Carbon Counter Agent) and identify domains where performance is strong or where improvement is needed (Progress Monitor Agent), addressing goals (a) and (f). When underperformance is detected, the system identifies the underlying behavioural barriers that may be limiting progress (Barrier Finder Agent), fulfilling goal (b). These insights are passed to the appropriate domain-specific coach (e.g., Travel, Food, Energy, Consumption, and Ethical Alignment Domain Coaches), which selects tailored, evidence-based interventions to address the identified barriers (goal c). In parallel, the system also suggests low-carbon

alternatives for high-emission behaviours individuals may wish to reduce (Leisure Domain Coach Agent), addressing goal (d). These interventions are delivered using adaptive and personalised communication that fits the individual's motivations and context (Communicator Agent). Finally, the impact of these interventions is continuously monitored and used to refine future strategies (Evaluator Agent), thereby supporting goal (e). Together, this coordinated set of agents forms a dynamic, personalised coaching system designed to help individuals live more sustainably.

Table 2: Agents that constitute the workflow.

Agent	Description
1. Data Collector	Gathers and processes relevant data from multiple sources (e.g., smartphones, smart home devices, spending records) and stores it in a shared profile other agents can use.
2. Carbon Counter	Estimates the carbon impact of activities by combining data on travel, food, energy use, and purchases with emission factors, then shows a clear breakdown by area.
3. Progress Monitor	Highlights domains and activities where the individual is already performing well and points out domains where there is the greatest room for improvement.
4. Barrier Finder	Identifies the main behavioural barriers to sustainable action by drawing on behavioural science theories and frameworks, and passes this on to the domain-specific coaches.
5. Travel Domain Coach	Selects personalised, evidence-based interventions (e.g., goal setting, social comparisons) to encourage lower-carbon travel choices such as public transport, cycling, or walking.
6. Food Domain Coach	Uses tailored behavioural strategies to support shifts towards lower-carbon diets, reduce food waste, and promote sustainable shopping habits.
7. Energy Domain Coach	Provides context-specific interventions to reduce energy and water use at home, such as optimising heating or encouraging efficient appliances.
8. Consumption Domain Coach	Applies behavioural techniques to guide more sustainable consumption, including buying less, choosing durable or second-hand goods, and reducing packaging.
9. Ethical Alignment Coach	Delivers personalised interventions that align financial choices and consumer voice with sustainability values, responsible investments, and ethical standards.
10. Leisure Domain Coach	Suggests fulfilling, low-carbon leisure alternatives, chosen to fit the individual's motivations and lifestyle so that sustainable living remains enjoyable.

Table 2: Continued.

Agent	Description
11. Communicator	Delivers the interventions recommended by domain-specific coaches and presents them through adaptive, personalised communication.
12. Evaluator	Tracks the impact of interventions delivered by the Communicator agent and continuously improves the intervention strategy over time.

Practical Implementation and Conclusion

The proposed agentic AI system could be practically implemented as a multi-agent architecture using existing conversational AI platforms, large language models (LLMs), and behavioural data pipelines. Each agent described in Table **2** can be instantiated as a modular AI component with clearly defined roles and shared access to a user profile and data environment. For example, platforms such as Microsoft's Semantic Kernel, Google's Vertex AI, or open-source orchestration frameworks like Haystack allow for modular agent construction and dialogue management across tasks. Data collection can be achieved through permissioned integrations with smartphone sensors, smart home devices, and similar data sources commonly used in digital behaviour change interventions[8]. Personalised feedback and barrier-informed coaching can be powered by fine-tuned LLMs or rules-based classifiers trained on behavioural science frameworks, such as COM-B[9]. Evaluation and adaptive learning loops can be implemented using reinforcement learning or Bayesian policy optimisation techniques, allowing the system to update intervention strategies over time based on observed outcomes. Together, these technologies provide a practical pathway to deploy the agentic AI workflow as an intelligent digital coaching system for sustainable behaviour change.

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