# Influencing Interaction: Development of the Design with Intent Method

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## ABSTRACT
Persuasive Technology has the potential to influence user behavior for social benefit, e.g. to reduce environmental impact, but designers are lacking guidance choosing among design techniques for influencing interaction.

The Design with Intent Method, a 'suggestion tool' addressing this problem, is introduced in this paper, and applied to the briefs of reducing unnecessary household lighting use, and improving the efficiency of printing, primarily to evaluate the method's usability and guide the direction of its development. The trial demonstrates that the DwI Method is quick to apply and leads to a range of relevant design concepts. With development, the DwI Method could be a useful tool for designers working on influencing user behavior.

## Categories and Subject Descriptors
H.1.2 [**Models and Principles**]: User/Machine Systems – *human factors, software psychology.* H.5.2 [**Information Interfaces and Presentation (e.g. HCI**]: User Interfaces – *theory and methods, user-centered design.*

## General Terms
Design, Human Factors.

## Keywords
Persuasive technology, behavior change, sustainability, energy, interaction design, design methods, innovation methods.

## 1. INTRODUCTION
As technological advances make consumer products more efficient, users are increasingly the weak link in the environmental impact chain. We buy 'energy-saving' lights and leave them on all night. We boil a kettle full of water when we only need a cup. We stick with the default setting on the washing machine, afraid of investigating the others. Behavioral decisions (or the lack of them) can be responsible for 26-36% of household energy use [36][49]; on a global scale, addressing human behavior to reduce environmental impact is both essential and urgent [45].

One approach, often favored by governments [7] is to use social marketing techniques (e.g. [29][26]) and tax incentives to educate and motivate consumers to change their own behavior. Persuasive Technology [19] offers a more subtle and perhaps more sustainable method of intervention: designing products and systems which influence behavior towards the goal of more efficient resource usage—including saving water [3] and reducing electricity use via individual or social [37] feedback systems—or other pro-environmental behavior such as reducing littering [27] or increasing awareness of local air quality [14].

The potential of applying 'heuristics and biases' thinking [24][25][20] from behavioral economics to environmental and other social problems has received political attention recently (e.g.[47][40]) as a result of high-profile work by Thaler and Sunstein [46] and Ariely [2] among others. The focus on understanding—and influencing—users' behavioral *choices* overlaps considerably with the domain of Persuasive Technology.

In many cases, *design for sustainable behavior* [32] helping users use products more efficiently, could also save them money and time. A well-planned intervention will provide an alignment of benefits—social for the community and financial for users.

Nevertheless, it is a challenge for designers to find the right forms in which to apply Persuasive Technology and other techniques to 'behavior problems', for example influencing more sustainable product use. As Blevis [10] puts it, "It is easier to state the kinds of behaviors we would like to achieve from the perspective of sustainability than it is to account for how such behaviors may be adequately motivated." Outside academia, design teams do not always find it easy to apply abstract taxonomies, or have time for incorporating this stage into a design process, so a quick method for translating theorists' valuable work into practical design suggestions for tackling particular briefs would be useful.

This paper introduces the 'Design with Intent' Method, which aims to address this issue, and describes a trial application by designers to two 'sustainable behavior' briefs, used to explore and help improve the usability of the method.

## 2. NATURE OF THE METHOD
The Design with Intent concept (DwI) itself was introduced at Persuasive 2008 [33]. Broadly, it refers to *design intended to influence or result in certain user behavior* across a range of disciplines from architecture to software.

Techniques used in one context, suitably generalized, can be applied in others, and the aim of the DwI Method is to assist this process. It takes designers from a brief involving behavior change, to a range of applicable design techniques and examples which can inspire concepts addressing the problem—a 'structured

brainstorming' method, perhaps. Over the past eighteen months a series of iterations of the method have been applied to behavior change problems, to develop and refine the method. The version described and tested in the trial discussed in this paper is designated v.0.8; the improvements made as a result of the trial have led to v.0.9 (see section 4) part of which has been released as [34].

## 2.1 Lenses: worldviews on behavior change

A major feature of the DwI Method is the grouping of design techniques or patterns into 'lenses', intended to capture different worldviews on behavior change and so allow designers to think outside the immediate frame of reference suggested by the brief (or client). For any brief about influencing behavior, each lens will have techniques which are especially pertinent to the brief. V.0.8 of the method uses five lenses (Table 1); the 'Persuasive interface' lens draws most heavily on the design elements of Persuasive Technology literature, including Fogg's 'tools' [19].

**Table 1. Five lenses: worldviews on behavior change**

| | |
|---|---|
| **Persuasive interface lens** | Use a system's interface, and the information/ feedback provided through it, to persuade users to change their behavior. |
| **System architecture lens** | Change a system's layout and structure to influence user behavior—physical elements (e.g. [1]), or metaphors [5][42] for them (e.g. in software or service contexts). |
| **Poka-yoke** [43] **lens** | 'Error-proof' the system [11][21]. As employed in manufacturing and medical device design, treat deviations from target behavior as 'errors' which trigger warnings or are prevented by the system. |
| **Security counter-measure lens** | Monitor and restrict users based on characteristics of their behavior, or of the users themselves. |
| **Heuristics & biases lens** | Recognize that users are influenced by cognitive biases and heuristics and make use of these to influence behavior, or help counter them where they lead to 'undesirable' behavior. |

## 2.2 Target behaviors

The second major feature of the DwI Method is the concept of 'target behaviors', expressing 'ideal outcomes' of interventions: what 'we' (as designers) would like to achieve with the intervention, described in an abstract form. It is assumed that a designer working in this field does have a 'goal' behavior he or she is attempting to influence in the user, even if it is an ideal outcome.

The 11 types outlined in Table 2 have been identified in multiple examples from different disciplines; there are many others which could also be described. This is a different direction of abstraction compared to target behaviors in Fogg's Behavior Model [18]; the two methods would not be incompatible.

In v.0.8 of the method, as shown in Table 2, target behaviors have been put into three groups: 'Paths', 'Flows' and 'Locks', which attempt to provide a slightly higher-level (more abstract) way of describing the target behavior as a starting point for the designer, before thinking in more depth about the specific target behavior(s) intended.

**Table 2. Target behaviors with examples**

| | | |
|---|---|---|
| **Paths group:** Shape the way that a user follows a path or process | | |
| **P1** | User follows process or path, performing actions in a specified sequence | *Customer places order via website without missing out any steps* |
| **P2** | User follows process or path optimized for run-time criteria | *User fills/boils kettle with right amount of water* |
| **P3** | Decision among alternatives: user's choice is guided | *Diners choose healthier meal in office canteen* |
| **Flows group:** Manage the flow of users and how they interact | | |
| **F1** | Separate flows and occupation: users have no influence on each other | *Traffic follows one-way system into/out of car park* |
| **F2** | Interaction occurs between users or groups of users | *Staff from different departments mix socially in atrium* |
| **F3** | No user-created blockages or congestion caused by multiple users | *Wide pedestrian concourses prevent groups blocking passage for others* |
| **F4** | Controlled rate of flow or passage of users | *Visitors to popular museum exhibit routed past it slowly on moving walkway* |
| **Locks group:** Prevent users doing something, on some criteria | | |
| **L1** | Access, use or occupation based on user characteristics | *Only users who know PIN can access bank account via ATM* |
| **L2** | Access, use or occupation based on user behavior | *If driver speeding, next traffic lights turn red, else green* |
| **L3** | No access, use or occupation, in a specific manner, by any user | *Park bench fitted with central armrest to prevent anyone lying down* |
| **L4** | User provided with functionality only when environmental criteria satisfied | *Office lighting cannot be switched on if ambient daylight adequate* |

## 2.3 Three approaches to influencing behavior

As an additional, parallel way of thinking about influencing behavior, the DwI Method offers a simple classification into *enabling*, *motivating* or *constraining* behavior (Table 3). The overall approach may, of course, be dictated by the client or other stakeholders rather than being the designer's decision.

Much work in Persuasive Technology is about *motivating* behavior, with attitude change a precursor, but Fogg's *reduction* and *tunneling* [19] are arguably also *enabling* particular behaviors by making them simpler (cf. Maeda [35]). Buckminster Fuller's 'trimtab' concept— "modify[ing] the environment in such a way as to get man moving in preferred directions" [28]—is also enabling and links to the wider field of design for social benefit. Strategies aimed at influencing health & safety behavior often employ a *constraining* approach; Beatty's [6] extended taxonomy for Persuasive Technologies in human factors engineering includes this via *forcing functions* [38].

There are some mappings between target behaviors and these three approaches, but these are not definitive. E.g. with a P1 target behavior (*User follows process or path, performing actions in a specified sequence*) a designer could consider tackling this through each of the three approaches, bearing the distinction between the approaches in mind while thinking about each relevant design technique and how it might be applied.

**Table 3. Three approaches to influencing behavior by design**

| | |
|---|---|
| **Enabling behavior** | Enabling 'desirable' behavior by making it easier for the user than the alternatives |
| **Motivating behavior** | Motivating users to change behavior by educating, incentivizing and changing attitudes |
| **Constraining behavior** | Constraining users to 'desirable' behavior by making alternatives difficult or impossible |

## 2.4 The suggestion diagrams

The relevant design techniques from each of the five lenses are presented via a set of 'suggestion diagrams', combining descriptions (with caveats noted) and illustrated examples in a circular 'idea space' to allow designers to understand the techniques quickly, even where the terminology is unfamiliar. The intention is that the descriptions and examples will inspire the generation of concept solutions to the brief.

With a target behavior group chosen, each of the five lenses provides a suggestion diagram. For example, for the 'Paths' group target behaviors, the Persuasive interface lens (Figure 1) suggests *reduction*, *tunneling*, *tailoring*, *kairos*, *self-monitoring*, *simulation*, *interface capabilities*, *feedback through form*, *computers as social actors*, *operant conditioning* and *respondent conditioning*. Most techniques derive from established principles in the literature, but some draw out common ideas more explicitly—e.g. *feedback through form* would include examples such as Broms' Puzzle Switch [4]. As a comparison, the Heuristics & biases lens for Paths suggests *affective engagement*, *social proof*, *authority*, *scarcity*, *framing*, *commitment & consistency* and *other cognitive biases*, drawing on Cialdini's 'six principles' [12] alongside work in behavioral economics (e.g. [24]).

In total, from all five applicable diagrams, 31 design techniques are suggested as relevant to the 'Paths' target behavior group, of which subsets are especially applicable to each target behavior (P1, P2, P3), indicated on the diagram by particular segments being colored. For the other target behavior groups, 'Flows' and 'Locks', similar numbers of techniques are suggested by the applicable diagrams. The method is expected to open up constructive innovation rather than immediately converge on particular solutions; in most design processes, situational constraints (financial, political, legal, development time, domain expertise, organizational factors) will largely shape the outcome.

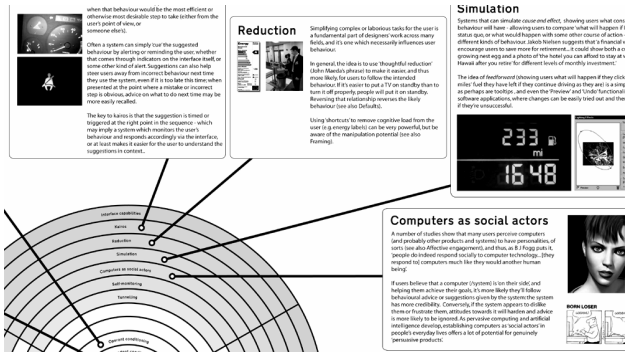


**Figure 1. Detail of the Paths group suggestion diagram for the Persuasive interface lens**

## 2.5 How to use it

Figure 2 shows the structure of the method as it is envisaged it will be used:

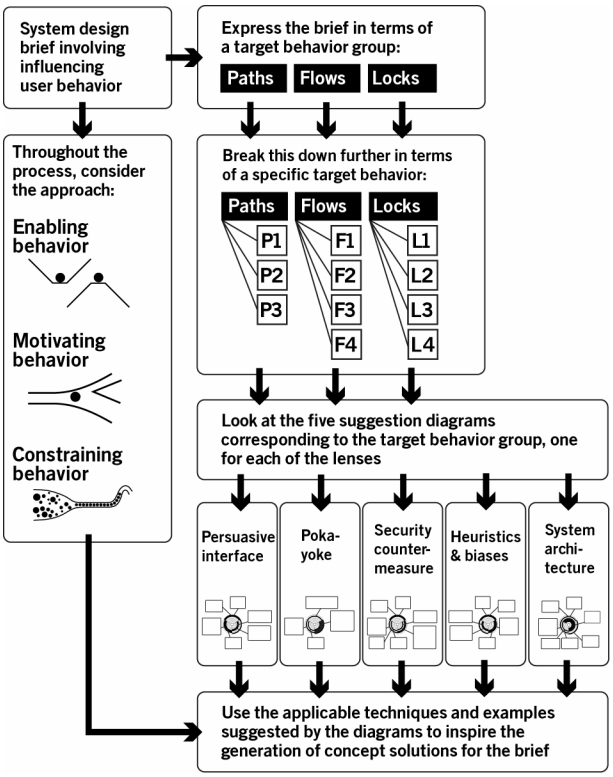


**Figure 2. Structure of the DwI Method v.0.8**

## 2.6 Usability of the method: pilot study aims

A design method such as this is only of value if designers find it useful: whatever 'intent' goes into its design, it is the process of using it and the quality of the results it produces which determine its utility. Accordingly, the first testing stage, as described in the remainder of this paper, was a quick pilot study primarily intended to investigate the *usability* of the DwI Method in the form described so far, so that it can be refined for further testing and application to problems. This pilot study aimed to address the following questions (Table 4):

**Table 4. Questions addressed by the pilot study**

| Questions | How addressed |
|---|---|
| Is it possible for a designer to understand the method rapidly? | Time; questions from participants |
| How does the designer use the categories / structure? Which elements cause confusion? | Observation; participants' think-aloud narratives and questions; evidence of misunderstanding |
| Are feasible concepts generated? | Output from sessions |

**Brief: Home lighting**

In most UK homes, lighting makes up 10-15% of the electricity bill [17]. Globally, it makes up 19% of electricity usage [9].

Aside from using lower energy bulbs, such as compact fluorescents (which may suffer from a 'rebound' effect in practice [44]), consumers can make a big difference to energy usage and their own electricity bills by changing their behavior: using lighting when it's necessary, but consciously switching it off when it's not. Your brief is broad but simple: **We want people to switch off lights that don't need to be on.**

Please use the Design with Intent Method to come up with concepts addressing the problem.

**Brief: Efficient printing**

Many people waste paper, ink / toner and time printing unwanted / unnecessary pages. One estimate puts the total cost of wasted printing for a FTSE 100 company at £400 million per year [13]. This waste rarely benefits users—it results from poor usability and user understanding of how to 'do it better'. Although factors outside the user's control can play a part, there is an opportunity for design to influence behaviour to help users be more productive and less wasteful. You are a designer given the following simple but broad brief: **We want users to print more efficiently.**

Assuming you can redesign the interfaces and the way that users interact with the printer and software, but that the basic printing method will remain technically similar, please use the DwI Method to come up with concepts addressing the problem.

# 3. USING THE METHOD: A PILOT STUDY

Four recent design graduates and product design students with industrial experience and an interest in environmentally sensitive design were chosen to participate in this initial pilot study. The aims of the study were as described in section 2.6: primarily (at this stage) investigating the usability of the DwI Method.

## 3.1 Study procedure

Participants A, B and C received an instruction booklet leading them through the method as in Figure 2, together with large (A2) versions of all the suggestion diagrams. The rationale and structure of the DwI Method were explained with reference to a non-environmental user behavior design problem—preventing a customer leaving his or her card in an ATM—and the types of solutions suggested were discussed, along with the usability and feasibility of each. Participant D, as a control, received none of this instructional material. Each participant had an individual session. All participants were then given one of the two following briefs (abridged here for space), and 40 minutes to use the instruction booklet and diagrams however they wished to generate conceptual solutions to the brief. From the authors' assessment, both of these briefs fit a P2 target behavior (Table 2) most closely, *User follows process or path optimized for run-time criteria*, but this was not mentioned to participants.

**Figure 3. A pilot study session in progress: a participant uses the suggestion diagrams to generate concept solutions**

A *think-aloud protocol* was used, where, as far as possible, each participant explained his or her thought processes as each part of the task was undertaken. The participants could ask questions to clarify aspects of the task, but all answers given were as succinct as possible to minimise the observer's input. While think-aloud usually does not involve the observer answering participants' questions [30], it seemed useful to do so here, given the purpose of the study. All audio was recorded along with video of the sessions. After the 40 minute sessions, the participants were asked to run through the ideas generated and explain the thinking behind them where this had not already been mentioned; the discussion continued with debriefing interviews in which the usability of the method was addressed and the questions in section 2.6 explored further.

## 3.2 Results

### *3.2.1 Is it possible for a designer to understand the method rapidly?*

Introducing and explaining the method via the ATM example took about 20 minutes for participants A, B and C, including answering questions about aspects of its use, prior to the 40 minute session.

Participant B referred to the instruction booklet in the early part of the session to compare the target behavior descriptions, and thereafter used the suggestion diagrams to support the concept generation, whereas A and C asked questions throughout the session to clarify aspects of how the method should be used.

All three did end up generating a range of design concepts addressing the brief given in the 40 minute session—so within an hour's total time (introduction and idea generation), it *is* possible to understand the method to some extent, and apply it—but the degree of clarification needed suggests that either more time is needed for designers to understand it better, or the method needs to be simpler and more rapidly comprehended. A lot of time was taken reading the technique descriptions: more succinct (e.g. bulleted) text here would help, especially with unfamiliar terminology, e.g. *kairos* and *social proof*.

### *3.2.2 How does the designer use the categories / structure? Which elements cause confusion?*

Two overall usage patterns were apparent from the participants' sessions. B followed the flow chart (Figure 2) to a large extent, considering which target behaviors were most applicable to the brief (lighting), and using the suggestion diagrams to narrow down the set of applicable techniques before using these for

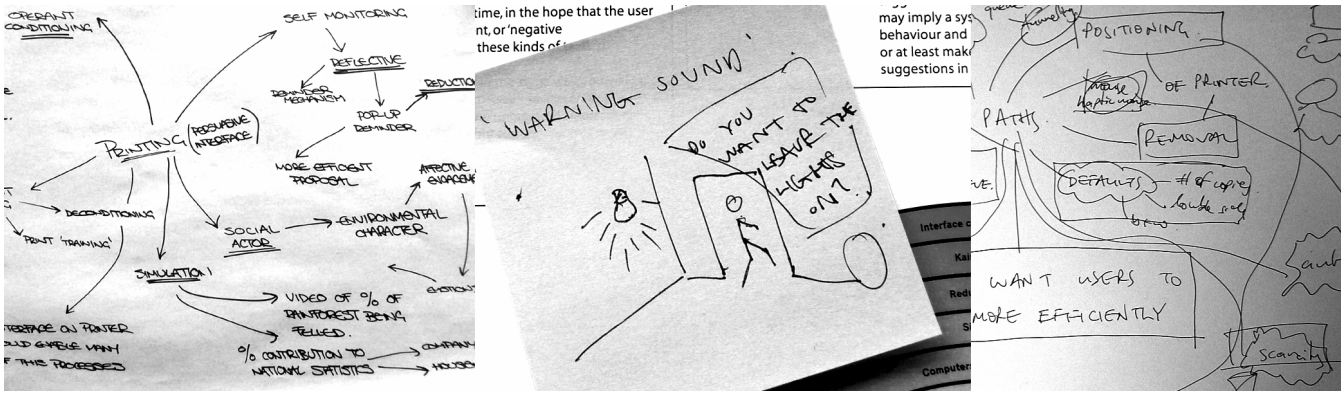


**Figure 4. Sample of participants' methods of annotation and concept generation**

inspiration. A and C, while aware of the target behaviors, made little use of them, instead using the techniques and examples on the suggestion diagrams directly as inspiration for generating concepts (for the printing brief). The two usage patterns are summarized in Table 5.

**Table 5. Two usage patterns apparent from the sessions**

| | | |
|---|---|---|
| **Prescription + inspiration** | B | Deciding on target behaviors, and using the mappings between target behaviors and applicable design techniques to support the generation of concepts, working through each lens's suggestion diagram |
| **Inspiration only** | A C | Using the suggestion diagrams as a starting point, generating concepts directly inspired by the techniques and examples, making little use of the target behaviors and mappings |

Of the various categories, the lenses were used by all participants as part of their concept generation process, and explicitly referenced as groupings for the design techniques. All participants worked through the lenses' suggestion diagrams in turn, seeing what concepts were suggested by the techniques and examples before moving on to another, but not all lenses proved equally useful. For example, A commented that only the Persuasive interface and Poka-yoke lenses seemed relevant to the printing brief, and accordingly only used techniques from those two lenses. C moved back and forth between lenses, sketching his own diagram linking techniques from the lenses to each other where he felt they were applicable. Neither A, B nor C used the Security countermeasures lens at all, although a number of concepts suggested by all three participants did involve elements of *surveillance*, one of the techniques suggested by the lens.

B, the only participant to make use of the target behavior classification, initially considered target behaviors in both the Paths and Flows groups as potentially applicable to the lighting brief, but decided to settle on Paths, and specifically the P2 and P3 specific target behaviors: *User follows process or path optimized for run-time criteria* (i.e. user would switch lights on/off strictly according to lighting criteria at that moment) and *Decision among alternatives: user's choice is guided* (i.e. the user would be somehow guided as to when lights should be on/off). B did not see it as essential to decide between the two as part of the concept generation process. The suggestion diagrams' use of color (or its absence) to indicate which techniques and examples are especially relevant to each target behavior within the group was potentially visually confusing and while explained in the instruction booklet, no participant made full use of this distinction. This aspect of the DwI Method would, therefore benefit from clarification or a redesign of the diagrams. None of the participants explicitly made use of the enabling / motivating / constraining approach distinction, which suggests that it is poorly explained or simply not considered immediately useful.

Participants chose to use either large sheets of paper or Post-It notes to describe and sketch concepts, either annotating the suggestion diagrams in place, adjacent to the techniques which inspired them, or creating 'mind-map' style networks of ideas and sketches (Figure 4). B and C noted verbally that in some cases, concepts related to multiple techniques, or drew only indirectly on the techniques and examples: they inspired the ideas, but did not *define* them. This is important: anecdotal experience with other 'innovation tools' such as TRIZ [23] or IDEO's Method Cards [22] suggests that many outcomes, while spurred by the categorization the methods offer, do not directly inherit all the characteristics of the categories which 'produced' them; sometimes the concepts generated will themselves suggest additional concepts. This was especially apparent from the concepts C produced, and also matched the way that D (the control) generated ideas without having any inspirational material present.

The aim of categorizing the techniques and examples in the method was not to persuade [15] designers that some were more appropriate than others, but simply to provide structured starting points for innovation in this field, often for abstract categories which a designer may not have previously considered. The extent, then, to which participants were initially guided by the categories and classifications, but felt free to merge or ignore them, is indicative of how the DwI Method or similar methods might be used by designers in practice: it ideally needs to be usable for both *inspiration* and *prescription* (Table 5).

### *3.2.4 Are feasible concepts generated?*

From the point of view of developing Persuasive Technology, these are the most interesting results, and while the aim of the pilot study was primarily to improve the usability of the method, the quality of the concepts generated is also valuable to ex amine. There is insufficient space here to reproduce all the concepts generated by the participants, but Table 6 gives a selection. They vary in the detail of resolution expressed, as would be expected given the time pressure of the session.

**Table 6. Selection of concepts generated by participants using the DwI Method**

| **Home lighting brief** | **Participant B** |
|---|---|
| **Concept** | **Techniques inspiring it** |
| Improve visual prominence of light switches (sketched: arrows pointing to switch) | Positioning & prominence |
| Change angle of switch / match to height of targeted users (sketched: variable angle switch & housing) | Orientation |
| Handheld 'restaurant buzzer' lighting alert device | Movement & oscillation |
| Remove light switches altogether and just have automatic sensors | Removal |
| 'Lights off' system default; users need to justify why they need them on | Defaults; Authority; Scarcity |
| User-specified lighting lock-out between certain times | Lock-out |
| Incorporate emoticons into light switch (sketched: happy and sad face buttons) | Interface capabilities; Affective engagement |
| Warning sound: 'Do you want to leave the light on?' as person leaves the room | Kairos |
| Daily feedback on lighting use encouraging continuous improvement or comparing individuals' use (or household's use) to other people's via social network | Self-monitoring; Social proof |
| Display what lights are on or off on the front of the house (sketched: display with 'Lights we're using') | Self-monitoring; Social proof; Surveillance |
| Display 'What neighbors are doing': 'If their lights are off, so should mine be' | Social proof |
| 'Enough light' message, based on user's prior setting of desired levels, a sensor detects light levels and suggests whether the lights should be on or off | Commitment & consistency; Authority |
| **Efficient printing brief** | **Participants A and C** |
| **Concept** | **Techniques inspiring it** |
| Changed print quality defaults (e.g. draft quality, duplex, grayscale) | Defaults |
| Display showing financial costs of every print job | Self-monitoring; Scarcity |
| Make print job take exaggeratedly longer the larger it is (intentional inconvenience leading to creation of new habits) | Operant conditioning; Respondent conditioning; Lock-in |
| 'Train' user to print more efficiently via an interface on the printer itself ('Next time, do this...') | Kairos; Interface capabilities |
| Modal pop-up reminders as user is about to print, intelligently suggesting a more efficient way to do it | Self-monitoring; Kairos; Interlock |
| Efficient printing wizard | Tunneling |
| Some kind of environmental 'character' to be displayed, to engage users' emotions and cause them to think about how much they're printing | Affective engagement; Computers as social actors |
| Video or animation of dramatic environmental events (rainforest, global temperature, etc) displayed while documents are sent to print, with explicit linkage made to user printing behavior | Simulation; Affective engagement; Self-monitoring |
| Display showing user's / household's / company's contribution to national statistics on energy or waste | Self-monitoring; Social proof |
| Embarrassing / irritating sound (e.g. siren) to be played when a user prints inefficiently (calculated) | Condition detection; Surveillance |
| Force user to view print preview every time a print job is about to be sent | Interlock; Simulation |
| Make it more difficult / slower process to print documents | Lock-out; Scarcity |
| Detect accidental or misguided printer settings and ask user 'Are you sure?' before correcting them | Closed loop; Kairos |
| In office, route shorter / more efficient documents through the print queue first | Segmentation & spacing |
| In office, position printer where everyone can see who is using it | Positioning & prominence; Surveillance |
| Haptic mouse giving user feedback on the efficiency of his or her printing as a print job is sent | Feedback through form; Self-monitoring |
| 'Woodpile' stack of paper is prominent, next to printer, and decreases as used, maybe weighed | Feedback through form; Self-monitoring |

Most are, indeed, entirely feasible and could be built and tested as part of a trial to determine how effective they really are in practice at influencing users' behavior in either the lighting or printing contexts. Some concepts could be combined as part of a service allowing users both within a household / office and in a larger community to understand and respond to their energy or printer usage; others could work as individual, retro-fit products or software. Some would almost certainly go outside the ethical boundaries of Persuasive Technology, and might be considered coercive or deceptive (e.g. by Oinas-Kukkonen and Harjumaa's definitions [39]). Nevertheless, it is worth reviewing these ideas even if only for a design team to decide 'how far' they want to go in influencing behavior.

How many concepts did participants generate? Including concepts which developed from others rather than being inspired directly by the suggestion diagrams, A generated 12, B generated 18, C generated 9 and D, the control, generated just 5. With such a small sample size, it is not possible to say whether the relatively more prolific performance of B, with a *prescription + inspiration* usage pattern (Table 5), versus the *inspiration only* pattern of A and C, is significant, or whether it is due to the different briefs addressed, or the individual design ability of the participants. Nevertheless, A, B and C all generated more concepts than D who had no stimulus material, which suggests that having *something* to focus one's thinking may be useful for concept generation. The concepts D suggested, as control, working on the printing brief, paralleled some of the same ideas A and C generated, but did not venture outside the feedback / self-monitoring area.

# 4. DISCUSSION & CONCLUSIONS

The initial pilot study described in this paper is a very limited test of the DwI Method, v.0.8. The sample size is very small and the think-aloud protocol is relatively free-form; it allows the participant, engaging in inspirational design thinking, to work without adherence to too many experimental requirements, but this does result in a lack of rigor from an analytical point of view. The aim was primarily to help develop the usability of the method first, so that the real application to a series of group workshop sessions, and subsequent public release, will involve a better version of the method. Nevertheless, the study described here

does demonstrate that the DwI Method, however used, allows a designer to generate feasible concepts—most of which would count as Persuasive Technology—in response to briefs about pro-environmental behavior. Based on the results of the study, recommendations for improving the DwI Method include:

- Reduction in overall complexity of the method so it is quicker to understand and apply
- Simplification of categories: the lenses seem to be easier to understand than the enabling / motivating / constraining approach distinctions
- More succinct (e.g. bulleted) descriptions of techniques, maybe with more familiar 'everyday' names or examples alongside specialized terminology
- Suggestion diagrams should highlight applicable techniques more clearly
- Rethink of the target behavior groups and the mapping of target behaviors to applicable techniques
- Provision for the method to be used more easily in either *prescription* or *inspiration* 'modes', with or without using target behaviors

In the next iteration of the method, v.0.9, these points have been addressed, along with other improvements, such as renaming some of the lenses (e.g. 'Poka-yoke' becomes 'Errorproofing'; 'Heuristics & biases' becomes 'Cognitive') and introducing extra techniques and examples. V.0.9 of the DwI Method also explicitly recognizes the prescription + inspiration and inspiration-only usage patterns by being designed to be used in two 'modes': as a TRIZ-style [23] prescriptive design method, and as a simple (flat hierarchy) inspiration 'toolkit'. At time of writing, only the latter has been published [34].

A series of group workshop sessions have been initiated with a range of participant designers and students (a much larger sample size), applying the method to a particular sustainable use problem, with the intent of assessing the *utility* of the method and not simply its usability. These will compare the performance of designers using the method (in both prescription and inspiration modes) to control conditions such as 'conventional' brainstorming and should permit a more rigorous analysis of the method.

Further work will involve building a series of prototypes of some of the concepts suggested, and running comparative user trials to determine which techniques have the most impact on user behavior in practice, and what human factors affect this effectiveness. This information can then be incorporated back into the DwI Method as a kind of 'effectiveness weighting' for different design techniques.

While developed for application to environmental problems, the DwI Method is intentionally 'neutral' enough to be applied to other situations where influencing user behavior can bring social benefit. Together with other work in the growing field of 'design for behavior change' and 'design for sustainable behavior' [8][16][32][41][48], it is intended that the Design with Intent approach will complement Persuasive Technology and help bring together perspectives from HCI, psychology and product design.

## 5. ACKNOWLEDGMENTS

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