FoodSampler

Engaging people to contextualise food behaviour: Mixed methods for monitoring choices and triggers of eating habits

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Mixed methods for monitoring choices and triggers of eating habits

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ABSTRACT

Overweight and obesity affect the entire population. On a day-to-day basis, this problem relates to what people eat, why people eat what they eat and their day-to-day food choices. Towards e-health solutions that support self-management of (health) food related practices, a better understanding of eating habits is needed. Validated food measurement instruments are challenged to generate such holistic knowledge. Primarily due to their limited scope (mostly descriptive) and their long and time consuming demands. The FoodSampler research project aims to explore *food informatics* strategies to engage people in generating contextual knowledge of their food behaviour. It targets an increasing vulnerable group in prevention of overweight and obesity: older adults with a low Socio-Economical Status (SES). The approach combines Mixed Method Research (MMR), Research through Design (RtD) and Living Labs research. In this way a user-centric innovative process is implemented, involving end-users and experts in cycles of exploring, prototyping and testing *mixed food informatics* strategies. By means of contextual research in-the-wild, co-design sessions, and in-situ interventions the project seeks for direct benefits to involve the targeted group as collaborators of the design process. In FoodSampler end-users and experts will co-generate knowledge on best practices for *mixed food informatics* and the values of the generated knowledge to explain food behaviour.

CCS CONCEPTS

• **Human-centered computing → Interaction design process and methods**; **User centered design**; **Participatory design**; **Contextual design**; *Field studies*; *Interface design prototyping*;

KEYWORDS

In-situ self-reporting, Mixed Methods Research, Research through Design, Living Labs, Health Informatics, Self-management, User-centric innovation

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1 INTRODUCTION

Research on digital media and healthcare envisions the role of e-health systems to empower patients taking own responsibility of their health [19]. In line with the definition of 'positive health' [13], this vision addresses a shift to support an active involvement of people in their own health condition. An active participation involves the ability to understand and communicate about one's health condition, the factors that influence it, and the impact on the overall wellbeing. In the specific context of health nutrition and prevention of overweight, and based on the definition by Axelson and Brinberg [1] we define food behaviour as *the act of making choices of one's eating habits, excluding the intake of nutrients.* E-health systems could support people and their informal and formal care network to engage in the day to day management of food behaviour [7]. Engagement in e-health revolves around data practices to actively managing (collecting and communicating) as well as using (reflecting and acting) rich data related to food behaviour. This rich data should encapsulate the complexity of eating by involving the context, personal needs and preferences, and daily routines of people. It is expected that such data-enabled practices support an active process of conscious decision-making by macro (medical) and micro (personal) assessments of the impact of their choices and actions.

Designers of self-management e-health apps seek for specific requirements of food informatics systems to support people's active engagement on regulating dietary intake. This position paper describes a study proposal with a two-folded goal: (1) generate research knowledge on the contextual factors that influence food

behaviour and (2) design knowledge on best practices for contextual and engagement strategies of food informatics tools.

As presented in Figure 1, three knowledge-base blocks will be generated targeting health experts, design experts, and end users.

- Best practices on contextual tools - contains knowledge on how to capture contextual data on food behaviour. It answers the question of the strategies to capture subjective and objective context by exploring digital and physical concepts. It also contains the analysis of what works and doesn't work by participants.
- Best practices on engaging tools- contains knowledge on how to maintain an active participation of end-users as providers of data by exploring reporting and reflective (in action / on action) mechanisms. It also contains the analysis of what works and doesn't work by participants.
- Data on contextualised food behaviour - contains a set of contextual factors that influence food behaviour and a representation of the contextual data captured by participants.

1.1 Contextual tools on food behaviour

On the side of practitioners and researchers, validated food measurements are mostly oriented to provide an overview of the quality and quantity of food intake, and its nutritional impact. The often-used Food Frequency Questionnaires (FFQs), food diaries, dietary recalls and dietary histories are examples of existing methods. In practice, these methods are criticised because of high demands and limited understanding of the contextual and personal nuances of food behaviour [8].

On the commercial side, a large number of health informatics apps offer ways for people to track their food intake, steps, sleep patterns, and other biological measures (heart rate, blood pressure, etc.). In The Netherlands, the percentage of healthcare users that keep track of their food intake and nutrition value went from 0% in 2013 to 12% in 2016, however this trend is mostly seen in the younger groups (<50 years old) and with higher education [17].

This proposal addresses the need for innovative tools to focus on capturing contextual factors. Table 1 summarises the characteristics of existing tools and the envisioned food informatics tool in relation to context sensitivity.

1.2 Engaging tools on food behaviour

As it relates to clients/people, the current understanding of food behaviour is limited as it is mostly based on misconceptions and biases, and therefore perceived as impractical.

Health informatics comprises several stages of people interacting with data: from preparation (what do I want to collect) to collection (how do I collect) to interpretation (how to organise the data) to reflection (what can I learn) and action (what can I do/change) [6]. Most commercial initiatives are technologically oriented and aim to automate the first three stages and leave to the user the reflection and action. Whereas the automation lowers the demand, it has been criticised to work against an active involvement of people hindering a natural appropriation of knowledge [15]. The FoodSampler project aims to explore and assess strategies to support people as active providers and consumers of information about their health, by enabling an active process of knowledge, awareness, reflection and action (k.a.r.a.) around food choices. Jimenez [15] describes k.a.r.a. processes as ?a continuing process of gaining self-awareness and becoming in control over the impact of one's behaviour?. People's engagement in macro and micro k.a.r.a. processes will be the core of this project. Table 2 summarises the characteristics of existing tools and the envisioned food informatics tool with regards to engagement strategies.

The remainder of the paper addresses the state of the art on self-management approaches. Next it describes the user-centric methodology developed for this study, and the hypothesis of engaging strategies to be explored. It closes with conclusions and discussion of the proposed approach.

2 RELATED WORK

The theoretical background of this proposal bases on existing frameworks related to:

- Personal informatics systems [6] and User engagement [22], to investigate techniques to motivate and engage people in an active role of their condition by enabling them in making accounts of their own data.
- Research on in-situ methods, to investigate the ease-of-use and direct benefit of in-situ tools that integrate different techniques of collecting [12] and reconstructing [16].
- Sensing technologies, such as life blogging or biomarkers [8, 11], to investigate ICT developments on automating the collection of objective data.

From earlier experiences, these frameworks offer opportunities for investigating adaptive self-reporting [32], motivational strategies [24], low-demand yet rich reporting tools (e.g. Pick-A-Mood [5]) and in-situ mixed interventions [14, 15, 26] to increase engagement and bring direct benefits to compensate the (low) effort invested. Research on photographs and crowdsourcing activities to define portion size [21], sensing and integrated visualisations [30], among others will be explored and tested in homes and home-care settings.

3 METHODOLOGY

The FoodSampler project bases on a pragmatic research paradigm combining Research through Design [34], Mixed Method Research [3, 26] and Living Lab research [18, 25]. The aim is to incorporate contexts and users as active elements in the design process. By involving end-users and experts as providers and consumers of information in the design process, data will be collected at the end-users' context, interpreted and evaluated with and by end-users. In the FoodSampler project, end-users are represented by two organisations to incorporate relevant contexts in the prevention of overweight for older adults. The first group, focuses on parents of overweight/obese children who are participants of a clinical program; the second group are older adults who are members of an organisation that hosts people dealing with different stages of overweight/obesity. In addition, two dietitian's organisations provide access to dietitians. Finally, the project consortium involves food researchers as well as designers and design researchers of healthcare technologies.

Two case studies are defined to investigate prevention of overweight in relation to the two end-user organisations involved:

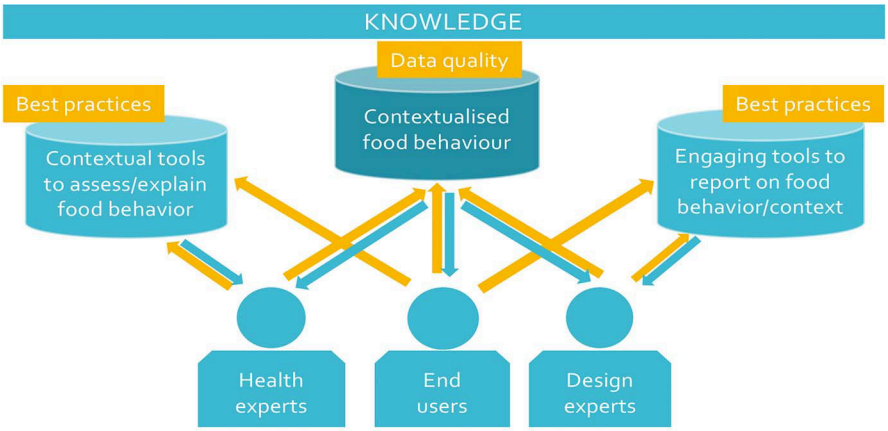

Figure 1: FoodSampler goals and outcomes

Table 1: Contextual food informatics tools

Existing tools	Envisioned tools
Focus is on quantifying food intake as a single activity. Capture either accumulated or single sampling days.	Sensitive to social and contextual factors. Sensitive to nuances of day to day food choices.

Table 2: Engaging food informatics tools

Existing tools	Envisioned tools
High cognitive and time effort. Long term (and unclear) benefit. Controlled and regulated activity.	Low effort mechanisms to actively report. Direct benefits of frequent reporting. Autonomous and reflective activity.

- Relapse: prevention will be studied in the context of maintenance of healthy habits, avoiding or recovering from relapse. Involving the needs of older adults in later stages of a dietary program will contribute to the design of food informatics that support the maintenance level.
- Social network: prevention will be studied in the context of parents of children that are patients in a clinical program that treats overweight in children. Understanding the needs of the involved parents throughout the child treatment will contribute to the design of food informatics that prevent parents to be overweight in older ages.

The FoodSampler project focuses on informing the design of engaging data-practices (providing and consuming data) around food behaviour in the daily context of people. The project is divided in three stages during a two-year period. In stage 1, the state-of-the art research is connected to user research (interviews and focus groups) with end-users and dietitians to provide input to co-design sessions [28] with the end-users to design food data practices in the daily context. This stage will provide a description of the experiences and expectations of using food measurement tools, the relevant contexts to consider, and concepts to implement data engagement practices in the daily context. In stage 2, engaging strategies are prototyped and tested with peers in an iterative cycle planned to further develop the concepts. An integrated concept is then tested with end-users in a longitudinal (2 months) in-the-wild evaluation. Finally, in stage 3 design, dietitian and end-users assess the knowledge gathered and define best practices for the design of data practices in food informatics systems.

3.1 Main explorations

In essence, stage 1 presents a unique opportunity to leverage creative and innovative ethnographic research tools to actively engage end-users to contribute to an open dialogue regarding their personal context in relation to food behaviour as well as their data practices in the context of food and beyond. Examples of methods that will be exploited to generate contextual and practice knowledge are: context mapping [33], cultural probes [10], and theatric-based participatory design techniques such as role-playing [31] and co-constructing stories [2]. As demonstrated in [4], these methods show promise for an exciting and engaging interaction with end-users while simultaneously optimising the data collection process.

Based on stage 1's outcomes, stage 2 hosts two iterations exploring, testing and prototyping engaging strategies, such as:

(1) Low-effort reporting in action [7, 15], aims to investigate efficient mechanisms to report close to the events of interest. It is expected that adaptive sampling protocols, multi-modal

input techniques and integration of sensing techniques will contribute to low-effort reporting in action.

(2) Reflective reporting on action [26], aims to investigate mechanisms to trigger reflective practices on accumulative events. It is expected that persuasive styles (e.g. nudging, confrontation, peer-pressure, gaming, etc.) will contribute to reflecting in reporting on action.

The integration of both reporting in action and on action, form the basis for in-situ mixed food informatics, as it is expected to minimise reporting costs while maximising richness of data. Mixed-design strategies [26] suggest to connect the output from one technique, as input to the other, to obtain richness in knowledge outcomes. For example, it is expected that the outcomes of reporting in action (e.g. timestamp of food and social moments, one-bit reporting) could be used as 'memory cues' to trigger reporting on action to explain those cues (e.g. mood state) .

4 CONCLUSIONS AND DISCUSSION

The use of digital tools to enable data-practices around food behaviour is expected to be a game-changer in increasing self-management and focusing on prevention rather than treatment. The FoodSampler project proposes a Research through Design process to investigate data-enabled practices in the context of low SES group and self-management of food behaviour. Understanding the extent to which data-enabled practices activates k.a.r.a. processes in low SES groups envisages several challenges:

- the understanding of the (digital) data practices that (older) adults from the low SES group engage in is constrained by the (digital) literacy of the participants and the particularly known low engagement on food measurement. Based on recent insights [23], we will look at the extend in which this group engages in data practices beyond the food and healthcare context. Consequently, this is expected to help in understanding people's ability, interest and motivation in adopting data practices in their daily life. Therefore, co-design explorations will start by building insights into existing daily data practices (and the motivations therefor) in other domains, exploring older and recent practices such as weather forecast, keeping an agenda/diary, making a shopping list, using a family calendar, monitoring a sport championship, keeping a digital/an analog phonebook or photo album, using a social network app, and so forth.
- the gathering of rich reporting and reflective strategies around food behaviour is constrained by how sensitive and confronting the issue might be experienced, as well as by the perceived lack of privacy and security. Direct benefits perceived when engaging in reporting and reflective tasks are expected to trigger direct (food related) and indirect (non-food related) motivations to report. Direct benefits will be explored grounded on theories such as health empowerment frameworks [20, 29], value sensitive design [9] and, the self-determination theory [27].

In conclusion, the FoodSampler project adopts an innovative pragmatic approach by integrating mixed methods in a user-centric process. FoodSampler expects to generate knowledge on the basis of explorations by means of a socio-technical research platform and experiential prototypes. The aim is to actively involve end-users and experts as collaborators in the exploration, design, development, testing, and analysis of the data generated.

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