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Motivating consumers for health and fitness: The role of app features

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Abstract

Smartphone apps can create value for consumers by supporting their health goals. The purpose of the study was to reveal people's preferences for Self-Determination theory derived app features of health-related apps that can potentially promote motivation and sustained use of such apps. Three discrete choice experiments, followed by a ranking task, were used to assess consumer preferences for specific app features that can support the basic needs for autonomy, competence and relatedness among respondents from Germany and Spain ($N = 719$). Participants preferred the autonomy supporting app features, namely making changes to the menu recommendations or self-selecting their rewards. The competence supporting features of levels of progress and feedback that provided encouragement together with facts were preferred across countries; however, presenting the feedback in a dynamic display was disliked in Germany. The relatedness supporting feature, presence of an anthropomorphic cue with the menu recommendations, was preferred in Germany but disliked in Spain. Health and fitness apps can benefit from including features that bring value to consumers by responding to their psychological needs and help them achieve their health goals. Allowing choice flexibility in app recommendations, providing feedback that is encouraging in addition to informative, and including gamification elements in health apps, can respond to consumer preferences and thereby increase engagement with apps. The study contributes to understanding how the theoretically derived features of health apps can be included in the design of apps to match consumer preferences.

1 | INTRODUCTION

Consumers are increasingly using smartphone applications (apps) in attempts to modify and regulate their own behaviours, typically in areas where consumers may find it difficult to define clear goals and implement them due to lack of opportunity and ability, for example in the areas of health and nutrition. Such apps can, not only help consumers achieve their own goals but their use can also contribute to

achieving societal goals like healthy and sustainable living. The development and marketing of behavioural change apps has therefore been an area where considerable resources have been invested in product development and launch.

Consumer spending on health and fitness apps amounted to 209 million U.S. dollars in the US and 82 million U.S. dollars in Europe during the last quarter of 2020 (Ceci, 2022). Worldwide, the downloads of apps in this category have reached about 600 million in the

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last quarter of 2021 (data.ai, 2022). A survey among respondents from selected countries showed that health app usage in 2020 varied between 65% in China to 12% in Japan, with some European countries such as Germany or Spain reporting use only slightly lower than the US (44%) (Buchholz, 2020). The apps in this category span nutrition or diet related apps, fitness apps as well as other apps such as those related to mental wellbeing or health monitoring (e.g., blood pressure). The first two types of apps were most common among consumers and continue to be in the top health and nutrition apps (data.ai, 2022; Krebs & Duncan, 2015).

Previous studies on health and fitness apps have assessed the potential of these apps to support behaviour change, providing evidence for their effectiveness (Coughlin et al., 2015; Zhao et al., 2016). Another stream of literature has content analysed the features of digital services that aim to support engagement (Abdulquadi et al., 2021) or more specifically features contained by health and fitness apps. Among the latter, some have further matched the identified features to behaviour change techniques known to be effective tools for behaviour change based on behaviour change theory (Flaherty et al., 2018; Franco et al., 2016; Mauch et al., 2018; Michie et al., 2013). Studies on individual experiences with health and fitness apps have focused mainly on adoption of apps or engagement with the apps, drawing on theories of technology acceptance (Beldad & Hegner, 2018; Cho, 2016; Cho et al., 2020; Davis et al., 1989; Yuan et al., 2015) or consumer engagement (Flaherty et al., 2019; Flaherty et al., 2021; Hollebeek et al., 2014). Such studies explored experiences with health and fitness apps in general by asking people to think about an app they normally use, or applied qualitative methods to the study of specific apps. Some studies have tested the effectiveness of apps in real-life interventions or have used longitudinal data or app usage data to investigate experiences with apps or behaviour change (Boratto et al., 2017; Hamari, 2017; Liu & Willoughby, 2018; McLean et al., 2020; Mitchell et al., 2017; Mitchell et al., 2018; Serrano et al., 2017). However, most of these do not provide tests of specific app features. Therefore, experimental insights into the role of specific app features that relate to behaviour change techniques and into consumer preferences for such features are needed.

To encourage consumers to adopt and use behavioural change apps, app developers have a vast array of parameters at their disposal that define the interface between the app and the user (Flaherty et al., 2018; Franco et al., 2016; Mauch et al., 2018). Decisions about what features to include in apps and in which combination have consequences for users' attitudes and intention to adopt such apps (Wang & Collins, 2021). Consumer studies on the optimal design of health app features are scarce, and those that exist reveal mixed results (Liu & Avello, 2021). Although several studies have provided descriptive content analysis regarding the types of features present in health and fitness apps (Flaherty et al., 2018; Franco et al., 2016; Mauch et al., 2018), there is a lack of understanding of the role that specific features may play in motivating use of the apps. While there are calls in prior literature to draw on theory in order to make decisions regarding which features to employ in the design of behaviour change technologies and how to implement such features (Hekler

et al., 2013; Peters et al., 2018), such calls have not been followed up by empirical research. The evidence is even more scarce if we look at nutrition apps and not fitness apps. Whereas nutrition and fitness apps are similar in their aim to promote healthy behaviour change, they differ in terms of how observable and long term oriented they are. For example, physical activity can have more clear short term observable effects (e.g., vitality, feeling energetic) as opposed to healthy eating, whose results can be difficult for the individual to notice on the short term. Therefore, there is little evidence-based guidance for app developers on which app features will contribute to consumer motivation to adopt and use the app (Hosseinpour & Terlutter, 2019; Yang et al., 2020).

In order to provide theoretical guidance for the selection of app features in behaviour change apps, it is useful to go beyond a unitary view of motivation. Consumers differ in their motivation for, for example, healthy eating, but these differences do not explain why a consumer motivated for healthy eating prefers one app facilitating healthy eating over another. In trying to link consumer motivation to different app features, self-determination theory has been invoked as a useful theoretical basis. Self-determination theory (SDT) links sustained motivation for a behaviour to the fulfilment of three basic human needs, namely autonomy, competence and relatedness. Features of behavioural change apps can potentially contribute to all three types of needs, and Villalobos-Zúñiga and Cherubini (2020) have recently provided a conceptual framework, where they link these three types of needs to twelve different features that they found by analysing behaviour change apps currently on the market. For example, apps that allow consumers to set their own goals for the behaviour change can contribute to the need for autonomy, giving feedback on the behaviours implemented can contribute to the need for competence, and sharing of results with other users can contribute to the need for relatedness. Villalobos-Zúñiga and Cherubini (2020) review other theories relevant for health behaviour but ultimately argue for the suitability of SDT due to its focus on the quality of motivation by differentiating between different types of motivations. A meta-analysis of using SDT in health contexts (Ng et al., 2012) and intervention or survey studies (Carbonneau et al., 2021; Coumans et al., 2022) support that SDT is a viable framework for healthy behaviour change.

Villalobos-Zúñiga and Cherubini (2020) did not put their framework to an empirical test. The coding of app features into the SDT types of needs was based on previous literature findings and also in some instances on the authors' own perceptions, thus, further empirical evidence testing consumer preferences of app features that could potentially support the basic needs satisfaction is necessary. In the present paper, we follow up on their framework and test hypotheses on consumer preferences for six app features that we have developed based on self-determination theory, providing a partial test of the framework. We do this in the context of a personalised nutrition app that was under development at the time of the study, an app that based on input provided by its users delivers a recommended weekly menu plan users should follow in order to attain health benefits. The app features of interest were embedded within this app.

The purpose of our research was to study people's preferences for features of health-related apps that can potentially promote their motivation and sustained use of such apps, using self-determination theory as a theoretical framework. We used an online survey conducted in Germany and Spain, which included discrete choice experiments that varied the features contained in the app in order to assess the effect of certain features on consumer preferences for the app. The tested features relate to people's basic psychological needs based on SDT and were embedded in a hypothetical app. In this way, our study deepens our understanding of the role of specific app features in consumer preferences for health and fitness apps and brings empirical evidence related to consumer preferences for app features that can be assumed to support the basic psychological needs that people have. Furthermore, we provide insights on how these features can be implemented to best support consumer preferences. Our results further contribute to extending the findings from previous literature on fitness apps or gamification to health apps. Our study has practical implications for the design of apps that promote behavioural change in terms of healthy eating, but also contributes to theory by showing that self-determination theory is a useful approach in studying people's motivation to adopt and use behavioural change apps.

The following section explains the theoretical background of our study. We then present the methods employed and continue with a detailed description of the results. The last section contains the discussion of these results in the context of previous literature together with the implications and limitations of the present study.

2 | THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

The study draws on Self-Determination Theory (SDT) (Ryan & Deci, 2000) to explore consumer preferences for selected features of a health and fitness related app. SDT posits that people's motivation can be facilitated or hindered by the satisfaction or frustration of basic psychological needs (Ryan & Deci, 2000). The three basic psychological needs are the need for autonomy (namely, feelings of agency and behaving in line with one's goals and values), competence (namely, feeling effective or able to engage in the behaviour) and relatedness (namely, feeling connected to other people or having a sense of belonging). In relation to adoption of a mobile app, the prediction drawing on SDT is that the interface of the app (i.e., the features it contains) can contribute to fulfilling these psychological needs, thereby supporting people's motivation and likelihood to adopt the app (Peters et al., 2018; Ryan & Deci, 2000).

App features that support the satisfaction of psychological needs can further contribute to long-term behaviour change (Ng et al., 2012; Peters et al., 2018). SDT distinguishes between different types of motivation to engage in behaviour that vary in the degree to which they are internalized. According to SDT, the fulfilment of basic psychological needs facilitates internalization of motives, which then contributes to enduring behaviour change (Guèvremont, 2019; Ng et al., 2012; Peters et al., 2018; Ryan & Deci, 2000). SDT has proven

to be a suitable framework to study the role of different motivations in consumer behaviour in the health context (Coumans et al., 2022; Ng et al., 2012) and it has been suggested as useful in classifying behaviour change app features in terms of their potential to support people's motivation (Villalobos-Zúñiga & Cherubini, 2020).

Recently, Villalobos-Zúñiga and Cherubini (2020) proposed a taxonomy of app features with potential to support people's three basic psychological needs, but they did not test the taxonomy empirically. There is, however, evidence on the potential of certain features to promote motivation based on satisfaction of basic needs coming from consumer studies in the related areas of sustainability and gamification (Bitrián et al., 2021; Wee & Choong, 2019). In the following we develop hypotheses about preferences for specific features of a health and nutrition app based on how they are expected to contribute to the three basic psychological needs.

2.1 | Competence supporting features

Competence refers to people's need to feel effective or capable (Deci & Ryan, 2000; Peters et al., 2018). Provision of opportunities for learning or of positive feedback are ways to support the satisfaction of the need for competence (Peng et al., 2012; Peters et al., 2018). In addition to its motivational role, provision of feedback is an important behaviour change technique (Michie et al., 2013; Zahry et al., 2016).

Features of apps that provide feedback on how well an activity was performed are seen as fulfilling the need for competence (Villalobos-Zúñiga & Cherubini, 2020). Another study on fitness apps shows that education-related features that provide tutorials or advice are preferred by consumers (Wang & Collins, 2021) and these features can be seen as supporting people's need for competence. Gamification, defined as 'the use of game design elements in non-game contexts' (Deterding et al., 2011, p. 10), can also be used to support people's need for competence. The inclusion of gamification in apps aims to increase user engagement and motivation to use the apps and has been linked with behaviour change and maintenance (Bardus et al., 2016; Chen et al., 2015; Direito et al., 2014; Flaherty et al., 2018; Mauch et al., 2018). Badges as gamification elements have been shown to increase user activity in a field experiment, however, in an area unrelated to health and fitness (Hamari, 2017). The most frequent game design elements in apps are levels or progress feedback, points or scoring, rewards or prizes, narrative or theme, personalization, customization, avatars and leader boards (Cheng et al., 2019; Johnson et al., 2016). From the consumers' point of view, the most preferred gamification elements in health-related apps are progress, goals, points, and levels of progress (Schmidt-Kraepelin et al., 2019). In the context of designing a gamified sustainability campaign, feedback related positively with people's need for competence that in turn promoted their motivation to engage in the campaign (Wee & Choong, 2019). This is in line with research on game design elements, where performance graphs were contributing to satisfy people's need for competence (Sailer et al., 2017). Progression oriented elements of gamification in a health and fitness app were found

to support people's need for competence (Bitrián et al., 2021). However, there is little insight into the individual effects of these different elements on consumer responses (Johnson et al., 2016).

Providing feedback based on the performance in the personalised nutrition app as levels of progress (e.g., beginner, expert) can support the fulfilment of people's need for competence, thereby contributing to their preference for such an app feature (Peters et al., 2018; Ryan & Deci, 2000).

H1. Consumers prefer the personalized nutrition app with a feature that provides levels of progress compared to the version of the app without this feature.

Different types of feedback can be used in apps to promote life-style behaviour change, like informative (e.g., bar graphs showing progress, factual text) or evaluative (e.g., in-app notifications in the form of congratulations when goals or challenges are met) (Mumma et al., 2016). In a study on performance outside the health domain, evaluative feedback coupled with informative feedback was more effective in terms of achieving maximal performance (Johnson, 2013). Providing both evaluative and informative feedback may contribute to satisfy people's need for competence as the evaluative feedback provides an interpretation and encouragement related to the fact-based information. Thus, we expect that people will prefer to have the feature that provides evaluative feedback together with informative feedback compared to not having it.

H2. Consumers prefer the personalized nutrition app with the feature that provides evaluative feedback together with informative feedback compared to the version of the app with informative feedback only.

The display format used to present health information can impact consumer responses to the feedback shown. Animated or dynamic presentation formats can attract attention and raise arousal levels of users, which in turn can facilitate learning and hence competence (Sundar & Kalyanaram, 2004). A recent study tested the effect of displaying health information as text, diagram, image or animation. The animation type of presentation was preferred, while the diagram had the lowest preference (Fang et al., 2019). Although the study was not conducted in the context of health and fitness apps, we expect that the presentation of the feedback information in a format that is dynamic instead of static text or numbers will be preferred for in-app feedback.

H3. Consumers prefer the personalized nutrition app with a dynamic display of feedback feature compared to the version of the app without this feature.

2.2 | Relatedness supporting feature

Relatedness refers to people's need to feel that they belong and connect with others (Deci & Ryan, 2000; Peters et al., 2018; Ryan &

Deci, 2000). Offering social-oriented elements, chat-based options, competitions or collaborations with others can support the satisfaction of people's need for competence (Bitrián et al., 2021; Johnson et al., 2016; Mitchell et al., 2017). Similarly, game design elements such as avatars support people's need for relatedness (Sailer et al., 2017). In consumer behaviour, products that are anthropomorphized, namely presented in human terms, are preferred by people (Aggarwal & McGill, 2007; de Visser et al., 2016). The use of anthropomorphic cues (Aggarwal & McGill, 2007; de Visser et al., 2016), could contribute to support people's need for relatedness as they communicate a sense of humanity (e.g., smile) (Peters et al., 2018).

On top of supporting people's need for relatedness thereby contributing to their preference, the use of anthropomorphism may help bypass people's reluctance towards advice or recommendations that come from algorithms (Dietvorst et al., 2015) due to the human characteristics being cued (Aggarwal & McGill, 2007; de Visser et al., 2016).

H4. Consumers prefer the personalized nutrition app with an anthropomorphic cue on the recommended menu compared to the version of the app without this feature.

2.3 | Autonomy supporting features

Autonomy refers to the feeling of volition or freedom with regard to one's behaviour and relates to acting in accordance with one's values and goals (Deci & Ryan, 2000; Peters et al., 2018). Providing consumers with choices, allowing customization, or making participation in an activity voluntary can support the satisfaction of the need for autonomy (Peng et al., 2012; Peters et al., 2018; Sweeney et al., 2014). Previous studies on fitness apps also show that features such as goal-setting, which can be seen as autonomy supporting (Villalobos-Zúñiga & Cherubini, 2020), are preferred by individuals (Wang & Collins, 2021). Previous literature in the area of sustainability provides insights into the role of design elements in gamified sustainability campaigns, namely the freedom to choose which energy-saving activities to adopt, results in higher motivation to engage in those activities due to feelings of autonomy (Wee & Choong, 2019). In the health and nutrition apps area, qualitative work suggests that a sense of personal autonomy is integral to consumer engagement with apps and use of apps. The integration of features that allow tailoring to the individual needs was central in supporting people's perceived autonomy, and giving the possibility to tailor the app recommended meal plans was linked with perceived autonomy (Flaherty et al., 2019).

Many health and fitness apps provide recommendations or advice that people should follow to attain the desired benefits, such as exercise or meal plans. Allowing people to make choices in the recommended plan (in our case: weekly menu plan) provided by the app, so that instead of following a fixed plan they could choose among some alternatives (i.e., choice flexibility) can support the fulfilment of people's need for autonomy (Peters et al., 2018; Ryan & Deci, 2000).

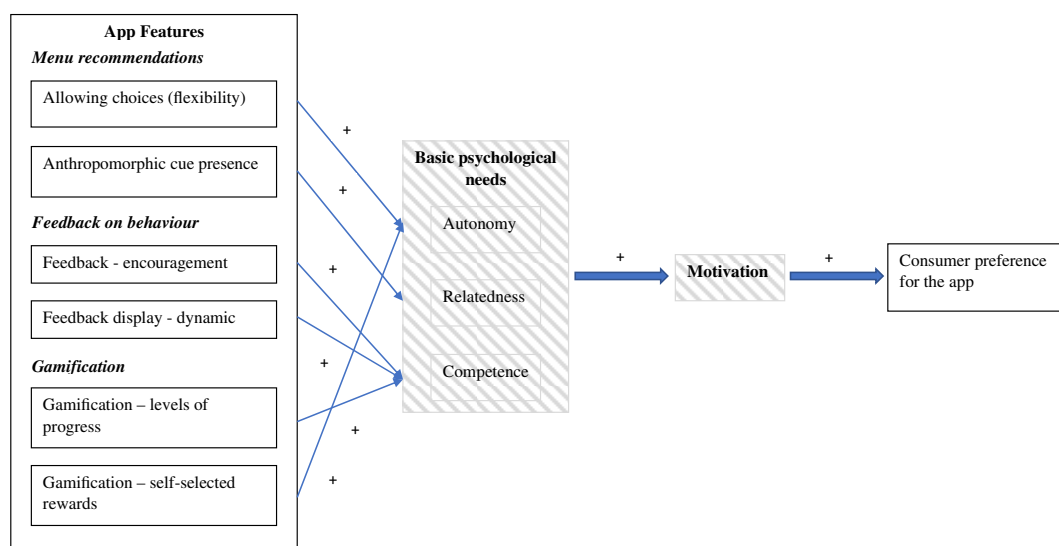
Thus, we expect that people will prefer to have the feature that allows choice flexibility in the recommended menu compared to not having it.

H5. Consumers prefer the personalized nutrition app with a feature that allows choice flexibility in the recommended menu compared to the version of the app without this feature.

Rewards are common gamification elements in apps (Cheng et al., 2019; Johnson et al., 2016). Non-tangible rewards that are connected with people's experience gain when using an app are seen as features that can motivate consumers in the context of SDT (Villalobos-Zúñiga & Cherubini, 2020). Moreover, features that provide rewards on behaviour are seen as supporting self-regulation, which is important in behaviour change (Zahry et al., 2016). In some cases, consumers may see certain rewards as irrelevant and thus not motivating (Flaherty et al., 2019). Providing options and allowing users to self-select the reward can support their need for autonomy thereby contributing to their preference for such an app feature (Peters et al., 2018; Ryan & Deci, 2000).

H6. Consumers prefer the personalized nutrition app with a feature allowing them to self-select the rewards compared to the version of the app without this feature (i.e., where the reward is fixed such as receiving points).

The overall conceptual framework of the role of app features on consumer preferences is displayed in Figure 1.



Note. The constructs with patterned background were not empirically investigated.

FIGURE 1 Conceptual model of app features effect on consumer preferences for the app. The constructs with patterned background were not empirically investigated. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/ch.2108)]

3 | METHOD

We conducted a cross-sectional online study across Germany and Spain, and measured consumers' preferences for app features, each related to one of the psychological needs of autonomy, competence and relatedness, in three separate discrete choice experiments (DCE). Germany and Spain are relevant target populations as health app usage is common, with 35% to 38% of the population using them (Buchholz, 2020).

3.1 | Participants

Participants were recruited from an online panel administered by a professional market research agency. Participants gave their informed consent prior to their voluntary participation in this research in exchange for monetary compensation.

Participants were eligible to participate in this research when they expressed at least some interest in technology (scoring above 2 on the question "I am open to trying new technology" on a scale from 1 = *strongly disagree* to 7 = *strongly agree*) and some interest in healthy eating (score above 2 on the question "I am very particular about the healthiness of food I eat" on a scale from 1 = *strongly disagree* to 7 = *strongly agree*; Roininen et al. (1999)).

A total of 1439 respondents were originally recruited in Germany and Spain. Of these, respondents who (a) did not consent to participating in the study ($n = 111$), (b) did not match the health and technology interest screening criteria ($n = 212$), (c) spent less than one second reading the instructions ($n = 210$), (d) failed the attention check question ($n = 180$), or (e) did not finish or had missing data ($n = 7$) were subsequently removed. The final sample counted 719 respondents from Germany ($n = 360$) and Spain ($n = 359$) (see Table 1).

3.2 | Design

The study consisted of three discrete choice experiments, each of which used a full-factorial 2×2 design testing the effect of app features within three main sections (feedback, menu recommendation, and gamification) of a to-be-developed personalised nutrition app (see Table 2). We deemed three independent DCEs for testing the six app features feasible as this allowed us to remain as close to the natural design of the app as possible, hence increasing external validity of the visual stimuli, and also avoiding response fatigue as six attributes could have easily resulted in confusion.

In the first DCE, the feedback section, the two features were evaluative feedback (yes vs. no) and dynamic display of feedback (yes vs. no), which related to the psychological need of competence. In the second DCE, the menu recommendation section, the two tested app features were choice flexibility (yes vs. no) and anthropomorphic cue (yes vs. no), which related to the psychological needs of autonomy and relatedness. In the third and final DCE of the app, the gamification section, the two tested features were levels of progress (yes vs. no) and self-selected rewards (yes vs. no), which related to the psychological needs of competence and autonomy.

Each of the three DCEs, administered in randomized order, featured a full-factorial and randomized combination of the attribute levels (i.e., app features), resulting in a total of six choice sets in which participants chose among two alternative visualized mock-up screens of the app section according to their use preference (see Appendix B and C).

The survey instrument was developed in English and translated to German and Spanish by the market research agency. Native speakers of German and Spanish checked the survey translations to ensure that the original meaning of the English translation was reflected in the country-specific translations.

The survey started with a general introduction, informing participants that their input will help the design of a new health app. Participants then read a short description of the personalized nutrition app and were shown mock-up onboarding screens to familiarize them with its concept (see Appendix A). In the following DCEs (feedback, menu recommendation, and gamification), participants were first introduced to the two app features covered in the DCE with a short description before they answered the six choice sets. After completing all three DCEs, participants were asked to rank all six attributes according to their overall importance. Lastly, participants answered questions on demographics, were debriefed and remunerated.

TABLE 1 Demographics for Germany and Spain

	Germany (n = 360)	Spain (n = 359)
<i>Gender</i>		
Female	180 (50.0%)	184 (51.3%)
Male	180 (50.0%)	175 (48.7%)
<i>Age</i>		
18–81	47.1 (15.5)	47.0 (14.5)

3.3 | Measures

Participants' preferences for the six app features (evaluative feedback, dynamic display of feedback, choice flexibility, anthropomorphic cue, levels of progress and self-selected rewards) were obtained through three independent DCEs, each covering a different section (feedback, menu recommendation, gamification) of a hypothetical nutrition app.

In addition, a measure of the overall importance of these six app features was obtained in a simple ranking task, in which participants ranked the six features in the order of their importance (rank: 1 = *most important* to 6 = *least important*).

Last, participants answered demographic questions limited to their gender and age.

3.4 | Data analysis

The three discrete choice experiments were each analyzed using discrete choice modeling using the *mlogit* package for R (Train, 2009), and separately for each country as an initial multigroup analysis revealed that participants' responses to the choice sets were not independent of country. The dependent variable was participants' choice of the app screen "they preferred to use". The independent variables were dummy coded variables representing the app features used for the respective app section (for feedback: evaluative feedback: 1 = yes, 0 = no and dynamic display: 1 = yes, 0 = no; for menu recommendation: choice flexibility: 1 = yes, 0 = no with anthropomorphic cue: 1 = yes, 0 = no; and for gamification: levels of progress: 1 = yes, 0 = no and self-selected rewards: 1 = yes, 0 = no).

The ranking task was analysed by means of two Kruskal-Wallis one-way ANOVAs, one for each country (Spain and Germany), testing for statistical differences in the ranks that participants assigned the six app feature attributes in terms of their importance (1 = *most important*; 6 = *least important*), followed up with Dunn's pair-wise rank sum tests using multiple comparison adjustments.

4 | RESULTS

We first present the results for the three DCEs followed by the results for the overall ranking of importance of the six app features. Table 3 summarizes the results of the DCEs per country.

TABLE 2 Attributes and attribute levels of the three discrete choice experiments

App segment	Attribute	Attribute levels
Feedback	Evaluative feedback	Yes, no
	Dynamic display	Yes, no
Menu recommendation	Choice flexibility	Yes, no
	Anthropomorphic cue	Yes, no
Gamification	Levels of progress	Yes, no
	Self-selected rewards	Yes, no

TABLE 3 Estimates for the three discrete choice experiments per country

	Germany		Spain	
	B (SE)	<i>p</i>	B (SE)	<i>p</i>
Feedback				
Evaluative feedback	0.42 (0.08)	<.001	0.29 (0.07)	<.001
Dynamic display	−0.35 (0.08)	<.001	−0.10 (0.07)	.17
Evaluative × Dynamic	0.13 (0.11)	.22	<−0.001	1.00
Menu recommendation				
Choice flexibility	1.16 (0.08)	<.001	1.07 (0.08)	<.001
Anthropomorphic cue	0.51 (0.08)	<.001	−0.18 (0.08)	.024
Choice flexibility × Anthropomorphic cue	−0.24 (0.11)	.037	−0.05	.653
Gamification				
Levels of progress	0.45 (0.08)	<.001	0.86 (0.08)	<.001
Self-selected rewards	0.46 (0.08)	<.001	0.35 (0.08)	<.001
Levels × Rewards	0.10 (0.11)	.356	0.05 (0.11)	.656

4.1 | Choice results

The results of the first logit model on the choice data on the feedback section of the app, also shown in Table 3, reveal medium to small sized positive effects for the presence (vs. absence) of evaluative feedback in Germany and Spain. The presence (vs. absence) of dynamic display of feedback, on the other hand, returns with medium to small sized negative effects for both Germany and Spain, significant in Germany but not in Spain. The features of evaluative feedback and dynamic display did not interact with each other. These results suggest support for hypothesis H2 regarding consumers' preference for the provision of evaluative feedback but not for hypothesis H3 regarding the effect of the dynamic display of feedback.

The results of the second logit model on the choice data of the menu recommendation app section reveal strong and positive effects of presence (vs. absence) of choice flexibility in both Germany and Spain. Whereas presence (vs. absence) of the anthropomorphic cue resulted in a medium-sized positive effect in Germany, the effect was small and negative for the Spanish sample. The interaction effect of choice flexibility with the anthropomorphic cue was small and negative in Germany, suggesting that the combination of the features is less effective than the presence of the two app features separately. This negative interaction, however, was not observed in the Spanish sample. These results bring partial support for hypothesis H4 due to the preference for an anthropomorphic cue in Germany but not in Spain. Hypothesis H5 regarding consumers' preference for choice flexibility was supported for both countries.

The results of the third (and final) logit model on the choice data of the gamification section of the app reveals significant medium to large sized positive effects for the presence (vs. absence) of levels of progress for Germany and Spain. The results further show medium sized positive effects for the presence (vs. absence) of self-selected rewards in both countries. Moreover, results suggest that the two features are independent, as the interaction terms for both countries are not significant. The results provide support for hypotheses H1 and H6

regarding consumers' preference for the levels of progress feature and the self-selected reward feature based on both the German and Spanish sample.

4.2 | Ranking of attributes

The results of the Kruskal-Wallis one-ways ANOVAs testing for difference in the mean ranks of the six app features revealed significant variation between the app features ranks for both Germany ($\chi^2[5] = 187.11$, $p < .001$) and Spain ($\chi^2[5] = 245.72$, $p < .001$) (Figure 2a,b).

In Germany, the features with the highest to lowest Median ranks (1 = most important to 6 = least important) in descending order were choice flexibility ($Mdn = 2$), followed by levels of progress ($Mdn = 3$) and dynamic display ($Mdn = 3$), and anthropomorphism ($Mdn = 4$), self-selected rewards ($Mdn = 4$) and evaluative feedback ($Mdn = 4$). Pair-wise comparisons confirmed that choice flexibility was ranked significantly higher than both levels of progress ($Z = -2.79$, $p = .008$) and dynamic display ($Z = -4.58$, $p < .001$), with the latter two features ranked the same ($Z = -1.79$, $p = .092$). Furthermore, levels of progress and dynamic display were ranked significantly higher than anthropomorphism ($Z = -5.19$, $p < .001$), self-selected rewards ($Z = -5.28$, $p < .001$) and evaluative feedback ($Z = -5.45$, $p < .001$), with the latter three ranked the same (anthropomorphism vs. self-selected rewards: $Z = -0.09$, $p = .931$; self-selected rewards vs. evaluative feedback: $Z = -0.17$, $p = .923$). This suggests a total of 3 distinct ranks for the app features among German participants: (1) choice flexibility, (2) levels of progress and dynamic display, and (3) anthropomorphism, self-selected rewards and evaluative feedback.

Results for Spain portrayed a similar, yet slightly different picture with the app feature scoring highest being levels of progress ($Mdn = 2$), followed by choice flexibility ($Mdn = 3$) and dynamic display ($Mdn = 3$), and anthropomorphism ($Mdn = 4$), evaluative feedback ($Mdn = 4$) and self-selected rewards ($Mdn = 4$) coming in last.

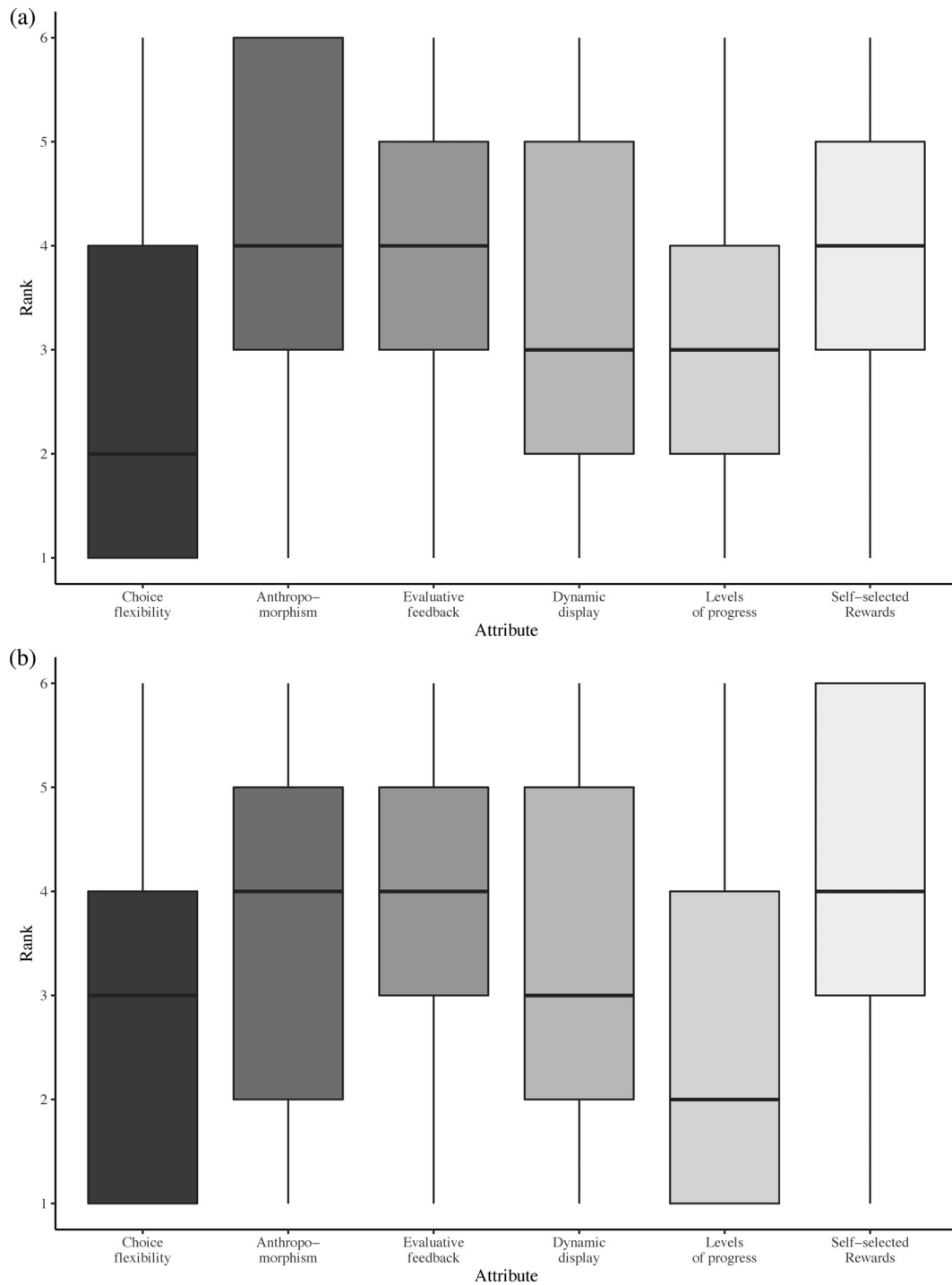


FIGURE 2 (a) Ranking of attributes for Germany (1 = most important to 6 = least important). (b) Ranking of attributes for Spain (1 = most important to 6 = least important)

Pair-wise comparisons confirmed that level of progress was ranked significantly higher than both choice flexibility ($Z = -2.10, p = .039$) and dynamic display ($Z = -5.46, p < .001$), while choice flexibility also ranked significantly higher than dynamic display ($Z = -3.36, p = .001$). Dynamic display in turn was ranked significantly higher than the last three app features: anthropomorphism ($Z = -3.52, p < .001$), evaluative feedback ($Z = -5.83, p < .001$) and self-selected rewards ($Z = -6.62,$

$p < .001$), with anthropomorphism ranked significantly higher than both evaluative feedback ($Z = -2.32, p = .024$) and self-selected rewards ($Z = -3.10, p = .002$), and with evaluative feedback and self-selected rewards ranked the same ($Z = -0.79, p = .431$). This suggests a total of 5 distinct ranks for the app features among Spanish participants: (1) levels of progress, (2) choice flexibility, (3) dynamic display, (4) anthropomorphism and (5) evaluative feedback and self-selected rewards.

5 | DISCUSSION

The present research investigates features relevant for the optimal design of apps in the health and nutrition area. Hypotheses on user preferences for app features were formulated based on Self-Determination Theory and more specifically on the app features' potential to contribute to the fulfilment of the three basic psychological needs of autonomy, competence and relatedness. Based on the results of three discrete choice experiments, it becomes clear that the success of health apps comes down to the careful selection and composition of their features. Providing feedback on achievements and doing this not only in a factual but also evaluative way, two app features that can contribute to the competence needs, where indeed preferred by users, whereas providing such feedback as a dynamic display was not. A relatedness supporting feature, the presence of an anthropomorphic cue, was preferred in Germany but disliked in Spain. In relation to autonomy supporting features, consumers preferred the choice flexibility and self-selection of rewards. While choice flexibility and anthropomorphic cue can increase preferences for the health app, they do cannibalize each other as combining those results in a less positive effect in Germany. Importantly, when ranked across the two countries, the features differed in terms of overall relevance to respondents, as choice flexibility scored highest in Germany while levels of progress scored highest in Spain. Taken together, these findings not only corroborate previous studies in this area but reinforce our belief that self-determination theory is a useful tool in the design of health apps and app features to support consumer motivation for adoption, sustained use and engagement.

In relation to the competence supporting features, people preferred the app providing levels of progress, and this was also the feature ranked as the most important one among participants in Spain. These findings are in line with the Self-Determination Theory (Peters et al., 2018; Ryan & Deci, 2000), as these features may support people's need for competence. Furthermore, the findings contribute to the gamification literature (Sailer et al., 2017), suggesting that gamification elements (e.g., badges, leader boards and performance graphs) have a motivating role in the context of health apps. The findings are in line with previous literature on consumer preferences for gamification features in health and fitness apps, where gamification features were preferred by consumers but the current market underrepresents such features in health and fitness apps (Wang & Collins, 2021). The presence of levels of progress is preferred across countries, which is also in line with the taxonomy developed by Villalobos-Zúñiga and Cherubini (2020), where information on progress was considered to support the need for competence, which then should contribute to motivation based on Self-Determination Theory (Peters et al., 2018; Ryan & Deci, 2000).

Consumers preferred the app with feedback that has an evaluative element in addition to the facts. This result supports prior literature showing that evaluative and informative feedback outperforms informative feedback alone in relation to how well people perform on a task (Johnson, 2013). This is also in line with the categorization of congratulations messages as competence supporting features in the taxonomy developed by Villalobos-Zúñiga and Cherubini (2020). Our

findings further contribute to that taxonomy by showing that evaluative feedback together with facts is preferred over feedback that is only factual, whereas the taxonomy considers both features as competence supporting and thus motivating.

Contrary to our expectation, results show that the dynamic display of feedback feature – compared to static text – did not positively influence people's preference for the health app. This result does not reflect prior research, which shows that an animated presentation of health information in tandem with an anthropomorphic cue was preferred by consumers (Fang et al., 2019). In our study, dynamic display was manipulated separate from the anthropomorphic cue, which limits comparability. This suggests that the positive effect seen in Fang et al. (2019) study may be driven by anthropomorphism rather than the dynamic display of information.

The relatedness supporting feature, the presence of an anthropomorphic cue stood out with its large positive effect on people's preference for the app in Germany. While this result is in line with the preference for anthropomorphized products (Aggarwal & McGill, 2007) and also with the Self-Determination Theory (Peters et al., 2018), cultural differences appear to moderate the extent to which people value anthropomorphic cues in health apps. This further suggests that the mere presence of an anthropomorphic cue in health app recommendations may not help overcome people's bias to reject the adoption of algorithms-based advice (Dietvorst et al., 2015). In conclusion, the application of the feature needs to be considered in the cultural context and pre-tested with target consumer groups.

Among the six app features, the choice flexibility (allowing people to make changes in the recommended menu that the app provides) returned the highest value of consumer preferences. In Germany, this feature ranked most important among all six features. Moreover, people prefer the app that allows choices in the gamified features, namely to self-select their rewards. The observed preference for choice flexibility and self-selected rewards is in line with Self-Determination Theory, as allowing people to make changes to the app can satisfy their need for autonomy (Peters et al., 2018; Ryan & Deci, 2000). This finding corroborates previous qualitative insights showing that giving people the possibility to tailor apps to their needs contributes to perceived autonomy and engagement with the app (Flaherty et al., 2019) and quantitative insights related to fitness apps where individuals prefer to have customized trainings (Wang & Collins, 2021). The finding is also in line with results from other domains such as gamified sustainability campaigns (Wee & Choong, 2019), personalisation in gamification (Bitrián et al., 2021) and algorithm aversion (Dietvorst et al., 2016), and extends their applicability to the context of health and fitness apps. Our finding extends the framework proposed by Villalobos-Zúñiga and Cherubini (2020) with the addition of features that allow users to make choices (i.e., changing menu or customizing rewards) as features that are preferred by consumers and have potential to support autonomy in addition to goal setting.

Mobile applications are part of consumers' everyday lives and can influence various behaviours from shopping to exercising (Kim & Hall, 2022; Trivedi et al., 2022). Although the use of mobile applications can promote healthy behaviours among consumers (Kim & Hall, 2022; Zhao et al., 2016), there is not enough evidence

regarding which aspects of such applications can support consumer choice and continued use of such health-related apps. Continued use would be important in order to achieve behaviour change, however, there are many drivers that influence continued use of apps and the role of specific features of apps is not well understood (Cho et al., 2020; McLean et al., 2020; Purohit et al., 2022). As discussed so far, our results contribute to deepen our understanding of the motivating role of app features in consumer choices of health-related apps.

Results show consistency between the relative value of the features observed in the discrete choice experiments and how they were ranked in the ranking task. This finding helps to understand the perception of features of an app, as those are typically explored through discovery or direct comparison in app stores where people can easily see key features of an app before downloading it similar to how they saw it in our tasks.

5.1 | Theoretical contribution

The main theoretical contributions are that we bring empirical evidence for consumer preference of app features that can be categorized as supporting different basic psychological needs, providing in this way empirical evidence related to the conceptual framework proposed by Villalobos-Zúñiga and Cherubini (2020). We further extend this framework by not only showing that specific features are preferred and could be seen as motivating, but also showing how they can be implemented to best match consumer preferences. For example, feedback is seen as supporting the satisfaction of the need for competence but we show that evaluative feedback together with facts is preferred to only factual feedback. Our study further contributes to previous literature by extending the findings from studies on fitness apps or gamification in domains such as sustainability to the area of health apps.

Having studied two of the markets with great potential for health and fitness apps (Buchholz, 2020) allowed to shed light on the robustness of our findings. Most of the features had consistent results across the two countries, which makes the findings particularly relevant for international marketing. There are cross-country differences in app use in general or in app popularity and some of those differences can be explained in part by cultural dimensions (Kübler et al., 2018; Lim et al., 2015). Cultural dimensions could explain some of the observed differences in our results as well, for instance as Germany scores higher in individualism than Spain (<https://www.hofstede-insights.com/fi/product/compare-countries/>), the anthropomorphic cue might have been preferred as it provides some abstract social presence without socializing with other people. Spain on the other hand, scores lower on individualism, thus, people in Spain may prefer actual human socialisation as opposed to the anthropomorphic cue. Therefore, the results may hold similarly in countries that have similar cultural dimensions to the ones studied, for instance Portugal or Brazil could be seen as similar in some social dimensions to Spain. However, cultural differences may not be the only explanation for these differences and future research is needed to further explore the reasons behind the identified country differences.

5.2 | Practical implications

People have a choice between a large variety of apps related to health and fitness. These apps vary in the composition of their features. The present study has provided insights into people's preferences for selected features of health and nutrition apps. Overall, our results suggest that people prefer apps with features that can support their needs for competence, relatedness and autonomy. These features relate to giving feedback on their performance (e.g., providing encouragement in addition to the facts, including levels of progress), displaying an anthropomorphic cue or promoting choice flexibility (e.g., being able to make changes in the app, self-selection of rewards).

Provision of feedback has been proven to be a good behavioural change technique that does support self-regulation (Michie et al., 2013), implying that features that relate to provision of feedback can support people's motivation as well as long-term behaviour change. Therefore, our results first have managerial implications for the use of feedback features in health apps in the sense that provision of an evaluation of the facts or encouragement should be accompanying the factual feedback. When feedback is provided as gamification element then showing levels of progress and allowing people to progress in stages based on their performance is preferred by consumers as opposed to not having this feature.

Having a coach in the app that provides support for one's activity leads to better performance (Boratto et al., 2017). Here we show that even an abstract representation of human characteristics like anthropomorphic cues can have an impact on people's preference for the app, although this effect seems to be country-specific. Even though presence of a coach is clearly superior, having an anthropomorphic cue is a much more affordable and easier way to implement a feature that can attract people to the app. The results regarding the anthropomorphic cue lead to the second set of managerial implications. Namely that managers can use anthropomorphic cues, but there is a need to consider the country context and confirm the role of this feature with a suitable sample of the country of interest.

In a weight loss app, people who engaged more with the app were those who used customization features present in the app (Serrano et al., 2017). Thus, allowing users to make choices in an app that are in line with their personal preferences may lead to higher engagement in addition to satisfying their need for autonomy. These findings have the third set of managerial implications, in that app developers should try to build features that allow people to make changes, for example by giving some choices in menus or by allowing people to select their preferred reward instead of using standardized points only.

5.3 | Limitations and directions for future research

We have investigated user preferences for different features of apps aimed at promoting healthy lifestyle changes, but there is still a need for future research to understand the reasons and verify the

mechanisms why those features are preferred. Our results are consistent with the propositions of the Self-Determination Theory in terms of designing motivating apps (Peters et al., 2018; Ryan & Deci, 2000), though we could not directly test the process by which the various features influence people's preferences for the app. Therefore, future research investigating the process by which specific features affect consumer preferences and experiments to exclude alternative explanations would be highly valuable.

Our study used discrete choice experiments to test people's preferences for features of apps that can be seen as motivational based on Self-Determination Theory, meaning that it provides evidence into consumer preferences for specific app features. The effect of app features on behaviour change or other outcomes was outside the purpose of this study, although such insights would be highly relevant in relation to individual experiences with health apps in order to provide strong evidence of the effect of features on behaviour change or on actual use of apps. Few studies have explored such aspects, for instance Liu and Willoughby (2018) experimented with the use of text reminders in fitness apps, therefore there is a need for future real-life interventions or field experiments containing longitudinal data.

The majority of features had consistent results across the two countries under study, suggesting that the implications for app developers related to these features (encouragement and information feedback, levels of progress, choice flexibility and self-selected rewards) can be applied across countries. There was a substantial difference in consumer preferences for the anthropomorphic cue, which could be in part explained by the differences in cultures between Germany and Spain. Future research is needed to further investigate the mechanisms responsible for this difference.

The three choice experiments included in our study were fully randomized, which provides good support to rule out the influence of systematic effects (Hutchinson et al., 2000). It may be relevant that future studies using a different design take such effects into account.

The present study relied on mock-up screens of an app that was still under development at the time. However, to measure behaviour changes, we need to study real world adoption and sustained use of a health app, preferably one that is widely available on the prominent app stores. Therefore, future research that validates the importance of features in the context of actual app usage would make a pronounced addition to the present literature.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in the Open Science Framework (OSF) repository at <https://doi.org/10.17605/OSF.IO/UZCMD>.

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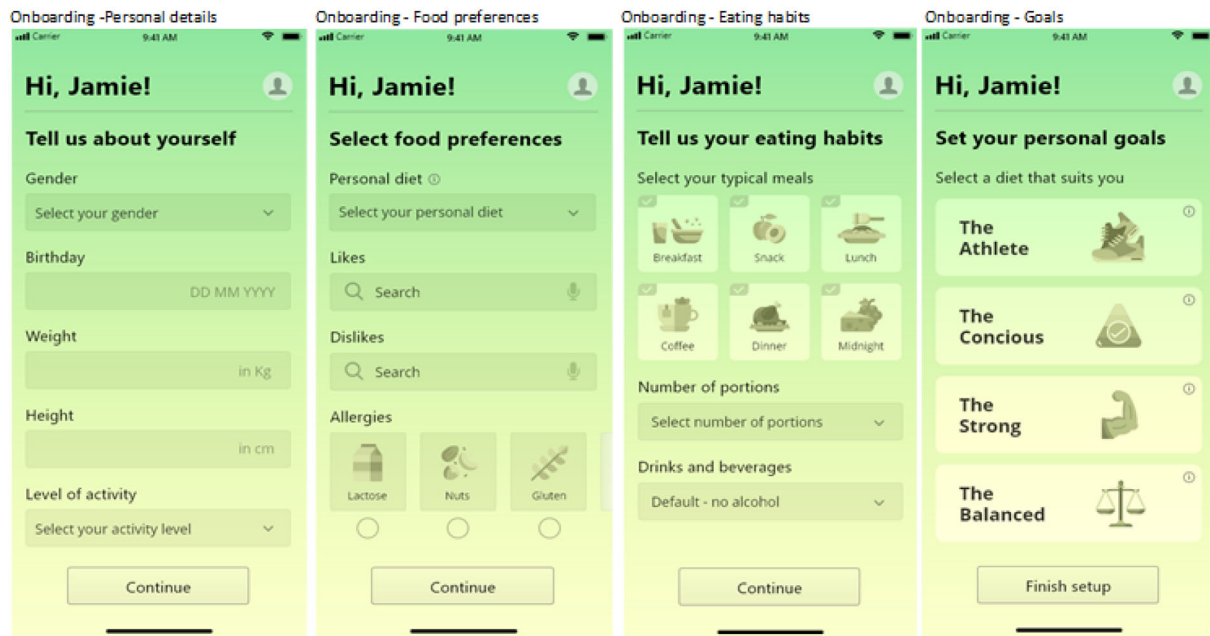
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APPENDIX A

A.1 | Onboarding screens shown to all participants to familiarize with the concept of the app



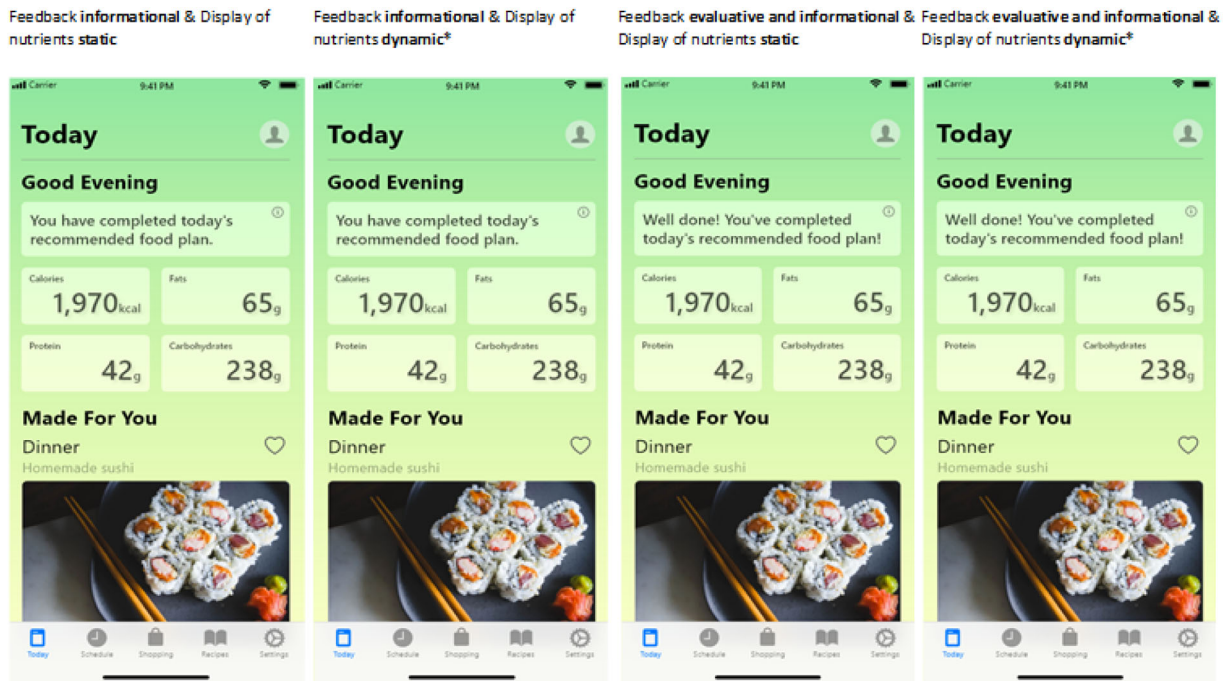
APPENDIX B

App features under study.

App feature	Presence	Absence	App screens
Choice flexibility	Allowed people to make changes in the recommended weekly menu plan	Recommended weekly menu plan was provided and no changes were allowed	See Appendix C, C.2, screens 1 and 3
Anthropomorphic cue	Advice companion that had human characteristics was present on screen with recommended weekly menu plan	Advice companion that had human characteristics was absent from screen with recommended weekly menu plan	See Appendix C, C.2 screens 3 and 4
Feedback type	App provides feedback that is evaluative in addition to information	App provides feedback that is informational only	See Appendix C, C.1, screens 1 and 3
Dynamic display	Instead of static numbers, ones performance in the app is shown in a dynamic way where numbers count up to the value achieved	Performance in the app is shown with numbers that are static	See Appendix C, C.1, screen 1 and 2, however the dynamic display consisted of a short video that cannot be shown here
Levels of progress	Progress in the app in terms of levels from Beginner to being an Expert based on the points collected in the app	No progression in terms of levels	See Appendix C, C.3, screens 1 and 3
Self-selected reward	Allows to choose reward	Rewards in terms of points	See Appendix C, C.3, screens 1 and 2

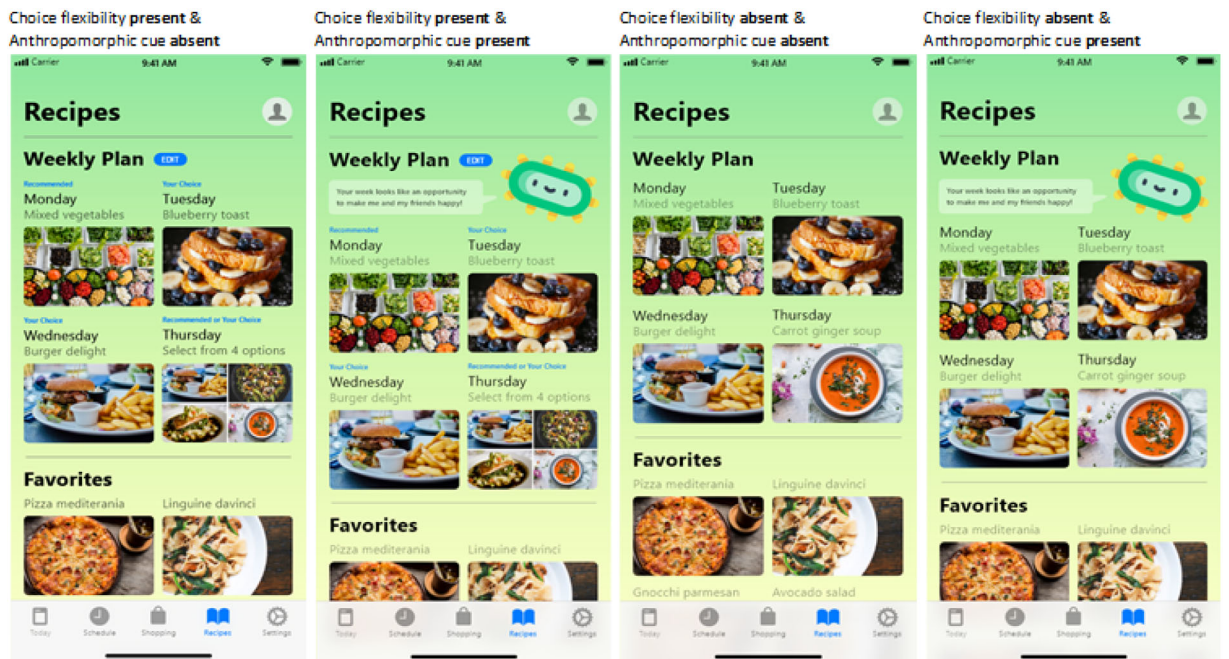
APPENDIX C

C.1 | Stimuli for experiment on feedback section of app (Manipulations of feedback type & display type)



*in the animated display condition, the stimuli were short videos where the numbers for the nutrients start at 0 and gradually increase until the final values shown in the screen here.

C.2 | Stimuli for experiment on menu recommendation section of app (Manipulations of choice flexibility & anthropomorphic cue)



C.3 | Stimuli for experiment on gamification section of app (Manipulations of levels of progress & rewards)

