An Affective Tool to Assist in Designing Innovations

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Abstract

While cognitive models of the design process have long dominated, many design innovation approaches advocate the importance of exploring affective concepts such as emotion, meaning and lived experiences in the creation of innovations. We suggest the capacity to think abstractly – to question, make connections and broaden understanding based on affect and meaning – is a fundamental skill for the abductive problem solving characteristic of expert designers. There are, however, few tools to promote questioning and reflection based on affect within the design innovation process. We see a need for such tools in design innovation workshops, particularly for non-designers who are less experienced with this type of thinking. We prototype a novel creativity tool for exploring affect within design innovation processes. It utilizes Affect Control Theory's dictionaries of affective meanings for social events to explore affective space. The dictionaries contain standardized affective ratings for a range of concepts. These ratings allow the linking of concepts that have similar affective properties. The initial creativity tool prototype is illustrated within Dorst's (2015) Frame Creation design innovation method. We envisage the tool being one tool among a range used for the analysis of themes and the development of frames within design innovation processes.

affect; design innovation; affective meaning; creativity tool

In this paper we propose a novel affective creativity tool to assist in the design innovation process. Several cognitive heuristic tools exist to act as prompts in the design ideation phases (see, Daly, Yilmaz, Christian, Seifert, and Gonzalez (2012), for a review). Here, we stress the importance of understanding the role of affect in the design process, and present a tool designed to facilitate the exploration affect within design innovation workshops. This tool is in the early stages of development, and while we are encouraged by a number of the simulated examples shown in this paper, we recognize the real value of the tool will only be established through its use and evaluation in range of design innovation contexts.

This paper proceeds as follows. The first section seeks to initially establish the importance and rationale for considering the role of affect in design innovation processes. It highlights that although many design innovation researchers suggest deep exploration of affective concepts is fundamental to creating innovations, relatively few tools exist to support the exploration of affect in design innovation processes. Dorst's (2015) Frame Creation method for design innovation is identified as the specific context for which we initially develop the affective creativity tool. In the second section we first briefly introduce Affect Control Theory as it establishes the importance and validity of exploring how the affective meanings people and cultures have for different concepts influence people's experience and behavior. We then introduce Affect Control Theory's dictionaries of affective meaning and a new construct of affective correlates that are fundamental to the affective creativity tool. In section three we describe the rationale and specific functionality of the affective creativity tool before providing simulated examples of the application of the tool using real themes and frames from design innovation workshops in section four. The conclusions in section five highlight the potential of the tool, areas for future development and plans for testing and evaluation.

The Affective Turn

There is no question that there has been an "affective turn" in design. This is most evident in the area of product design where the importance of affect and emotion in understanding and designing products is widely established (Desmet & Hekkert, 2007). Less often, however, is the role of affect considered in understanding design processes. When affect is explicitly discussed in relation to design processes it usually relates to the impact of designers' evaluative appraisals and affective states in the development of concepts (Dong, Kleinsmann, & Valkenburg, 2009; Love, 2000). Affect is largely conceptualized in terms of designers' feelings that result from cognitive processes and decision-making, rather than being the source of information for the creation of new ideas. Creative thinking in design is still largely investigated and understood as a cognitive, rational process (Chrysikou, 2015; Gero, 2012). While philosophical accounts offer some challenges to a purely cognitive view suggesting the importance of deep understanding and reflection, the relationship or role of affect in such deep understanding is not well articulated.

Design's "affective turn" is mirrored, and in many respects originates, in a broader "affective turn" in the humanities and social sciences during the 1990's (Kim, Bianco, Clough, & Halley, 2007). Zajonc's (1980) psychological research that found affect influences judgment directly, and is not simply a response to a prior analytic evaluation, was a major change in the way affect was conceptualised within the social sciences (De Martino, Kumaran, Seymour, & Dolan, 2006; Slovic, Finucane, Peters, & MacGregor, 2007). More broadly in the humanities, it has resulted in researchers across many fields testing and moving beyond a strict adherence to a cognitive, logical rationality of human information processing and experience (De Martino et al., 2006). The implicit use, characterization and association of meaning and affect is increasingly viewed as critical to understanding human experience (Kim et al., 2007; Robinson, Smith-Lovin, & Wisecup, 2006). As such, this new

view suggests that our everyday acts may not be guided by exhaustive cognition but by the processing of the affective meanings embedded within the cultures in which we live.

Within the design innovation field, Bucolo and Wrigley (2012), Verganti (2008, 2013), Dorst (2015) and others (van der Bijl-Brouwer & Dorst, 2014) have emphasized the importance of the exploration of meaning, emotion, values and lived experience in the design innovation process. We suggest that designers' capacity to think abstractly – to question, make connections and broaden understanding based on affect and meaning – is fundamental to the abductive problem solving that is considered a feature of expert designers (van der Bijl-Brouwer & Dorst, 2014).There are, however, few creativity tools for use within design innovation workshops that explicitly facilitate the exploration of affect and meaning. In this paper we propose and prototype a novel affective creativity tool for design innovation workshops that utilizes concepts and data from Affect Control Theory.

While we suggest our affective creativity tool could be relevant across a range of design innovation scenarios, we conceptualize and describe this first iteration of the prototype for use within workshops based on Dorst's (2015) Frame Creation methodology. In addition to being familiar to the authors, Dorst's (2015) nine-step Frame Creation workshop methodology is reasonably unique in the clarity and structure it brings to the design innovation process. It is particularly suited to solving complex social problems involving multiple stakeholders with different values and needs. After undertaking an investigation about how the problem is currently understood and why it is difficult to solve, the Frame Creation method involves a broadening of the problem by identifying the range of stakeholders and their needs and aspirations. From these needs and aspirations, themes are identified that resonate across stakeholders. From deep analysis of these themes, new frames, or new perspectives on a problem situation, are identified and used to guide solutions.

Techniques for understanding the problem and the stakeholders needs and aspirations are relatively well articulated in Frame Creation and elsewhere (Daly et al. (2012), however there are fewer techniques for supporting the task of transforming themes into frames. We suggest the proposed affective creativity tool may assist in this regard – both in the thematic analysis and the exploration of alternative frames. Dorst (2015) states that themes are transformed into frames through an exploratory, prospective process of thematic analysis that bears similarity to conducting a hermeneutic phenomenology investigation (van der Bijl-Brouwer & Dorst, 2014). While questioning techniques and a model of human insights are often used (van der Bijl-Brouwer & Dorst, 2014), and an approach for the purposeful use of metaphors for the creation of frames is being developed (Pee, van der Bijl-Brouwer, and Dorst, forthcoming), the need and value of additional tools to support transforming themes into frames is widely recognised (Dorst, 2013). Thus, it is at both the thematic analysis and frame analysis stages that we envisage the use of the affective creativity tool. This will be explained further in subsequent sections of the paper when we introduce the new tool (sections 5 and 6). Next, we introduce Affect Control Theory from which our tool has its origins.

Affect Control Theory

Within social psychology, Affect Control Theory is an approach premised on the centrality of affect in understanding people's experience and behaviour (Heise, 1979, 2007; Smith-Lovin & Heise, 1988). Affect Control Theory suggests our desire to maintain affective meanings about the world is central to explaining and understanding how we feel, what we do and the emotions we communicate in situations. Affect is proposed to provide people with an abstract but common metric for perceiving and collating meaning about a wide variety of concepts in the world. As such Robinson, Smith-Lovin and Wisecup (2006; pg179-180) suggest Affect Control Theory "turns the historically cognitive symbolic interactionism paradigm on its head, positing that the dynamic of affective processing underlies both routine role taking behaviour and creative, negotiated responses to non-routine situations". Across a number of disciplines Affect Control Theory research provides compelling support for the model (Heise, 2007) including research in design related to settings (Lulham, 2007), products (Lulham, 2013); Shank & Lulham, 2015) and technology (Shank, 2010).

Affective correlates: linking concepts with similar feelings

Central to the development of our creativity tool is the notion of affective correlates. Stemming from an earlier paper by Lulham (2013) on Affect Control Theory (ACT) and design, affective correlates relates to the idea of exploring the affective similarity of concepts in terms of their goodness, powerfulness and liveliness. By concept it is meant elements such as social identities, behaviours, settings, and so on. Affective correlates involve exploring concept similarity in terms of people's affective meanings – or culturally shared feelings about a concept - rather than similarity in terms of literal meaning as found in a thesaurus. In this section we elaborate on the idea of affective correlates and revisit the example from Lulham (2013), but before doing this we need to explain the ACT dictionaries and how we identify concepts as having similar affective meanings.

Affect Control Theory dictionaries

A key feature of ACT is the availability of dictionaries that contain standardized ratings of affective meanings for a range of concepts related to social events or situations. ACT's conceptualization and measurement of affective meaning builds on the extensive research of Osgood, May, and Miron (1975) on the cross-cultural universals of affective meaning. Osgood et al. (1975) found that when people were asked to describe a range of concepts affectively, including everything from people's roles to symbols, their descriptions across cultures universally denoted meanings associated with the three dimensions of evaluation (goodness), potency (powerfulness) and activity (liveliness). Affect Control Theory uses a set of validated 9-point rating scales (shown in Figure 1) to measure people's affective meanings on these three dimensions (Heise, 2010). After surveying a large sample of participants from a culture, mean values ranging from -4.3 to +4.3 on each dimension are used to approximate the shared affective meaning for a concept.
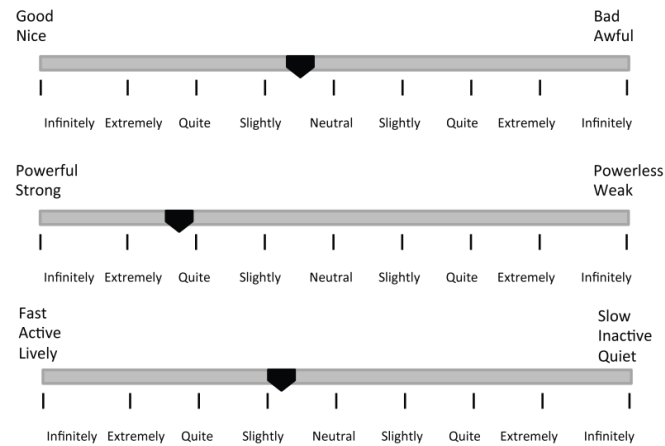
Figure 1. Semantic differential scales used to measure affective space.

With the focus of ACT on understanding social situations, dictionary studies often collect ratings of affective meanings for hundreds of social identities (e.g. professor, student), behaviors (e.g. advise, berate), settings (e.g. home, tutorial) and also identity modifiers (e.g. traits, moods or emotions used to describe identities like stubborn, happy and jealous). With these affective meanings, it is then possible to construct social situations using standard language syntax such as; "a professor berates a stubborn student in a tutorial". While in other ACT studies the dictionary data is often used to estimate how, for example, the professor and student would feel, and what they would do next, our use of the data within the affective creativity tool is considerably simpler and more abstract. We use the ACT dictionary data to see what social event concepts share similar affective meaning with, or "feel the same as", other concepts of particular interest or relevance to the design task (e.g. themes, brands).

To provide the reader with a broader sense of the type and range of concepts included in an ACT dictionary, Table 1 displays alphabetically the first five social identities, behaviours, settings and modifiers in the Indiana dictionary (Francis & Heise, 2006). With each concept are the numerical values as well as the corresponding semantic, qualitative descriptions associated with the affective meaning. For example, the numerical value for the behavior "abandon" is -3.05 on the evaluation dimension, which corresponds to the descriptor "extremely bad" on the first semantic differential scale in Figure 1.

Table 1: Examples of concepts and their affective values from the Indiana dictionary (Francis & Heise, 2006).

Element	Concept	Eval. Pot. Act.	Semantic description
Social identities	abortionist	-1.1, 1.62, -0.46	bad, quite powerful
	adolescent	0.63, -0.56, 2.11	good, weak, quite active
	adult	1.36, 2.04, 0.61	good, quite powerful, active
	adulterer	-2.85, -0.28, 0.05	extremely bad, weak
	adulteress	-2.53, -0.69, 0.53	extremely bad, weak, active
Behaviours	abandon	-3.05, -0.92, -0.81	extremely bad, weak, slow
	abuse	-3.97, 0.71, 0.66	infinitely bad, powerful, active
	accommodate	2.73, 1.24, 0.45	extremely good, powerful
	accuse	-2.12, 0.76, 1.25	quite bad, powerful, active
	address	1.52, 1.4, 0.29	quite good, powerful
Modifiers	abusive	-2.74, -0.16, 1.55	extremely bad, quite active
	accommodating	2.47, 1.52, 0.64	quite good, quite powerful, active
	adventurous	2.41, 2.41, 2.95	quite good, quite powerful, extremely active
	affectionate	2.57, 1.72, 0.98	extremely good, quite powerful, active
	afraid	-2.06, -0.43, -0.35	quite bad
Settings	abortion clinic	-1.38, 1.01, -0.44	bad, powerful
	adult bookstore	-0.53, -0.07, 0.39	bad
	airplane	1.96, 2.54, 2.3	quite good, extremely powerful, quite active
	amusement park	2.78, 2.56, 3.19	extremely good, extremely powerful, extremely active
	April Fools Day	0.85, 0.4, 1.26	good, active

NB. Eval. = evaluation (goodness), Pot. = potency (powerfulness), and Act. = activity (liveliness)

Affective correlates of Mac and Windows PCs

To further explain and establish the potential of exploring affective correlates we revisit the example of Mac and Windows PCs initially described in Lulham (2013). While retrospective to the design process, it presents as a vivid and useful example for explaining the technique. It provides support that exploring affectively similar but contextually unrelated concepts for particular products can promote a meaningful and potentially useful analysis.

To do this exploration we first obtained from Shank's (2010) technology dictionary the numerical values associated with the affective meanings for the concepts "Mac PC" and "Windows PC" on the three affective dimensions (evaluation, potency, and activity; first row of the Table 2). Using these values (e.g. 2.19, 0.97,1.95 for Mac PC), we then searched the Indiana affective meaning dictionary (Francis & Heise, 2006) that includes 1500 concepts for the four most similar identities, behaviours, settings and identity modifiers. The selection process was done mathematically by selecting those concepts that result in the smallest Euclidean distance calculated across the three dimensions between the product (or target concept) and all other concepts in the dictionary. Those with the smallest distance, and hence that are the most affectively similar, are displayed in the table below.

Table 2: Affective correlates of "Mac" and "Windows" personal computers.

	Mac PC	Eval. 2.19	Pot. 0.97	Act. 1.95	Windows PC	Eval. 1.49	Pot. 1.32	Act. 0.68
identities	honeymooner	2.26	1.08	1.84	uncle	1.62	1.23	0.67
	playmate	1.84	0.93	1.80	schoolteacher	1.63	1.25	0.61
	wife	2.29	1.44	1.53	heterosexual	1.67	1.18	0.57
	buddy	2.28	1.61	1.65	guy	1.27	1.41	0.79
behaviours	drink to	2.15	1.48	1.78	reply to	1.53	1.37	0.68
	dance with	2.19	1.54	1.76	talk to	1.51	1.28	0.86
	joke with	2.00	1.56	1.81	collaborate with	1.44	1.11	0.61
	play with	1.96	1.06	1.31	join up with	1.60	1.45	0.87
modifiers - adjectives	young	2.33	0.84	2.16	White	1.24	1.08	0.61
	horny	1.90	1.09	1.97	euphoric	1.42	1.09	0.99
	playful	1.87	0.82	1.69	cooperative	1.87	1.11	0.61
	cheerful	2.11	1.43	1.42	moved	1.70	1.03	0.42

NB. Eval. = evaluation (goodness), Pot. = potency (powerfulness), and Act. = activity (liveliness)

When compared qualitatively, the affective correlates for Mac and Windows computers do appear to reflect some of the broader associations and meanings commonly held about these products. Mac is linked with identities, behaviors and adjectives that are more fun, interactive and new, while Windows PCs are associated with more conservative, fixed and practical concepts. Many of these concepts, particularly for the Mac PC, resonate with characterizations in Apples "Get a Mac" advertising campaign (see Figure 2; Nudd, 2011). While this exploration was obviously not conducted for the purpose of designing, the characterization inferred by the combination of the identity, behaviors and modifiers also appears to potentially provide a rich context for the development of design ideas or frames. It is this use of exploring affective correlates as a tool for informing conceptual design in design innovation workshops that is progressed in the remainder of this paper.

Figure 2: Screen takes from the 'Get a Mac' advertising campaign.

NB. In this campaign, Mac PCs are presented as "fun" and "better at life stuff", whereas Windows PCs are positioned as less interesting, and more serious, with references to spreadsheets, calculators and clocks.

The affective creativity tool prototype

This section articulates our proposed prototype of the affective creativity tool. All of the tools' functions and analyses can be carried out manually using the ACT simulation program Interact (see Heise, 2007 for a full description) and a standard spreadsheet program. Using Interact for this purpose, however, is cumbersome and time-consuming as the program was

not designed with this purpose in mind. Taking 10-15 minutes for each exploration, it is difficult to conduct these analyses manually in real time within a workshop situation. As a result we have committed to developing a dedicated tool for use in workshops. In this section we describe the basis for the forthcoming affective creativity tool including mock-ups of the tool's interface design.

Overview

The tool is for use in design innovation workshops and enables the exploration of concepts with similar affective meanings to a target concept or concepts. In this initial prototyping of the tool for the Frame Creation workshops, the input for the target concepts will be either themes or potential frames identified by participants in the workshops. The tool is a java-based application for use on a laptop computer that enables the automated searching of any nominated ACT dictionary. Once affectively similar concepts to the target are found, the application facilitates the clear presentation of the social concepts to workshop participants on a projector screen or monitor.

Purpose

The purpose of the tool is to assist participants in design innovation workshops to explore and analyze the affective qualities of themes and frames within the design process. Through linking concepts affectively, rather than literally, the tool promotes participants to think about themes more abstractly, deeply and across contexts when looking to develop new frames. For the analysis of potential frames, the tool may identify concepts that prompt thinking related to new solution scenarios related to the frame and assist in evaluating the broader "fruitfulness" of the frame. In both the analysis of themes and frames we see the tool's purpose as promoting and supporting the type of generative thinking known to lead to innovative solutions, rather than the tool itself explicitly specifying frames or solution scenarios.

Rationale

Many emerging approaches in design innovation highlight the importance of exploring the affective and symbolic qualities of a problem. Drawing on observations and interviews with expert designers, Dorst (2015) suggests the type of deep analysis undertaken by expert designers is similar to that in hermeneutic phenomenology. The hermeneutic phenomenology approach elevates the importance of questioning, symbols and the interpretation of language in developing deep understanding. Questioning that opens up problems and broadens the horizons of understanding is suggested as central to the approach. We propose that through the linking of concepts with similar affective meanings the new tool provides a prompt to the type of questioning and thinking that broadens the horizons of understanding of a theme or frame. We suggest the tool may be particularly useful when the design innovation workshop participants are not experienced designers and are unfamiliar with the abstract, deep and affective thinking characteristic of expert

designers. The tool is not intended to replace the role of the designer as the creator of innovative acts, but instead to assist in the facilitation of the design process.

Functionality and interface

The prototype tool is designed for use by a workshop facilitator. The tool's java based application will consist of two main screens; a set-up screen and a presentation screen. The set-up screen (see Figure 3) enables the workshop facilitator to create a project that could include multiple theme and/or frame explorations. For each concept exploration, the workshop facilitator can select the data dictionaries used, search for the target concept in these dictionaries and then select the type and maximum number of output concepts. Once the set-up phase is complete, the concepts identified as affectively similar to the target concept can be presented to the workshop group using the presentation screen (Figure 4). This initial mock-up of the presentation screen is purposefully plain and simple in design as it was thought that a strong aesthetic or technical appearance could inadvertently impact on people's engagement in the task.
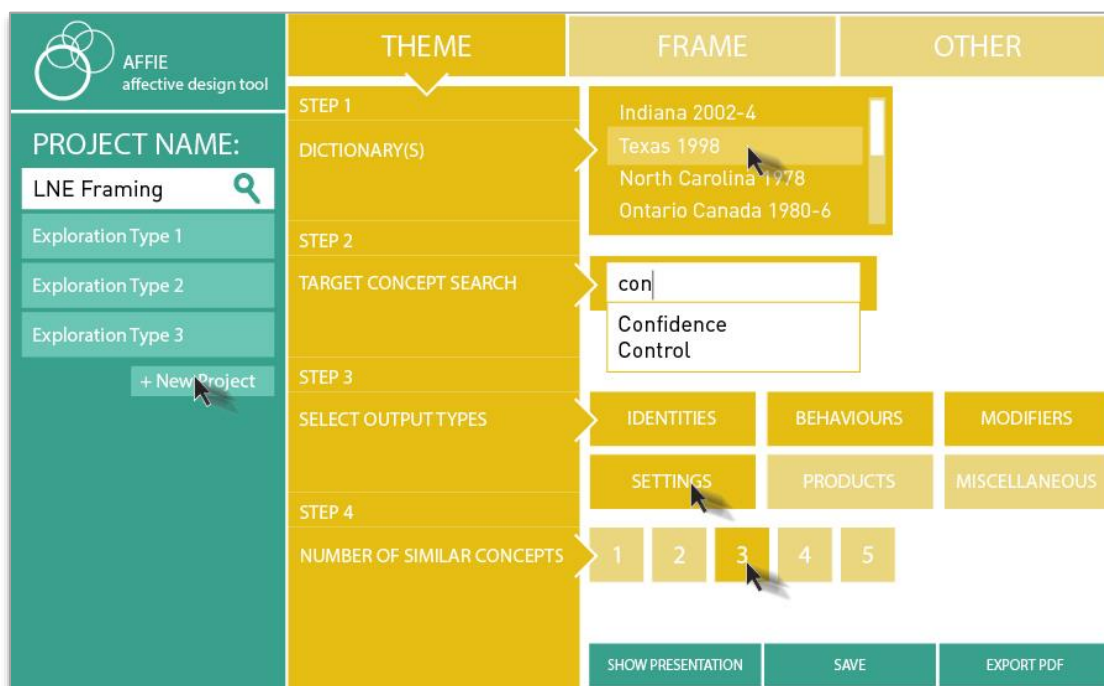

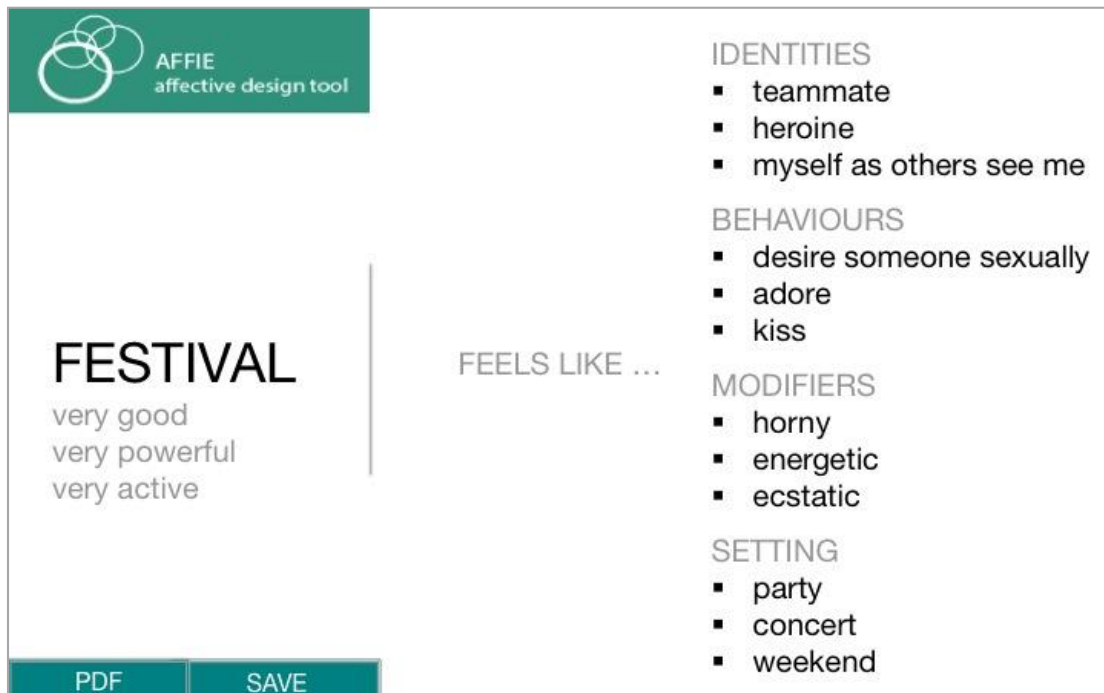Figure 3. Proposed software interface for the opening page of the Affective Creativity Tool

Figure 4. Proposed software interface for the exploration of a specific theme or frame. In this case, the frame, "festival" is explored and the elements (identities, behaviours, modifiers and settings) that it "feels like" affectively are displayed (affective correlates).

Use scenarios

Within the frame creation process the affective creativity tool is designed to facilitate the thinking and questioning required for moving from themes to frames. It can be used as an activity at two points within this stage of the workshop process; the analysis of themes and exploration of frames. We outline the general procedures for each of these uses in each stage.

For the analysis of themes, the use of the tool occurs as part of the process of looking more deeply into the personal and universal meanings of the theme. As indicated earlier, a thematic analysis involves "unpacking" the themes and establishing their personal content and universal structure. Through identifying similar, affectively related concepts to a theme, the tool may assist workshop participants to explore and interrogate the meaning, implications and opportunities for new understanding of the problem context.

In the analysis of frames, the tool will identify affectively related concepts that prompt the kind of thinking related to finding solutions as well as assisting in determining their suitability and/or feasibility. By considering their applicability to the original scenario together with evaluating their affective connotations across the different levels of concepts/elements, it is possible to evaluate their suitability for counteracting the problem situation.

Simulated examples

To illustrate how the tool would be used we provide two simulated examples; one related to analyzing themes and another to exploring alternative frames. Both examples come from actual design innovation workshops on problems of alcohol related violence in an adult, entertainment precinct (Kings Cross; see Dorst, 2015 for a full description of this problem and its resolution). In these examples we take the actual information (themes and frames) that was developed in the workshops, and explore their potential application with the proposed tool.

We set the scene with a description of the real scenario that inspired the aforementioned workshops. The problem situation can be described as follows:

> *Kings Cross had become a scene of violence and un-rest, with a high influx of young people attending on Friday and Saturday nights. Previous attempts at enforcing strong-arm tactics only served to strengthen the grim atmosphere. The Designing Out Crime team was called in and assessed the situation, realizing that the trouble-makers were not in fact criminals, despite their actions, but were just young people looking to have a good time. Due to various conditions present (or absent) at Kings Cross, such as lack of adequate public transport, high concentrations of young people were gathering at the Cross for extended periods of time, and the resulting boredom combined with alcohol was leading to the aggressive behaviours on display...*

Affective analysis of themes

In the first simulated example we explore three key themes as identified and analysed in a workshop at the Designing Out Crime research centre that revisited the problem of alcohol related crime in Kings Cross, Sydney, Australia. We then explore these themes with the Affective Creativity Tool by using them as input concepts.

After analyzing the problem, identifying the underlying paradoxes and mapping out of the stakeholders and their core needs, the following key themes were identified: respect, control and sensuousness. In the workshop, the theme ***respect*** was found to be related to stakeholder needs or desires around inclusiveness, widening the demographic mix and creating a more women-friendly environment. The theme ***control*** related to regulating the types of people who were allowed into venues and strategies to reduce conflict and violence in venues, but it also related to increasing people's own sense of control. Finally, the theme ***sensuous*** related to desires around intimacy, losing the self in the moment, love and escaping from the daily grind.

For each theme an affective exploration is now undertaken (Figure 5-7) using the new tool to identify those social identities, behaviors, settings and modifiers that feel similar to each target concept. While we would hope many of the "similar feeling concepts" would resonate with the problem context, it is expected that some will be less relevant as they could come from quite different institutional or social contexts to the problem. Similar small issues are found in other uses of the affective meaning data in ACT tools, but overall there often is a

surprising relevance of the concepts. Regardless, the activation of multiple concepts promotes a deeper level of understanding of themes that is both directly relevant as well as external to the problem situation.

For the theme *respect* (a behavior in the ACT dictionary), the exploration of concepts with similar feelings displayed in Figure 5 raised some interesting connections. Concepts pertaining to things such as calmness, trust, being relaxed, and being dependable, have obvious positive connotations that, if realized in a new frame, would be a considerable improvement on the problem situation. Furthermore, settings such as mealtime and Thanksgiving day could be examined further with the possibility of incorporating these ideas into the backdrop of the more active Centre stage of the precinct. The concepts Hug and Lovers Lane also resonate and connect in interesting ways with the more active theme of *sensuous* that was also identified during the workshops.
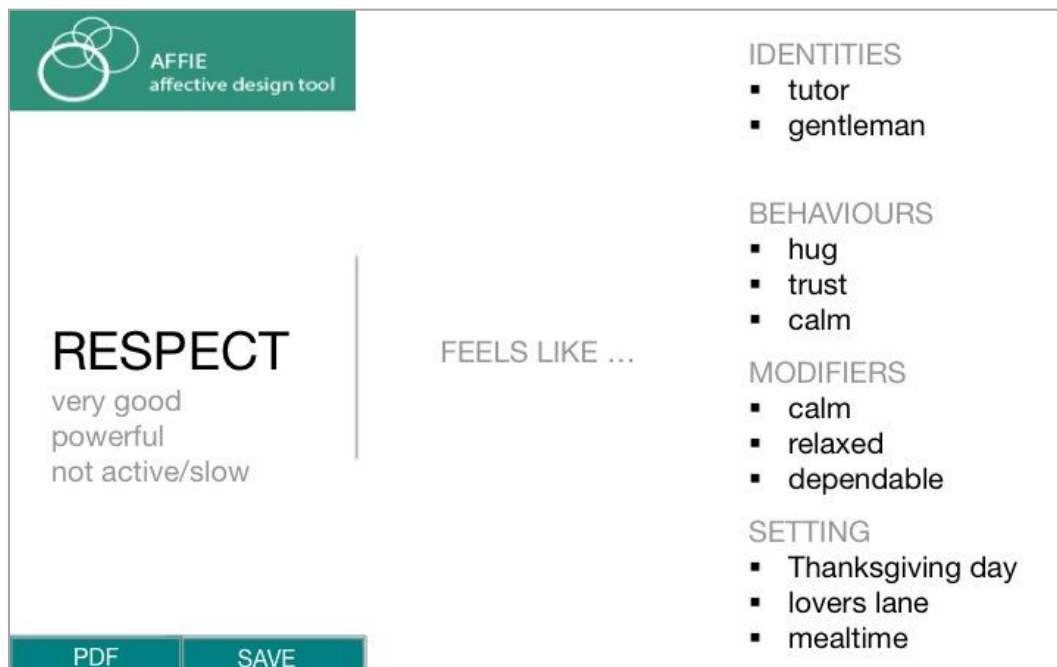

Figure 5. Affective correlates for the theme, "respect".

When exploring the theme *control* (Figure 6), concepts with similar feelings to the behavior "control" were associated with quite negative and powerful feelings. Social identities with similar feelings had an underworld, crime feel, while the behaviors "contemptuous" and "manipulated" were at odds with the behavior "trust" associated with the *respect* theme. A common link for settings with similar feelings to 'control' was that the performance of occupants in each setting is usually under close scrutiny. This exploration of control could provoke questioning around whether it may actually be counterproductive to frame or intervene in the problem from a basis of controlling behavior. Indeed, in the actual problem situation, previous heavy-armed tactics employed by law-enforcement had failed.
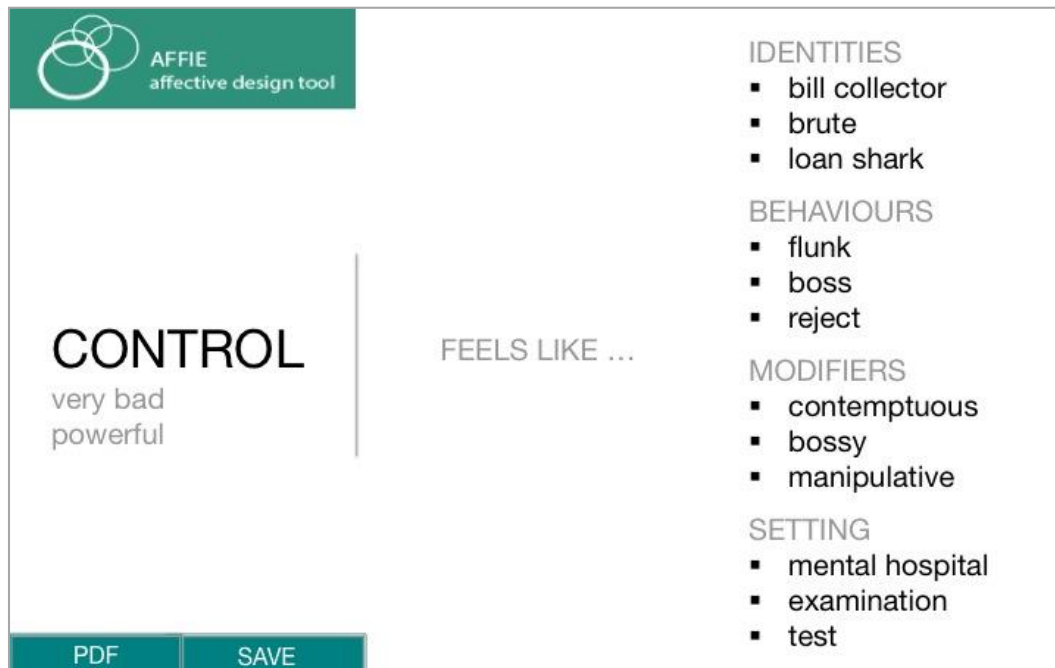
Figure 6. Affective correlates for the theme, "control".

For the very good, powerful and active theme of *sensuous* (Figure 7), identities with similar feelings included the very connected, relationship-focused identity of kindred spirit. Interestingly, both nurse and maternity ward had a similar feeling to sensuous possibly due to the high visceral aspect of birthing and the caring role of a nurse. Similar behaviors and modifiers including thrill, dance with and enthusiastic, again have a strong visceral and physical feel. The behavior "witty" is a particularly interesting one for the problem context as it is often seriousness rather than humor that characterizes adult entertainment precincts. This contradiction could be perceived as opening up possibilities for frames that have a more positive connotation than the problem situation. In the explorations of frames to follow, it is very apparent how the theme of sensuous readily fits with a frame of a nightclub, topless bar, or festival. Each of aforementioned frames are characterized by high activity and concepts relating to excitement.
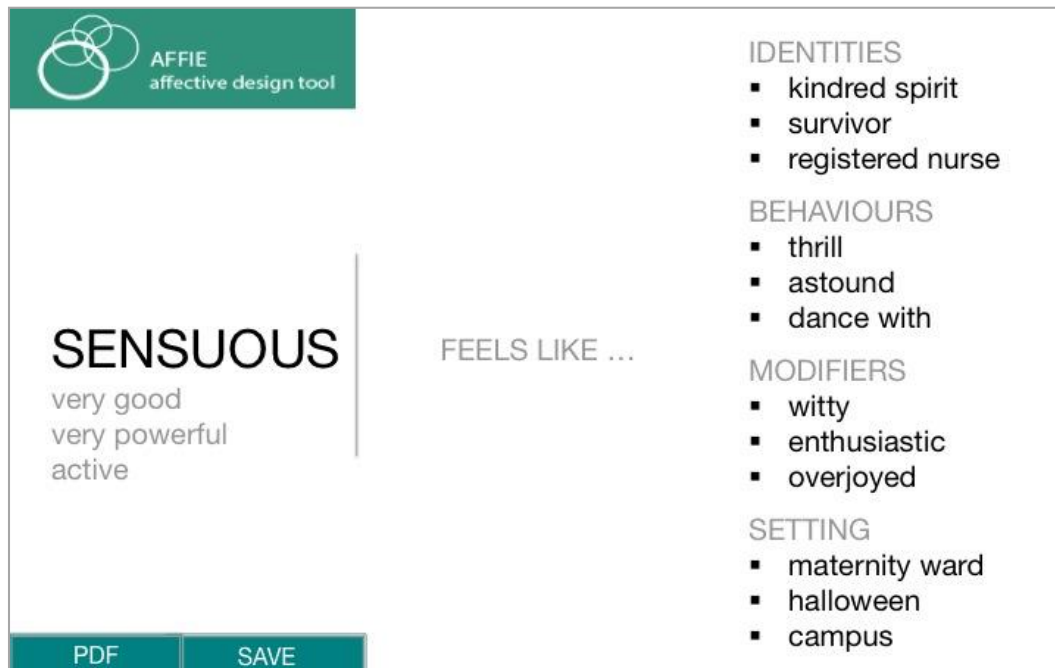
Figure 7. Affective correlates for the theme, "sensuous".

Affective analysis of frames

For the analysis of frames, we return to the Kings Cross innovation project whereby the new frame of "festival" was identified during the workshop as a suitable means for directing solutions. We continue the description of the problem scenario below and follow this with an investigation of the affective correlates of the new "festival" frame in comparison to other more typical frames (e.g. "nightclub" and "topless bar") for this adult, entertainment precinct that were also identified during the real workshops (Figures 8-10).

> ... Through the use of metaphors, the designers asked themselves, "what if this situation was treated as a if it was well-organised music festival?' Thus, the music festival becomes a new frame and provides a course of action: by treating the night-spot as if it were a music festival it is possible to borrow from solutions that are already present in a festival and apply them back to the problematic situation at Kings Cross. For instance, a well-organised music festival would have multiple means of getting attendees out of the venue once the festival was over. At Kings Cross, one of the many solutions executed included implementing extra signage to direct the young people towards alternative train stations nearby.

For the very good, very powerful, and extremely active frame of **nightclub**, the associated identities had positive connotations, for example, winner. It could be argued that the behavior modifiers, adventurous and thrilled, while positive, are high energy and therefore

not necessarily desirable for counteracting an alcohol-fueled and troublesome situation such as Kings Cross.
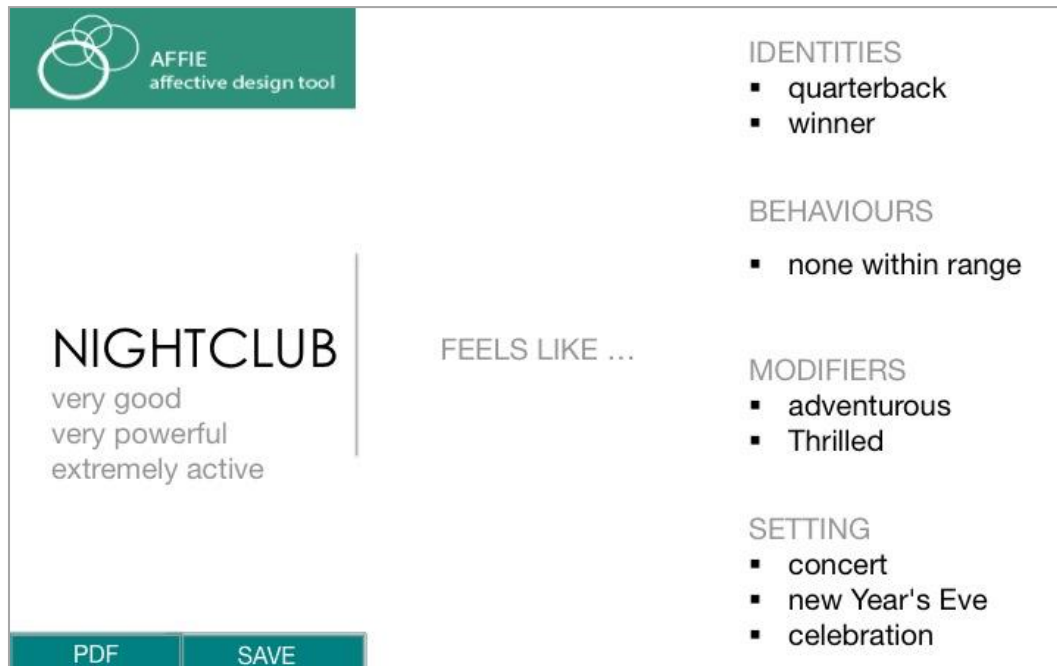

Figure 8. Affective correlates for the frame, "nightclub".

The frame of **topless bar** has obvious negative connotations (identities of "daredevil", "playboy", and behaviours, "strip" and "chase") that again might not seem conducive to counteracting the troublesome behaviours at Kings Cross. Instead, these dimensions would seem to perpetuate the types of aggressive, potentially violent behaviours on display that the designers were attempting to stop.
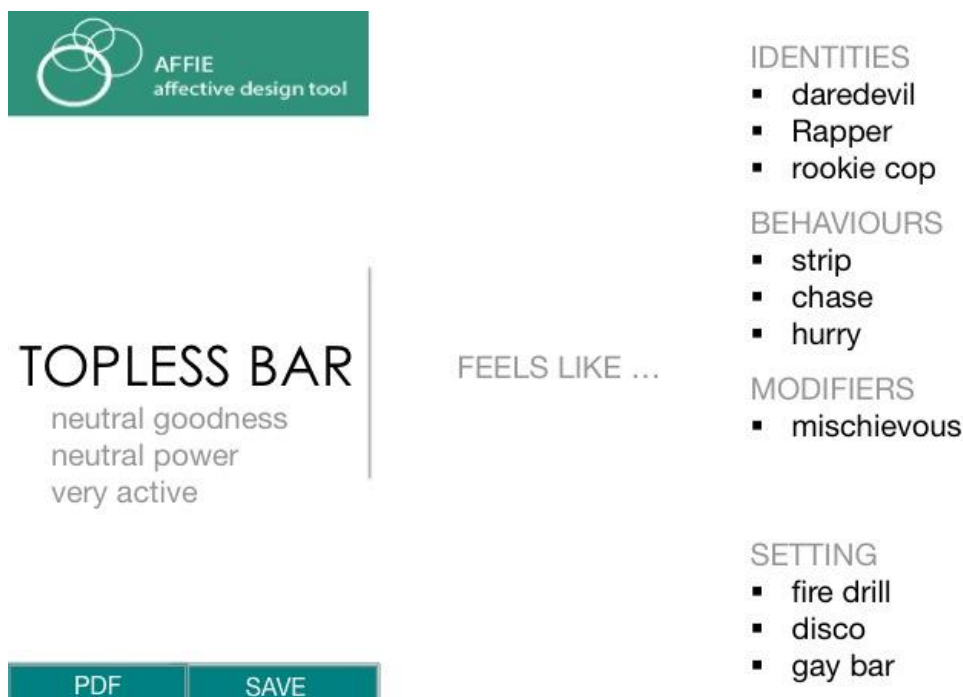

Figure 9. Affective correlates for the frame, "topless bar".

The frame of **festival** could be seen as the most fruitful frame given its positive connotations across all levels of concepts (e.g. identities of "teammate", behaviours of "adore", settings of "weekend" and so on). When considering the crowd-control strategies already implemented at festivals, these generally use alternative measures than strong-arm tactics. For example, having two popular musical acts performing on different stages at the one time prevents all festival-goers from gathering in the one place at once. Such tactics were in fact mirrored in the resolution of the actual King Cross project: alternative forms of entertainment such as salsa dancing were set up in multiple locations to control and occupy crowds.
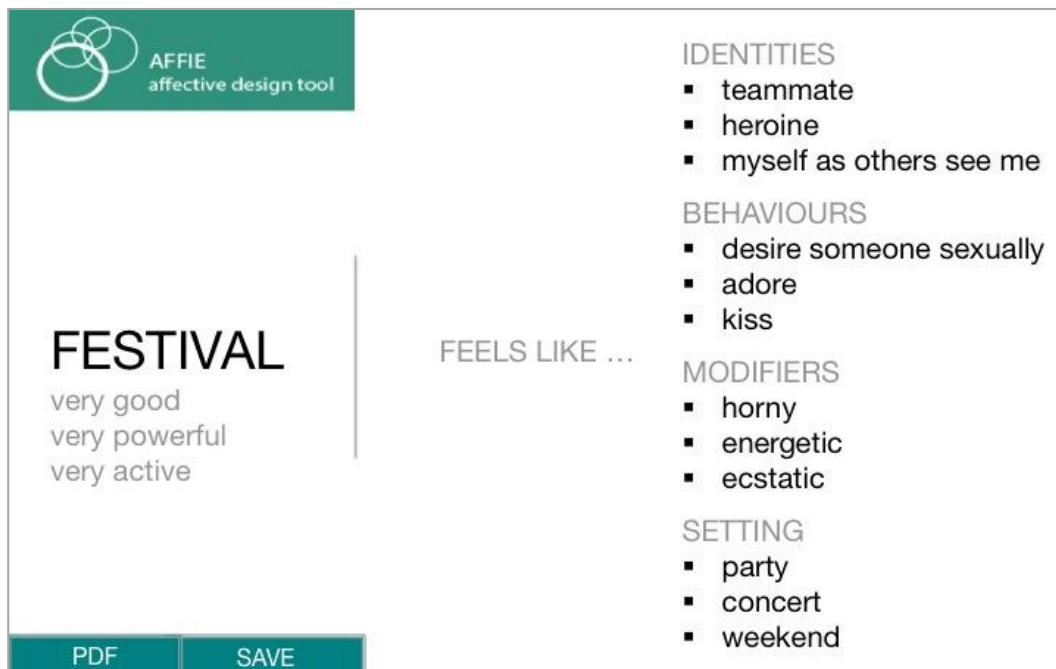

Figure 10. Affective correlates for the frame, "festival".

Conclusions

In this paper we have presented a prototype of a novel Affective Creativity Tool for design innovation processes. We are not aware of any other creativity tools that specifically facilitate the exploration of affective meanings within the design process. Our tool is also relatively unique in the way it utilizes data from a social psychology theory of social experience. In suggesting connections between concepts with similar affective meanings, rather than literal meanings, we believe the tool will promote the kind of abstract, prospective questioning and thinking required for design innovation.

We used the prototype tool to retrospectively explore themes and frames from actual design innovation workshops. The results of these explorations support the potential value of the tool. The software and procedures for integrating the tool into design innovation workshops in real time are currently being developed. We intend to evaluate the impact of the Affective Creativity Tool on the design process and the creation of innovative solutions.

While a number of large ACT dictionary datasets are available, and new North American and Middle Eastern data sets are currently being collected, some additional targeted data collection for the purpose of the Affective Creativity Tool would also be beneficial. Many

concepts commonly identified as themes within design innovational processes (confidence, control, safety) are included in these data sets, but some common themes can be more difficult to find (identity, freedom). The collection of new data, although participant intensive with associated costs, is relatively straightforward due to the clarity of the methodology (Heise, 2010). A project designed to collect such data is currently underway.

Opportunities also exist for extending the functionality of the affective creativity tool. Currently the tool locates those concepts affectively similar to the target concept (i.e. theme) based on the smallest Euclidean distance across the three affective dimensions. An additional option when conducting explorations could be identifying the "affective opposites" of the target concept defined as those in the dictionary with the largest Euclidean distance across the three affective dimensions. Exploring the affective opposites of a theme or frame may promote additional productive questioning that may assist in creating frames and solution scenarios. Another potentially interesting extension to the functionality of the affective creativity tool is the incorporation of other similar data sets from outside Affect Control Theory. While some propriety issues exist, data sets such as those from The Centre for the Study of Emotion and Attention including the International Affective Picture System (IAPS), International Affective Digital Sounds (IADS) and Affective Norms for English Text (ANET) could be used to provide exciting possibilities.

Finally, while we are encouraged by a number of the simulated examples shown in this paper, we recognize the real value of the tool will only be established through its use and evaluation in a range of design innovation contexts. We have shown here, retrospectively, the potential of the tool for social innovation projects with a specific example of a crime and punishment problem. We intend to explore the application of our tool to a variety of our other past projects within a multitude of social domains including crime, mental health, and so on, as well as our industry based projects within the private sector including the manufacturing industry and the automotive industry. Importantly, we intend to test and evaluate the new software within actual design innovation workshops as they are in motion in the coming months, potentially sharing some of our findings at the conference in November.

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