

# Envirofy: Behaviour Change Wheel based Tool for Sustainable Online Grocery Shopping

Gözel Shakeri<sup>1</sup>[000–0002–3154–0814], Claire McCallum<sup>2</sup>[0000–0001–7801–1330], and Youssef Ramadan<sup>1</sup>[0000–0002–8332–6414]

<sup>1</sup> University of Glasgow, Glasgow, Scotland `first.last@glasgow.ac.uk`

<sup>2</sup> University of Bristol, Bristol, England `claire.mccallum@bristol.ac.uk`

**Abstract.** In the past two decades, online grocery shopping has steadily increased. In 2018, almost a quarter of grocery shopping occasions in the UK happened online, this proportion nearly doubled during the COVID-19 pandemic. Today, online grocery shopping accounts for 14% of the UK’s annual greenhouse gas (GHG) emissions, however dietary change could reduce this by half. Many people intend to make sustainable food choices, but fail to do so at the point-of-purchase. Lacking relevant knowledge can be a significant barrier to buying sustainable food. We developed a browser extension called Envirofy which addresses this requirement by presenting theory- and evidence-based behavioural intervention techniques, at the point of purchase, during online shopping. We conclude with a discussion on the unique opportunities this workshop provides to explore the future development of Envirofy, and ultimately in reducing GHG emissions.

**Keywords:** Sustainable Human-Computer Interaction; grocery e-commerce; traffic light feedback; browser extension; digital intervention;

## 1 Introduction

Food consumption is one of the most important areas to improve environmental sustainability [14]. Food choices can have a considerable effect on climate change as around 14% of the UK’s greenhouse gas (GHG) emissions are attributable to online grocery shopping. For many people, including those who intend to shop sustainably, lacking relevant knowledge can be a significant barrier to buying sustainable food [9][4]: even if individuals are motivated and willing to choose sustainable products, such intentions can be undermined by misconceptions around the impact of their shopping choices [19]. Consumers can believe that whatever they purchase will not make much difference to the environment (i.e. ”perceived consumer effectiveness” can be low) [5] and even misconceive the impact of sustainable shopping relative to other pro-environmental behaviours. For example, consumers in one study were found to believe that recycling packaging has a 1.5 times greater environmental benefit than reducing their intake of GHG-heavy food such as meat [9], whereas the opposite is true. Solid waste management contributes less than 5% to global GHG emissions [1] compared to the food sector’s contribution of 30% to total GHG emissions [20].

In addition to addressing misconceptions around the impact of their shopping, educational approaches should equip consumers with the skills and information needed to choose between products, so that they can make fully informed sustainable food choices. Improving consumers' understanding of the environmental impact of their food choices, and improving the availability and accessibility of environmental information for individual products, may help to close the "attitude behaviour gap" [19] that exists for consumers who are willing to purchase sustainable food but whose intentions do not transform into actions. A large body of literature suggests that most consumers are willing to buy sustainable food products (e.g. [18]) and it is crucial to convert these intentions into actions. Even for those who are not yet willing or motivated (or do not have the opportunity) to shop sustainably; ensuring consumers have the relevant knowledge and skills remains an essential pillar in changing their behaviour [11].

In his paper, we outline Envirofy, the first real-time web-based tool targeting sustainable food shopping behaviour. Envirofy was developed using both behaviour change theory (the Behaviour Change Wheel, BCW) [11] and multidisciplinary evidence to support online shoppers during the point of purchase. We demonstrate and argue for the translation and "operationalisation" of theory- and evidence-based Behaviour Change Techniques (BCTs) into digital intervention tools to support sustainable grocery purchases. It is crucial to share these developments "early and often" to promote agile and responsive research [7], and to take advantage of the latest technologies.

## 2 Background

The most important step individuals can take to lower GHG emissions substantially is to change their diet [14]. Changing diet itself involves a range of sustainable food choices, including specific food types (i.e. reducing meat and dairy), and choosing to buy food products that are produced locally (i.e. not imported by air), in season, and require minimal packaging [3]. Despite these sustainable food choices being predicted to have a high impact on climate change, consumers rarely make them. In fact, some of the least sustainable food choices are expected to increase. Meat consumption, for example, is expected to have risen by 72% from 2000s to 2030 [12].

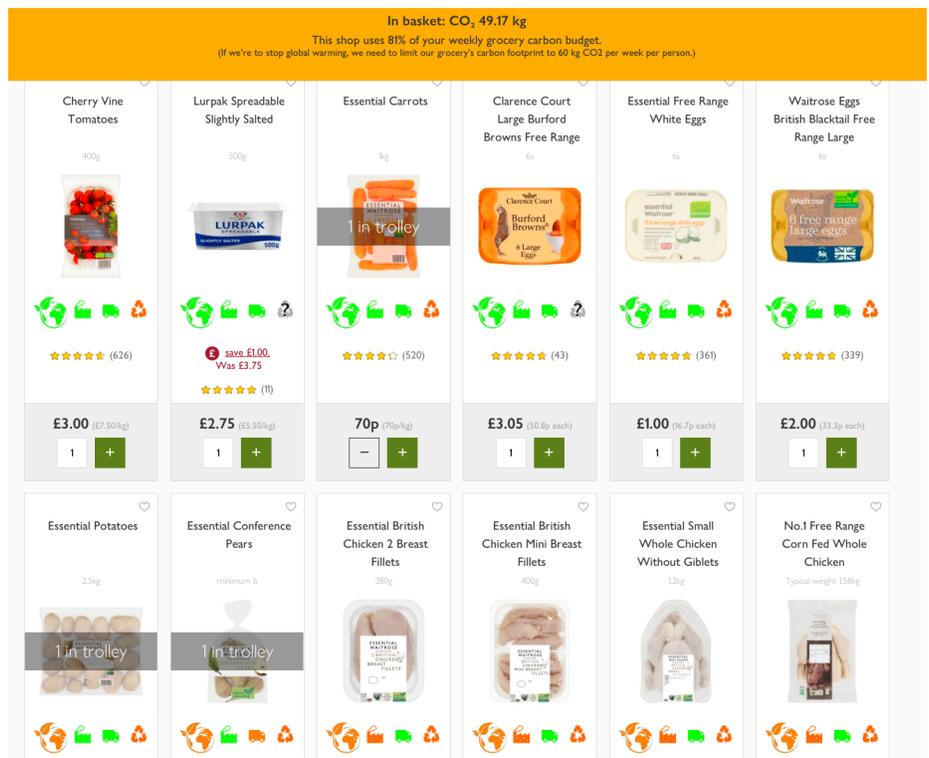
Individual-level behaviour change interventions are urgently needed to promote sustainable food choices. A recent systematic review [6] across sustainability and technology literature used the BCW [11] as a comprehensive framework to assess the state of the art in digital behaviour change interventions for a range of sustainable food consumption behaviours. The review called for more interventions to be evaluated for their behavioural impact, and crucially to be theory-based, to advance understanding of why they did or did not work. Importantly, interventions targeting food choices and purchases were relatively understudied, representing only 1 of 15 included studies, with the vast majority targeting food

waste. The authors called for more rigorous work to develop interventions in this area.

In this paper, we first outline the theory- and evidence-based BCTs embedded within Envirofy’s algorithm and interface. We then discuss potential future directions of our work and the unique opportunity this workshop provides through the expertise of its attendees.

### 3 Behaviour Change Techniques within Envirofy

In this section we describe the main components of Envirofy’s user interface (Figure 1). Envirofy is a web browser extension which works on top and independently of standard websites of UK supermarkets. Envirofy injects BCTs into the current webpage which support the consumer in sustainable shopping at the point of purchase (the specific barriers targeted in this tool are detailed in [15]).



**Fig. 1.** Envirofy’s graphical user interface on Waitrose.com. Envirofy injects Behaviour Change Techniques (BCTs) into the current web page. Injected BCTs: 1) carbon labelling and traffic light colour icons; 2) ordering products by environmental impact; 3) goal setting and running total. Screenshot taken on 02/04/2021.

***Carbon labelling and traffic light colour coding*** One of the main components of Envirofy are carbon labelling and traffic light colour coding. Carbon labelling encourages consumers towards sustainable purchases through increasing knowledge about food product sustainability [2]. In Envirofy, four traffic light colour coded labels are displayed under each product allowing for high level information at a single glance: *overall* (Total Environmental Impact, TEI), *production*, *transport*, and *packaging* carbon footprints. The carbon labelling and traffic light colour icons provide users with information about social and environmental consequences; and help conserve mental resources. The main function of the BCTs implemented is Education [11].

***Ordering products by environmental impact*** Another main feature of Envirofy is the ordering of products by environmental impact; from most sustainable (at the top of the page) to least sustainable. As consumer choices can be governed by the choice environment, rearranging this environment can engage with consumer’s automatic and impulse-driven decision making [22]. The essence of such ‘nudging’ approaches is to change environments in such a way that the better choice becomes a more convenient, attractive, or normal choice [21]. The reordering of the food items according to sustainability helps users to conserve mental resources. The main function of the BCTs is Environmental Restructuring [11].

***Goal setting and running total*** Goal setting and performance feedback have been shown to provide strong motivational impact for pro-environmental behaviour compliance [17]. In Envirofy, a goal is set by contextualising CO2 values with a target CO2 per person. The presentation of the running total supports users in self-monitoring the outcomes of their behaviour, provides feedback on the outcome of their behaviour, provides information about social and environmental consequences and supports salience of consequences. The main functions of the BCTs implemented are Knowledge, Training, and Persuasion [11].

## 4 Discussion and Future Work

This paper presents the first real-world tool that helps online grocery shoppers to reduce their dietary carbon footprint by presenting behavioural intervention techniques at the point of purchase. Future research will examine the feasibility of embedding BCTs within Envirofy, such as multimodal feedback as cues for behaviours. Presentation of information to different sensory modalities, capturing consumers attention (known as the key “First Moment of Truth” [10]), has been shown to influence shoppers’ purchasing decisions successfully (e.g. *olfactory* feedback to increase overall purchases [8], *auditory* feedback to increase fish purchases [16]). Neither in the field of HCI nor in any other area, has research focused on systematically designing high-throughput interactions to nudge consumers towards sustainable shopping. We will produce a set of new multimodal interaction techniques to allow users rich interaction with low environmental impact.

We will further investigate the feasibility of a recommender system: plant-based alternatives do not require changes to meal planning or cooking skills (as meat can be swapped with meat alternatives), which indicates a good scope for a shift towards more sustainability [3]. In order to enable consumers to shift to a lower-impact diet, it is important to broaden choice rather than introducing restrictions [3]. We will develop the first recommender system that provides consumers with sustainable alternatives to high-impact foods, including products that have a high transportation carbon footprint (e.g. avocados, bananas).

The BCTs investigated in this work not only support online shoppers in increasing their knowledge and behaviour regarding sustainable grocery shopping (UN Sustainable Development Goal (SDG) [13] #12) and in adapting to the climate emergency (SDG #13); they may also change suppliers' behaviour. Restructuring the shopping environment (i.e. ordering food according to their CO2 impact) could incentivise suppliers to produce more sustainable products to improve their visibility and reputation. As Envirofy displays local and seasonal foods at the top of each page, Envirofy has the potential to reduce transport emissions by increasing their demand. Further, Envirofy can be easily adapted to become compatible with any online supermarket website (e.g. Tesco, Amazon, Shopify), including international retailers, and has huge potential for scaling up to different domains (e.g. fast fashion). This in turn has the potential to strengthen partnerships between producers and retailers (SDG #17) and promote sustainable industrialisation (SDG #9).

This workshop will provide a great opportunity for discussion of Envirofy and its exploration of BCTs towards reducing food related GHG emissions.

## 5 Conclusion

To improve the impact of our food choices on the planet, individual consumer behaviour has to alter significantly. Envirofy supports online grocery shoppers in reducing their environmental footprint by presenting theory- and evidence-based behavioural intervention techniques, at the point of purchase, when online shopping. Human-Computer Interaction researchers have a significant role in designing, developing, and evaluating novel BCTs that target behavioural drivers and barriers in order to support sustainable food consumption, and ultimately in reducing GHG emissions.

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