Designing Smart Jewelry for Urban Office Workers Using the Fogg Behavior Model

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Abstract: According to the research findings, office workers often neglect short breaks during working hours for various reasons. This study aims to use smart jewelry as a medium to integrate daily health behaviors more naturally into office workers' daily work. Based on the Fogg Behavior Model, this paper conducts design research and analysis to identify the problems office workers face when performing health behaviors and translate them into design opportunities. The results show that the Ability dimension has the greatest influence on user needs. Finally, in the design practice stage, a smart ear clip and smart ring solution is developed.

Keywords: Fogg Behavior Model; Smart Jewelry; Office Workers; Health Microbehaviors; G1 Method.

1. Introduction

An observational study of office workers' health behaviors found that using health-related apps or Pomodoro timers for health management did not effectively improve the implementation and maintenance of health behaviors. In actual work situations, office workers find it difficult to perform health behaviors according to predetermined plans. Unexpected reminders during work often become interruptions, while app-based health management software is inconvenient to use [1]. During six months of continuous tracking, further interviews conducted by the researchers revealed that work intensity was an important factor hindering the implementation of health behaviors [2]. Similarly, health-monitoring products such as smart wristbands have difficulty effectively improving office workers' health management capabilities due to similar problems, and are often left unused after a relatively short period of use [3].

We examined how smart jewelry could help workers start and repeat small actions such as standing up, drinking water, or taking a short recovery break. The Fogg Behavior Model guided the analysis of barriers, the G1 method assigned weights to the requirements, and experts compared the design concepts.

2. Background and Design Problem

2.1 Work Routines and Health Microbehaviors

A health microbehavior in this study is a small, observable action such as standing briefly, taking a sip of water, or pausing for a breathing exercise. In Fogg's model, a behavior occurs when motivation, ability, and a prompt coincide [4]. Here, ability refers to how easy the action is in the current situation. Repeating an action in a consistent context can increase its automaticity over time [5]. At work, the end of a meeting or the completion of a task could cue one of these actions.

Researchers have used the Fogg model to distinguish motivation from practical barriers in a vaccine adoption survey [6] and to design a pilot weight-management intervention [7]. The model can help researchers decide what to ask in a survey and where to intervene. As Figure 1 shows, a prompt may work at the same level of motivation if the action is easier to perform.

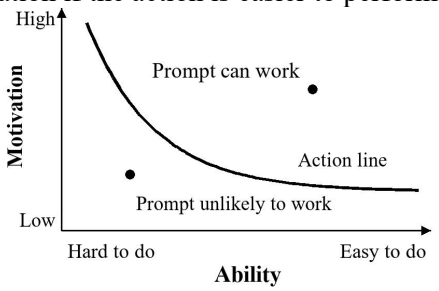


Figure 1. Motivation, Ability, and Prompts in the Fogg Behavior Model

Conceptual diagram based on Fogg [4]. The action line has no empirical scale.

2.2 Opportunities for Smart Jewelry

An ear clip can deliver a cue without drawing

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attention, and a ring can register a quick hand gesture. A wireless earring has been used to measure earlobe temperature [8], and overnight data from a commercial smart ring show that heart-rate-variability estimates hinge on data quality and the averaging interval [9]. What remains untested is how well the proposed ear clip collects signals during office work and how comfortable it is to wear there.

3. User Requirements and Weighting

3.1 Study Workflow

Based on the analysis of previous user questionnaires and interview results, we further organized the actual needs of office workers, laying the foundation for subsequent needs weighting analysis and the development of design strategies, as shown in Figure 2.

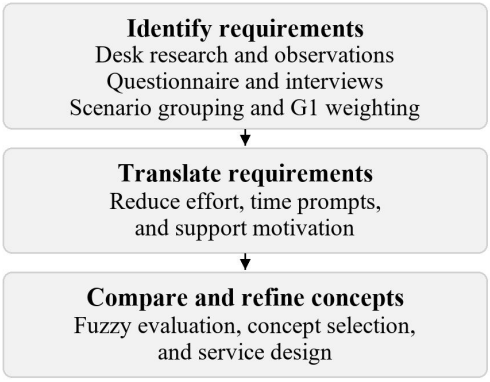


Figure 2. Research and Design Workflow

3.2 Initial Requirement Framework

Table 1 lists the questions asked under each component. Motivation refers to the benefits office workers can obtain from using smart jewelry, including various factors that make the jewelry worth wearing. Ability refers to potential barriers to using smart jewelry, such as a mismatch between the jewelry style and the user's outfit, or an environment where wearing conspicuous jewelry is inappropriate. Prompts mainly refer to the interaction methods of smart jewelry and how health reminders can be delivered without causing interruptions.

Table 1. Initial User Requirement Framework

Factor	Category	Examples
Motivation	Internal	Expected benefit, health concerns, feedback
	External	Jewelry functions and appearance
Ability	Time cost	Time available, work pace, overtime
	Cognitive cost	Forgetting, task transitions, reliance on alerts
	Interaction effort	Number of steps, effort to set up or log actions
	Setting limits	Access, social acceptability, site restrictions
Prompts	Internal or routine cues	Existing habits, thoughts, prior experience
	External	Modality, form, user control

3.3 Survey and Interview Findings

According to the in-depth interview results, office workers do not want to be disturbed during their busiest working periods. They tend to ignore or directly turn off health reminders. In addition, the research found that office workers are more likely to feel tired during the afternoon working period. Frequent health reminders cause noticeable psychological pressure and discomfort.

Based on the research findings, four typical user groups were identified: people experiencing long-term stress, people who attend frequent meetings, people whose work environments frequently change, and health-conscious people. The first group accounts for the largest proportion and is the least receptive to intrusive and forceful reminders. Figure 3 presents a journey map of this group, developed through a qualitative synthesis of the user research. Table 2 further summarizes the needs of this user group.

Stage	Arrival	Morning	Midday	Afternoon	Evening
Goal	Get into a work rhythm	Focus and stay professional	Rest and regain energy	Stay focused and wind down	Relax and prepare to sleep
Activity	Commute, check email, and prepare for meetings	Desk work and meetings	Chat or take a short break	Process files and finish tasks	Commute, chores, and phone use
Experience	Rushed or under pressure	Engaged, sometimes tense	Briefly relieved	Focused, but tired	Relaxed, with some fatigue
Barrier	Urgent tasks delay breaks	Alerts can disrupt meetings or focus	Short breaks limit rest	Missed water and stretch breaks	Phone use can delay bedtime

Figure 3. Journey Map for Office Workers under Sustained Concentration and Time Pressure

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Table 2. User Requirements by Fogg Model Component

Dimension	Subcriterion	User requirements
Motivation (M)	M1 Internal motivation	N1 Credible and understandable routines, N2 sustainable actions, N3 immediate benefits, N4 a sense of progress, N5 personalization
	M2 External motivation	N6 wearing comfort, N7 appearance, N8 health monitoring
Prompts (P)	P1 External prompts	N9 discreet cues, N10 distinguishable cues, N11 adjustable intensity
	P2 Internal prompts	N12 cues tied to context, N13 fewer interruptions and less annoyance, N14 less reliance on reminders, N15 immediate encouragement
Ability (A)	A1 Time cost	N16 quick completion, N17 long battery life and convenient charging
	A2 Cognitive cost	N18 fewer decisions
	A3 Interaction effort	N19 actions broken into small steps, N20 simple interaction
	A4 Environmental constraints	N21 user control, N22 fit with the setting, N23 discretion

3.4 G1 Weighting

A 10-member panel of experts and target users ranked the criteria at each level and compared adjacent criteria by relative importance. The G1 method converts these ordered comparisons into normalized weights [10]. For n criteria ranked from most to least important, w_k is the weight of criterion k. Equation (1) defines the ratio r_k for adjacent criteria. In Equation (2), $r_{k,j}$ denotes the ratio supplied by panelist j, and $\bar{r}_k$ is the geometric mean across the 10 panelists.

$$r_k = \frac{w_k}{w_{k+1}},\ r_k \geq 1,\ k = 1,\ldots,n-1 \quad (1)$$

$$\bar{r}_k = \left(\prod_{j=1}^{10} r_{kj}\right)^{1/10} \quad (2)$$

Equations (3) and (4) normalize the weights by first calculating w_n, the weight of the least important criterion, and then working back up the ranking. Equation (5) gives the global weight W_{ij} of subcriterion j within primary criterion i. Here, w_i is the primary weight and v_{ij} is the local weight.

$$w_n = \frac{1}{1 + \sum_{k=1}^{n-1} \prod_{i=k}^{n-1} \bar{r}_i} \quad (3)$$

$$w_k = \bar{r}_k w_{k+1},\ k = n-1,\ldots,1 \quad (4)$$

$$W_{ij} = w_i v_{ij} \quad (5)$$

The pooled ratios for the primary criteria were A/M = 1.3270 and M/P = 1.1983. Tables 3 and 4 report the primary weights and the local weights for the eight subcriteria. Table 5 ranks the subcriteria by global weight.

Table 3. Primary Criterion Weights

Criterion	Weight
Ability (A)	0.4197
Motivation (M)	0.3163
Prompts (P)	0.2640

The Ability dimension has the highest weight among the primary criteria. Within this dimension, cognitive cost and interaction cost rank first and second, respectively. Therefore, we tend to adopt simple options and one-step interactions. Among the eight sub-criteria, Internal Motivation has the highest global weight, followed by External Prompts.

Table 4. Local Weights of Subcriteria

Factor	Subcriterion	Local weight
M	M1 Internal motivation	0.5649
	M2 External motivation	0.4351
P	P1 External prompts	0.5981
	P2 Internal prompts	0.4019
A	A2 Cognitive cost	0.3194
	A3 Interaction effort	0.2621
	A1 Time cost	0.2364
	A4 Environmental constraints	0.1821

Table 5. Global Weights of Subcriteria

Subcriterion	Global weight
M1 Internal motivation	0.1787
P1 External prompts	0.1579
M2 External motivation	0.1376
A2 Cognitive cost	0.1341
A3 Interaction effort	0.1100
P2 Internal prompts	0.1061
A1 Time cost	0.0992
A4 Environmental constraints	0.0764

4. Design Strategies

4.1 Selecting Strategies for Office Situations

We used the work context to decide when to prompt workers, what action to suggest, and how to acknowledge completion [11]. The proposed system would suggest a brief action at a task

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transition. Workers could defer the prompt in meeting or focus mode.

4.2 High-Frequency Situations

During sustained desk work or long meetings, workers need to be able to put off a cue. When a break is possible, they should be able to respond without diverting much attention from work. Table 6 lists strategies for these situations.

Table 6. Strategies for High-Frequency Situations

Factor	Design response
Prompt	Prompt at task transitions. Start with a discreet cue, space out repeated prompts, and provide meeting, focus, and snooze controls.
Ability	Offer a brief action and one-step confirmation. Where sensing is reliable, reduce manual logging.
Motivation	Acknowledge completed actions and show progress without penalizing missed days.

4.3 Medium-Frequency Situations

For afternoon fatigue, overtime, or tension around meetings, Table 7 lists brief recovery actions that workers could do where they are, without preparation.

Table 7. Strategies for Medium-Frequency Situations

Factor	Design response
Ability	Offer a one- to two-minute recovery action. Provide an alternative when the setting limits movement and let users defer the action.
Motivation	Acknowledge the action and show attainable milestones, such as weekly completions.
Prompt	Deliver a low-intensity cue at a suitable break or task transition and let users postpone it.

4.4 Less Frequent Barriers to Continued Use

Discomfort, the effort of charging, and privacy concerns may arise only occasionally, yet any of them could lead workers to stop wearing the jewelry. Table 8 shows how the design would address these barriers.

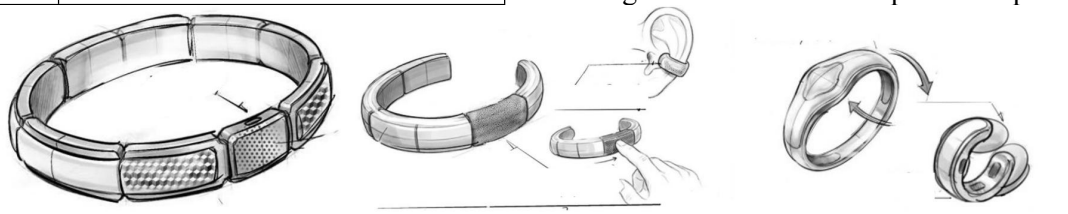
Table 8. Strategies for Continued Use

Factor	Design response
Prompt	Let users adjust intensity, frequency, active hours, and modes. Phrase cues as suggestions.
Ability	Make the jewelry comfortable and easy to charge. Let users adjust cue intensity within a defined limit.
Motivation	Use forms that fit office attire, explain what data are collected, and make it easy to resume after a break.

5. Smart Jewelry Design

5.1 Concept Development and Selection

Figure 4 shows the original sketches for the three concepts developed from the weighted requirements. Concept 1 uses a context-sensing bracelet with tactile feedback. Concept 2 pairs a semi-open wrist cuff for gesture input with a sensing ear clip. In Concept 3, the ring registers hand gestures and the ear clip delivers prompts.



Concept 1
Context-sensing bracelet
Sensor module and haptic feedback

Concept 2
Gesture cuff and smart ear clip
Swipe input and physiological sensing

Concept 3
Interactive ring and smart ear clip
HRV sensing and bone-conduction audio

Figure 4. Three Smart Jewelry Concepts

Original sketches with English labels.

Each concept was described in terms of its design, intended use, and main interactions, and ten experts then rated all three against the primary criteria (A, M, and P). The 100-point scale placed scores of 90 or above as excellent, 80 to below 90 as good, 60 to below 80 as satisfactory, and below 60 as unsatisfactory. Within each concept and criterion, the proportion of experts in a given band supplied the fuzzy membership value [12], and the primary weights from the G1 analysis were used to compare the concepts.

Concept 1 scored 78.62, Concept 2 scored 74.15, and Concept 3 scored 82.47. Concept 3 achieved the highest score and was selected for further refinement.

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5.2 Refinement of the Selected Concept

In the selected concept, the ear clip would collect signals and cue the wearer discreetly. A small hand movement registered by the ring would let the wearer respond without taking out a phone. Wearers would use the app to set preferences and review completed actions. Figure 5 shows both pieces and how they would be worn.



(a) Selected concept (b) Smart ring worn (c) Ear clip worn

Figure 5. Smart Ear Clip and Smart Ring Designs and On-Body Views

5.3 Functions of the Ear Clip and Ring

The smart ear clip detects users' physiological data based on physiological information collected through HRV and delivers prompts through bone conduction. The ear clip can reliably capture signals of user fatigue, providing a basis for determining the timing of prompts. The wearer only needs to make a single gesture to acknowledge or postpone a prompt, or confirm an action. Users do not need to open any app while completing a task.

5.4 Service Workflow

As shown in Figure 6, office workers preset their working hours and prompt intensity in the app. As fatigue accumulates, the system combines various data with the current working environment to determine whether to deliver a prompt. The ear clip delivers the prompts, while the ring records the corresponding behavioral responses. Subsequently, the app records health behaviors and periodically provides summaries, allowing office workers to adjust the settings accordingly.



1. Fatigue Office work | **2. Sense** Ear clip | **3. Prompt** Discreet cue | **4. Act** Ring interaction | **5. Record** App review

Figure 6. Office Use Storyboard for the Proposed System

Storyboard scenes and app mockup from the design board.

6. Conclusion

6.1 Findings

This study uses the Fogg Behavior Model to summarize and analyze office workers' needs. Among the various factors, the Ability dimension has the highest weight. The combination of the ear clip and ring achieves the highest score. In the proposed design, the ear clip provides discreet prompts, while the ring supports feedback through a single gesture. Users can also review and manage their activities in the app. The design aims to make it easier for office workers to perform health behaviors and manage their health.

6.2 Limitations and Future Work

This study has some limitations. The findings are mainly based on questionnaires, user interviews, and expert evaluations. The proposed smart jewelry solution has not yet been tested using a fully functional prototype. Therefore, its actual performance in office settings remains to be verified. Future research will focus on prototype development and user testing. The usability of the product and users' responses to prompts will be evaluated. Further research will explore whether this design can help users develop stable health behaviors.

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