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Swing Compass

A metaphorical and embodied approach to structuring choices for user reflection

Information design aims to arrange and present not only information for people to retrieve and understand, but sometimes also choices for them to select and reflect on. In this paper we introduce a configurable, intelligent, and embodied recommendation system, Swing Compass. It allows users to select items spatially arranged on a compass-like interface, according to their past selections. The user can also turn the device to reveal new alternatives. The interaction embodies the metaphorical meaning of 'swing', prompting users to reflect on their choice behaviours. This paper articulates the theoretical framework and the design of Swing Compass. It also presents a summary of experience testing and discussion.

1. Introduction

Swing Compass is a configurable, adaptive, and embodied system which turns a tablet computer into a compass. Like a reflective selection device, Swing Compass allows users to select from a set of recommended items spatially arranged at different directions on its compass rose interface (Figure 1). It sometimes prompts the users to "swing" both their bodies and selections, and encourages them to reflect on their selection habits. Examples of choice making in everyday life include choosing how to spend the weekend, deciding what to buy at the supermarket, or selecting an app to launch among many others on a mobile phone.

Designers first configure a topology of information nodes (Figure 2), each of which consists of a set of possible options (e.g., various types of fruit available at the supermarket). Each option is annotated with user-defined attributes (e.g., high fiber) through which the system can compare differences or similarities (e.g., fiber vs. protein) between options at two connected nodes (e.g., fruit vs. meat). Based on this annotated information map, the system suggests choices for the next move at different directions (e.g., front, back, left, right) from the current position. When the user selects an option at a certain direction, he/she makes a move to the next node along that direction on the map.

Based on configured moderation logic, the system manipulates the options available to the users at every move. By default, the system suggests options of a similar kind – for instance, with the same values for certain attributes (e.g., high protein), based on the user's last move. If a user chooses the same option for
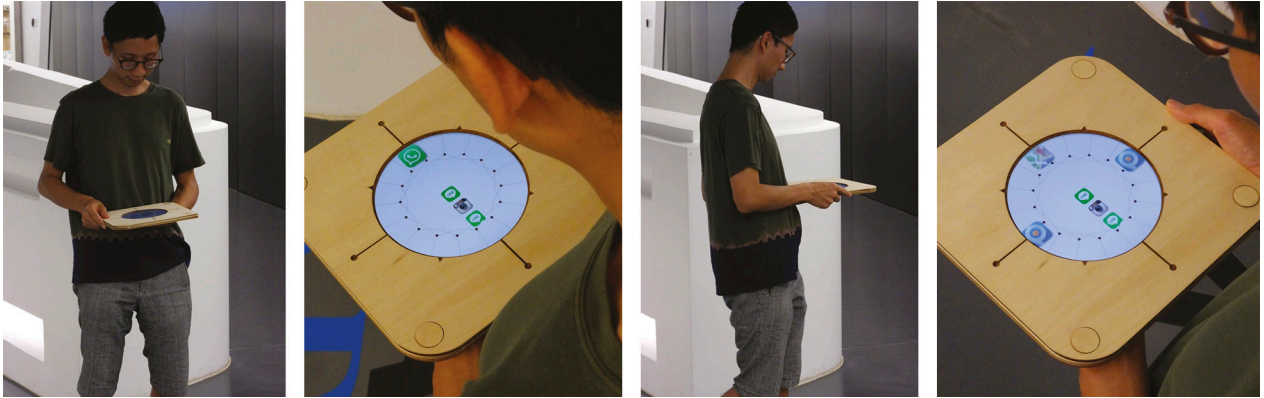
Figure 1. Swing Compass arranges items at different directions on its compass-rose interface for user selection. The items shown inside the rose correspond to the user's selection history.
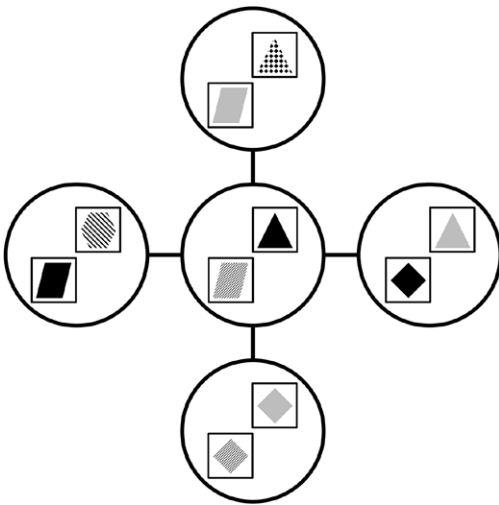

Figure 2. A topology of information nodes. Each circle represents a node. Each tile inside the circle represents an option, and the graphic qualities inside the tiles (e.g., shape, tone, pattern) represent the annotated attributes.

many consecutive moves (e.g., too much protein), the system reduces the number of available choices in order to prompt the user to turn the compass. After the user makes a turn, the system reveals more options of contrasting kinds (e.g., high fiber). Through this intervention, the user becomes aware of alternatives. It is possible to swing to another kind of choice and swing back soon after, in order to balance the choice behaviour.

Swing Compass is an exemplar of lively interactive artifacts, demonstrating the reflective potential in users. This paper introduces the theoretical framework, articulates the design concept, and presents the intended user cognitive processes and diagrams. It also discusses the empirical results of the user experience study. The whole process demonstrates how the framework can assist designers and researchers by proposing intended user experiences, and how evaluation generates real and particular outcomes, and informs the next step towards the design goals.

2. Theoretical framework

2.1 Behaviour models of Swing Compass

The design of Swing Compass makes use of some influential models of human behaviour.

2.1.1 Fogg's Behaviour Model. B. J. Fogg (2009) introduced a behaviour model (FBM) for designing persuasive systems. The model states that the three determinants of a person's behaviour are: motivation, ability, and triggers. Motivation refers to factors related to one's intention, namely immediate effects (i.e., pleasure vs. pain), foreseeable outcomes (i.e., hope vs. fear), and social conforming. Ability refers to factors which determine whether a behaviour is feasible. With sufficient motivation and ability, people become determined, however, they still need triggers in order to take an action. Thus triggers are important to design. Fogg introduces three types of triggers that are applicable to the design of Swing Compass: spark, facilitator an signal. Spark is used to highlight the relevant motivators to the user (e.g., via reflection). Facilitator makes a behaviour easier or harder to perform (e.g., by system intervention). Signal provides timely and relevant reminders (e.g., depending on the latest selections).

Swing Compass is designed to moderate users' choice behaviours. One design strategy is to apply facilitators and signals, making certain choices easier to be made and others harder to be found, based on one's latest selection inclination. Over-selected categories can be hidden, while under-explored categories are introduced when the user makes a turn. Another objective of the design of Swing Compass is to make the introduction of under-explored choices a reflection, and therefore a spark in the user.

2.1.2 Choice Architecture Model. Richard H. Thaler and Cass R. Sunstein's model of choice architecture (2008) is very informative to the design of Swing Compass. While information architects and designers organise and present information for people to understand (Murray 2012; Wurman 1997), choice architects arrange options for people to select from. To Thaler and Sunstein, this job can be an effective means to influence people's decision making. Starting from a few points similar to Donald Norman's usability principles (2002), such as feedback and error tolerance, the model emphasizes the power of defaults, mapping from choice to welfare (or even wellbeing), and structuring complex choices for people.

A default is like a convenient recommendation, which is most welcome in case of complex choices. Yet, defaults are sometimes precarious, and so making a few alternatives available to users is required. Swing Compass recommends options to users at every step, such as setting up defaults, but it always allows the user to have further alternatives via turning.

Helping users understand the mapping from choice to welfare or wellbeing is important. Swing Compass allows categorization of choices in multiple dimensions and the options are arranged correspondingly in different positions on the compass rose. As we will see in the next section, according to Norman's principle of mapping (2002), spatial arrangement is a good way of mapping choice type.

Thaler and Sunstein also note that to present people with choices they seldom explore can sometimes be good for them. Swing Compass moderates user choice behaviour by reducing the number of options. By seeing a limited number of options, the user is prompted to uncover other categories, which did not occur to them before, but which are worth considering.

In summary, the design strategies of Swing Compass pertaining to users' choice behaviour are:

– Default choices are recommended, like an enabler (positive facilitator), and alternatives are available via turning;
– Choices which include over-selected kinds are harder to be found, like a barrier (negative facilitator);
– Choices which include under-explored kinds are introduced when the user makes a turn, like a spark that illuminates something which has been overlooked.

2.2 Design of Swing Compass

2.2.1 Natural Mapping: From spatial relation to choice category. Norman's principle of mapping (2002) suggests applying physical analogies or cultural practices for immediate understanding. Spatial relation can be one analogy for constructing good mapping. A good example is the vertical arrangement of floor buttons on a lift control panel, where the bottons correspond to the levels of targeted floors. Swing Compass allows configuration of choice categories in a chosen topology, in analogy to the physical or metaphorical relation among the choices. For instance, food choices in a supermarket can be arranged in a corridor fashion in which left and right options belong to the same category, while up (front) and down (back) directions lead to increasingly different groups.

2.2.2 Embodied Interaction: Metaphorical meaning of swing. Not only can spatial analogies be applied to build good mapping, but also physical and social experiences at large should be utilised to assist people in understanding it. Drawing upon notions from phenomenology, Paul Dourish's embodied interaction (2001) is a notion which helps designers to bring familiar and meaningful actions or habits from the everyday world into the design of interactive systems. Swing Compass incorporates the common act of turning, which people automatically perform in their daily lives whenever they are not satisfied with the current offer, or want to look for something different. Users can understand the metaphorical meaning of the action of turning by actually performing it.

2.2.3 Reflective Design: Turning from over-selected to under-explored options. With understandable mappings from the spatial arrangement of options into categories, and consequent implication of options, users of Swing Compass can choose from a few closely related categories, or they can just turn away to look for alternatives in other contrasting categories. When a user makes similar kinds of choices (i.e., without any turn), Swing Compass reduces the number of options in those categories in order to prompt the user to turn. This physical action makes the user feel as if turning away from unwanted options to preferred ones, or from familiar options to new ones, and the moderation provides guidance or make recommendations. This kind of embodied imagination aims to provoke reflection in users' choice behaviour.

The reflective design proposed by Phoebe Senders and her colleagues (2005) targets the potential of critical reflection triggered by design. Grounded on critical theory, this design notion emphasises critical reflection as a means of exposing people's unconscious assumptions about everyday technologies, and invites them to look at possibilities other than the norm. It integrates a range of related approaches, including critical design (Dunne & Raby 2001) and ludic design (Gaver et al. 2004), and proposes a set of design principles and guidelines, which designers can follow not only to question entrenched practices but also to remind users of the same ones. The strategies most relevant to designing Swing Compass include defamiliarising the interface (rather than using common design patterns) and incorporating ambiguity (rather than offering meanings which are always direct

and clear). Some of these suggestions seem incompatible with the common usability principles. As Sengers and Gaver respectively put it, the interpretation of a design cannot be completely open, and ambiguity should not be an excuse for bad design. The aim of the design of Swing Compass is to strike a balance between the familiar and the unfamiliar in the interface presentation, and between what is direct and what is indirect in the meaning construction. As an exemplar of lively interactive artifacts, Swing Compass can achieve this goal.

2.3 Lively interactive artifacts

Swing Compass is an exemplar of lively interactive artifacts (Chow, Harrell & Wong 2015). Lively interactions are reminiscent of users' past experiences and invite them to make sense at multiple cognitive levels:

At the immediate and operational levels, the user acts upon the artifact and receives quick feedback. During these reactive moments, the interaction between the user and the lively artifact, represented by two arrows in Norman's conceptual model diagram (2002: 16) (Figure 3a), is so instantaneous that it turns into a sensorimotor feedback loop in the user (Figure 3b). The loop evokes a slice of life, and triggers a blend of the current and the past experiences. Blending, a notion introduced by Gilles Fauconnier and Mark Turner (2002), is a pervasive cognitive operation that integrates concepts and outputs new ones. At this level, the output is an imaginative and embodied concept giving the user a sense of control between the familiar (past experience) and the unfamiliar (current experience).

Swing Compass allows the user to look for alternatives. When the user starts to turn, the options displayed on the interface fade out gradually and new options fade in. One can sneak a peek at the options "hidden" on the other side, and then decide to choose or turn back to the old set. This sensorimotor phenomenon is reminiscent of the user's past experience of shopping at a supermarket, or window-shopping at a mall. We can glance at the products on the shelves or in the window, and if not interested, we can turn away and look at other shelves or shop windows. Sometimes, we might swing back after seeing the adjacent shelves or shops. Thus the user immediately understands the operational meaning of turning in Swing Compass.

At the reflective level, the lively artifact shows perceivable changes unintended by the user. These changes cause the user to become curious about their meaning (Figure 3c). The user then invokes an interpretive frame to make sense of and account for the changes. A frame, a
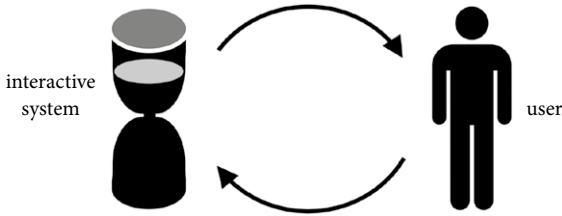

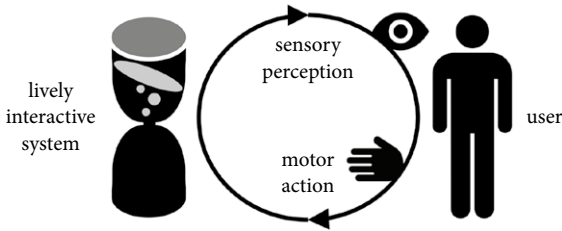**Figure 3a.** Reproducing part of Norman's conceptual model diagram.

Figure 3b. At the immediate level, the sensorimotor feedback loop gives the user a sense of control.
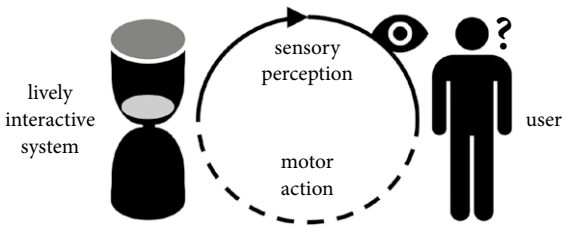
Figure 3c. At the reflective level, the contingent changes cause the user to become curious about their meaning.

notion first introduced in artificial intelligence research (Minsky 1974) and reinforced in cognitive linguistics (Fillmore 1985), is a conceptual framework from long-term memory that provides the structure in terms of elements and their relations for understanding a scenario (Coulson 2001: 17–20). The user accesses a frame from memory and fills in local details to form a remembered or imagined scenario. By analogically mapping the scenario with the current experience of the contingent changes, the user elaborates a metaphorical blend, resulting in a blended scenario with reflective meaning.

Swing Compass reduces the available options of over-selected categories based on the user's selection history. This can be subtle to the user at first, but after a few rounds, the user may notice the change. The system seems to prompt the user to swing. The user may assume (with an interpretive frame invoked) that the system has made the change as a performative suggestion because of one's unbalanced choice behaviour.

3. Configuration of Swing Compass

3.1 Topology

For natural mapping from the spatial arrangement of items to the corresponding categories, Swing Compass

allows configuration (in an XML format) of a topology of choice categories for user selection. Each option is conceptualised as a 'tile' with four sides (up, down, left, right), each side is annotated with a marker. The tiles with opposite sides (i.e., up vs. down, left vs. right) and sharing the same marker are connected (Figure 4). All the tiles are linked together forming a graph. After a selection, the system considers only those tiles connected to the current choice and then prioritises them for the next selection. In other words, the user navigates through the graph by selecting one tile followed by another.

3.2 Analogy

The choice categorization is not a 'box classification' in which each item is simply 'put into' one particular category. Instead, each tile is annotated with multiple attributes specifying its kind in multiple dimensions. Two tiles are of the same kind if all their attributes share the same values. If only some attributes coincide, the two
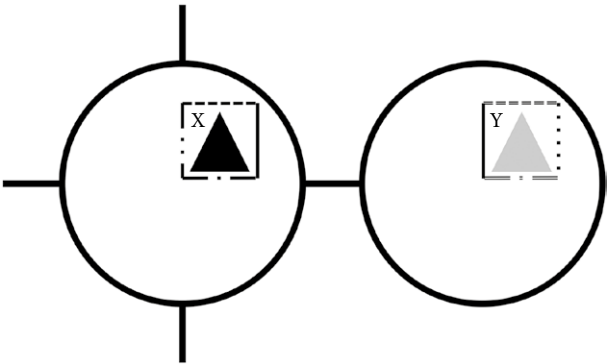

Figure 4. Each side of a tile is marked with different line qualities. Two tiles are connected in the topology only if they share the same marker on the opposite sides. For example, Tile X has a solid line on its right, while Tile Y has a solid line on its left.

tiles are in partial similarity. For instance, a tile named 'cycling' has attribute 'activity' as 'doing' and 'welfare' as 'healthy', while a tile named 'smoking' has 'activity' as 'eating' and 'welfare' as 'unhealthy'. The two tiles are of completely different kinds. A tile named 'gambling', with 'activity' as 'doing' and 'welfare' as 'unhealthy', is partially similar to both 'cycling' and 'smoking', but just in terms of different dimensions, that is, in terms of different attributes. 'Cycling' and 'gambling' are similar in terms of 'activity: doing', while 'gambling' and 'smoking' are similar in terms of 'welfare: unhealthy' (Figure 5).

Based on the topology of tiles, the system prioritises the connected tiles as options for the user, according
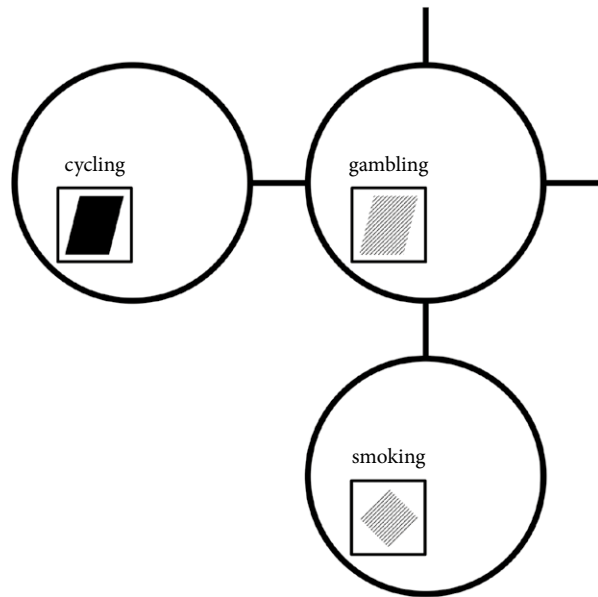

Figure 5. The attributes of each tile are illustrated in different graphic qualities (e.g., shape and pattern). Tile 'cycling' and Tile 'gambling' are similar in terms of 'activity' (i.e., shape), while Tile 'gambling' and Tile 'smoking' are similar in terms of 'welfare' (i.e., pattern).

to the analogy between each option and the current selected tile. The user then selects partially similar tiles, those sharing some attributes, until a turn is made. The system then shifts to consider other partially similar tiles in contrasting terms. For example, 'smoking' is linked to 'gambling' because of 'unhealthy', which is then shifted to 'cycling' because of 'doing'.

3.3 CHESSBOARD: The status messenger

Different topologies and analogies of tiles result in different configurations. One configuration is CHESSBOARD. The topology is complete in that all tiles share the same marker on all sides. The analogy is based on two attributes, and each attribute has two values. The two attributes cross-divide a matrix in which the tiles are distributed. The Status Messenger is an instance of Swing Compass with this configuration. It functions as a tool for users to update their status in terms of daily activities. The tiles are annotated as either 'eating' or 'doing' in the attribute 'activity', and either 'hedonic' (related to happiness, pleasure) or 'eudemonic' (related to human potentials, virtues) in the attribute 'welfare'. Figure 6 shows some examples. The Status Messenger suggests options of similar activities in the 'welfare' dimension. If the current tile is 'gambling', 'smoking' may be shown on the compass rose because two tiles are similar in terms of 'welfare: hedonic'. If the user turns to make a shift, 'cycling' may be shown because both tiles share 'activity: doing'. Consecutive selections, with or without turns, result in navigation such as walking across a checker floor or a chessboard.

3.4 CORRIDOR: The app launcher

Another configuration is CORRIDOR. Tiles of the same kind are connected to each other horizontally (i.e., left and right only), and connected to partially similar tiles (i.e., same value in one attribute but different in the

other) vertically (i.e., up and down). When choosing options in the left or right direction, one sticks to options of the same kind. When selecting options in the up or down direction, one moves to partially similar options. The navigation is comparable to walking along a corridor of shelves filled with commodities, as in a supermarket. The items on the left and right are of the same category, while those in the front or at the back are increasingly varied. When turning, the user sees horizontal options of partially similar kinds in another dimension, and vertical options of completely different kinds (i.e., different in all attributes), which is similat to going to another floor of a supermarket.

The App Launching Compass is an instance with this configuration. It functions like an app launcher found on common gadgets. It suggests the type of apps the user 'should' launch by displaying the app icons as options. The app tiles are marked as either 'casual' (including social networking and entertainment apps) or 'serious' (including news and productivity apps), or as either 'extrovert' (social networking and news) or 'introvert' (entertainment and productivity). Figure 7 shows some examples. Without a turn, the compass provides the same or a similar kind of app. For instance, after selecting a social networking app, one may see other social networking apps horizontally and some entertainment apps (they share 'casual' with social networking apps but are 'introvert') vertically. After a turn, the user sees news apps (they share 'extrovert' with social networking apps)

Figure 6. Both 'smoking' and 'gambling' are 'hedonic' in 'welfare', but whereas the former is 'eating' , the latter is 'doing'. Both 'gambling' and 'cycling' are 'doing' in 'activity', but whereas the former is 'hedonic', the latter is 'eudemonic'. CHESSBOARD: at each step on the compass rose, one sees tiles from one cell only (e.g., 'eating' and 'hedonic'). The user moves horizontally across the cells without turning, or vertically after a turn.

Figure 7. CORRIDOR: at each step on the compass rose, one sees apps from one column (e.g., 'causal'), with 'introvert' and 'extrovert' arranged in alternating rows. The user stays in one column without turning, or shifts horizontally across the columns after a turn.

horizontally and completely different productivity apps ('serious' and 'introvert') vertically.

4. Intended user cognitive processes

Both instances above show characteristics of liveliness. The compass 'disrupts' a user's habitual engagement with activities (because using an app implies a kind of activity) through manipulating the set of available choices. It forces the user to actually 'swing' the body (to reorient the compass) in order to shift to other kinds of activities. There is an embodied analogy between a swing in a physical action and a shift in behaviour. We expect that this analogy will emerge in the user via imaginative blends with affective responses. The intended cognitive processes are delineated at two levels.
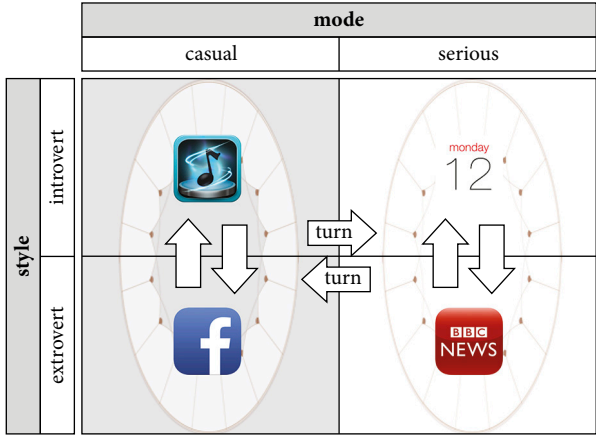
4.1 The immediate level

Given a set of options, the user may tap what is wanted; otherwise one turns the compass left or right to look for other options. Rotating repeatedly, one can see the old set fading out and the new one fading in. The user may turn back to the old set or continue to turn further, which depends on the appraisal of the new set. The impulsive desire to swing and the automatic appraisal of the options mobilize the sensorimotor feedback loop that is reminiscent of one's physical experience of looking around for a target. With the compass, the act of turning around is similar to the act of moving and looking around, and the immediate blend results in an embodied imagination of turning around to look for options.

Figure 8a shows the blend with desire and appraisal. It is based on Fauconnier and Turner's conceptual integration diagrams (2002). An integration diagram consists of circles representing mental spaces. Each circle contains
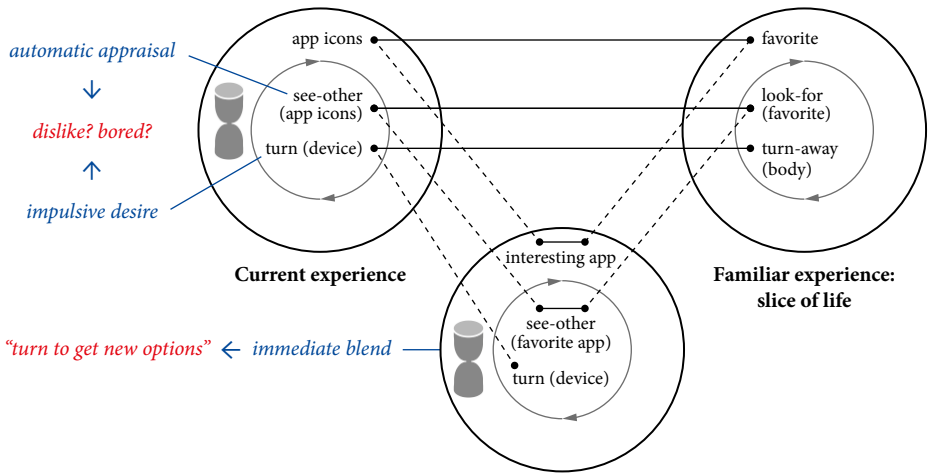

Figure 8a. At the immediate level, the sensorimotor loop evokes the experience of turning away from dislikes, resulting in immediate understanding of the action.

conceptual elements of a scenario, such as actors, objects, or actions, and their relations, structured by a frame. The two horizontal circles (mental spaces) are input for the blend, while the one below is the output. The horizontal solid lines between the two input spaces are links mapping the counterparts respectively. These outer-space links are compressed into inner-space relations inside the blended space. Other elements are selectively projected from either input to the blend. We add to the integration diagram the sensorimotor feedback loop, which envelops motor action and sensory perception in the mental space. The left input is the current experience enabled by Swing Compass, featuring a loop mobilized by impulsive desire and automatic appraisal, which is analogical to a past experience denoted by the right input. The texts in red represent the user's imaginary thoughts and feelings. The resulting blend gives the act of turning a new operational meaning, which is immediate and direct for the user to control. Turning is to look for new options.

4.2 The reflective level

After several rounds of selection, the user may wonder about the changing pattern of the compass's recommendation. Sometimes, the number of options is reduced, and the user needs to turn to uncover more options. One may invoke an interpretive frame to account for these unexpected changes, recalling some past scenarios that involve similar contingency. Some users might see the compass as an intelligent guide who suggests turning occasionally, while others might see the compass as some authority who is directing them. The interaction provokes different imagined narratives via different metaphorical blends. After extended appraisal, the user may feel thankful to the device for the suggestion, or displeased with the limitation. Figure 8b illustrates a possible blend. The sensorimotor feedback loop is partly faded in the user's mind, but the user may nevertheless notice the subtle change of available options. The user

Figure 8b. At the reflective level, an interpretive frame is invoked to account for the contingent change, leading to a metaphorical blend of a familiar scenario with the current experience.

invokes an interpretive frame (in red), and a meta-phorical blend is created. This gives rise to an imagined narrative (in red) and elicits emotions (in red).

5. User experience study

In order to collect empirical data of user imagination, emotion, and reflection a user experience study on the above instances was conducted. The research methodol-ogy and initial findings have been published elsewhere (Chow et al. 2015). In this section, we summarise the methodology and latest findings with a view to demonstrating how the empirical findings enhance the interpretive analyses and design of Swing Compass.

Each experiment was conducted with one participant at a time. It consisted of a questionnaire session and a series of activities, followed by an in-depth semi-structured interview.

The first activity was a warm-up exercise with the compass. The second activity was about the Status Compass. The participant was shown some images of everyday activities (42 in total) and asked to identify the ones they liked or performed frequently. The participant was then invited to use the compass as if they were updating their status on social media. The third activity involved the use of the App Launching Compass. First the participant was given the icons of all available apps (20 in total). They were then asked to fill out the one-day app usage map with those given apps according to their own past experience. The participant then used the compass as if it was the usual way of launching apps.

The in-depth interview was semi-structured. The outline roughly matched the timeline of the expected user experience based on the theoretical framework. The questions included those related to immediate blends, impulsive desires, automatic appraisals, contingent changes, metaphorical blends, and extended appraisals. Researchers always refered to the interpretive diagrams to elaborate questions for further discussion.

Table 1 summarizes the questions.

There were 17 participants: ten female participants and seven male participants. Five participants were

Table 1. Questions asked during interviews refer to the theoretical framework

Immediate blends	• *Which activities have you selected? What apps have you launched? Why?*
	• *How did you know the turning feature?*
	• *To turn or not to turn, what are the reasons behind?*
	• *Do you recall anything similar in everyday life?*
Impulsive desires and automatic appraisals	• *How did you feel before and after a turn?* (Emoticons are used to cross-check verbal descriptions)
Contingent changes and interpretive frames	• *Did you notice any patterns from the options?*
	• *Could you relate to any scenarios in daily life?*
Metaphorical blends	• *Do you prefer guidance or reminders?*
	• *How do you feel about intelligent agents?*
	• *Facing a dilemma, would you consult friends, mentors, fortunetellers, or even spiritual means?*
Extended appraisals	• *How did you feel about the compass's behavior? What would you say about the compass?*

18–25 years old, 11 participants were 25–35 years old, and one participant was over 35 years old. Six participants had a background in Design or related disciplines, one participant in Linguistics, one in Philosophy, one in Anthropology, one in Business, five in Engineering, one in Statistics, and one in Chemistry.

5.1 Qualitative findings

The findings include qualitative data, such as participants' quotes during the interviews, which reveal their thoughts and feelings. Table 2 shows a summary of the interview data with some sample quotes.

Table 2. Significant responses from 17 participants

Immediate blends	Participants spoke about what they recalled from the act of turning, revealing their imaginary concepts of the action.
	Turning as choice making
	Switching choices casually in daily life:
	"It's like shopping! If you don't like the items in a shop, or you haven't seen those before, you turn away!" (XJ)
	Changing choices with sacrifice:
	"It reminds me of attending a seminar conference last week. Even though I found the presentation boring, I was hesitant whether to move to another concurrent panel. Just like I would not turn because the compass was heavy." (HU)
	Turning as a mental activity
	Shifting focus of attention:
	"I turned to ignore them, they didn't show up, but they were still there if I turned back. It's like in different drawers, or in my peripheral vision over a table" (MM)
	Changing thoughts in problem—solving:
	"Turning around when I got stuck in a lecture, in order to find a solution. Turning the body, turning my mind." (CB)
Impulsive desires and automatic appraisals	Participants felt bored or wanted to look for another target, so they turned. If they found something good, they felt satisfied or were excited and surprised. Otherwise, they felt disappointed or even annoyed.
	Some of them kept turning until they found something acceptable.

(continued)

Table 2. Significant responses from 17 participants (continued)

Contingent changes and interpretive frames	Participants tried to make sense of the options they were given by invoking different frames.
	Compromise
	"You have to select something you don't like in order to get something you like." (TK)
	The like-minded
	"I suddenly noticed the pattern. It quite accurately reflected my way! … like friends of similar taste." (MM)
	Reminder
	"If I eat something bad, I am reminded to exercise." (MA)
	Upselling
	"It's like online advertising. Changing in their offers … It's suspicious, a bit uneasy. Does it target my data?" (KA)
	Regulation
	"It's like I hit the limit and need to relax." (WW)
Metaphorical blends and imagined narratives	Participants tried to describe the compass metaphorically, showing their imaginations of using it.
	About striking a balance
	"If you work on something so often, you become specialized and that may limit your options, you need to diversify your skills … Pendulum—stops you from being one sided, but it props you to another side." (RA)
	About friends' suggestions
	"It's like a companion, going with you everywhere. The suggestions might not necessarily be the right one. It's no harm to listen. Just selective listening." (KA)
	About guidance
	"Traffic lights, sometimes you need to wait, sometimes it flashes and you need to walk faster." (WX)
	About regulation
	"Universities tell us that we have choices, but not many. We can change our majors after the first year, but actually they are all the same." (WR)

Table 2. Significant responses from 17 participants (continued)

Extended appraisals	**Useful and inspirational**
	"It could be very insightful, I think. For food, for health, it'd be great. For apps, I think it's good as well, because it kind of tells you that you've been staring at Facebook for too long … It keeps you from bad choices." (SC)
	All about self-discipline
	"People don't like being controlled. Don't make the advice too obvious. Now it's just right … I try my best to do self-management. I reward myself after doing healthy activities." (HU)
	Too limited
	"I don't like someone setting limits for me." (WW)

6. Discussion

6.1 The immediate level

All participants were able to 'act out' the meaning of 'swing'. If participants could not see their targets, or they found the options available uninteresting, which was in fact an automatic appraisal on the offers, they had an impulsive desire to turn. The appraisals resulted in emotions (e.g., frustration, confusion, boredom, uncertainty, satisfaction, gratitude, pleasure) and actions (e.g., turn vs. stay, change vs. accept). The sensorimotor feedback loop evoked varied slices of life in the participants. At least nine participants said that turning is like choice making, similar to deciding where to shop in a shopping mall, choosing among concurrent presentations, deciding which bus to take, choosing a place to eat, deciding how to spend the weekend, accepting or rejecting an offer, choosing a job, or deciding who to become friends with. Two participants interpreted turning as a mental activity, such as shifting the focus of attention on the desktop and contemplating problems.

Among those who saw turning as choice making, the immediate blends tended to be divided into two kinds, those involving sacrifice or effort, versus those without much cost, except time. For the first kind, at least four participants found turning the compass rather tiring, and the mental images provoked in their minds involved certain hurdles (e.g., getting out of a seminar room, walking away from a bus stop with some uncertainty, asking the boss for further work). At least three other participants mentioned that turning caused dizziness, and that it required some effort, as if being proactive in the pursuit of something. The cost of turning, on the other hand, was not obvious in the imagination of other participants (e.g., walking inside a shopping mall or shopping at a supermarket).

6.2 The reflective level

Not all participants were fully aware of the compass's moderation logic. At least eight participants, however, noticed the contingent changes that prompted a turn. Other participants, although they did not fully

understand the patterns, felt that the compass had intervened to a certain extent. The interpretive frames invoked included compromise, the like-minded, reminder, upselling, and regulation. Participants described the compass as a pendulum that makes the user 'swing', as a companion who gives suggestions, as someone providing guidance or direction, and even as a regulator. The imaginative blends show a continuum of reflection. They seem to vary from understanding the need for balance in life, through selective listening to advice, to following guidelines or being bounded, resulting in different degrees of appreciation.

7. Conclusion

Based on a rigorous theoretical framework, we have built Swing Compass, a configurable, adaptive, embodied recommendation system. We have also instantiated a few applications, followed by user experience testing. Swing Compass offers a reflexive approach which explores the users' experiences by provoking their imagination and creating emotions through lively interactive artifacts. Researchers and designers start their work by configuring the topology and analogy of choices, cognitively walking through what one would perceive, act upon, and recall in the mind; these are then conceptualized in diagrams as blueprints of the intended user experiences. The current proposal can be evaluated with user experience testing. The evaluation is exploratory, generative rather than validating, and affirmative. Our aim is not to approve or validate the success of a design concept, but to look for real samples of users' cognitive processes for intended reflective meanings. Designers are fully aware of the importance of making the designs more likely to reach their goals.

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