MOTIVATION, CYBERWORLDS AND COLLECTIVE DESIGN

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Abstract. Collaborative design is characterised by small-scale, carefully structured, professional design teams. The increasing popularity of social computing and mass communication supported by cyberworlds suggests there is now also a strong possibility of design through mass participation, beyond small-scale, collaborative design scenarios. However to achieve collective intelligence in design, there is a need to motivate large groups of users to contribute constructively to design tasks. This paper studies different types of cyberworlds to classify the motivation profiles of their user bases. We compare these motivation profiles to those required for the emergence of collective intelligence and develop a list of technological requirements for cyberworlds to support collective intelligence and design.

Keywords. Collective intelligence; design; motivation; cyberworlds.

1. Introduction

Collaborative design is relatively well understood in the literature, and is characterised by small-scale, carefully structured, professional design teams. The increasing popularity of cyberworlds – including social networking sites (SNSs) and virtual worlds (VWs) – suggests there is now also a strong possibility of design through mass participation, beyond current small-scale, collaborative design scenarios. Cyberworlds are already a recognised platform for collective intelligence (CI) (Levy, 1997), a form of group intelligence that emerges from collaboration and competition among large numbers of individuals. CI games such as I Love Bees (McGonigal, 2008), and applications
such as NASA’s *Clickworkers* (Romero, 2009), have demonstrated the capacity of CI to solve complex problems. Directing CI for design purposes creates the concept of ‘collective design’. Collective design is defined as large-scale participation from both professional and non-professional designers in increasingly complex and challenging design tasks, beyond small-scale collaborative design scenarios (Maher et al, 2010). To achieve this, however, an understanding is required first of what motivates individuals to contribute constructively to CI applications, and secondly which components of existing cyberworld technologies are necessary both to foster CI and to support design.

Section 2 of this paper reviews four human motivations relevant to CI and design: activation, achievement, affiliation, and power. These motivations are closely related to the explorer, achiever, socialiser and killer user types proposed by Bartle (2003) for VWs, but extend to cyberworld users in general. Section 3 studies a number of different types of cyberworlds, including VWs, SNSs and CI applications to classify the user types they support and identify the technical components that support these users. Section 4 summarises cyberworld technologies and their capacity to support a combination of CI and design, based on their capacity to support and encourage achievement-motivated behaviour. A list of technological requirements (and non-requirements) is proposed for cyberworlds to support CI and design. In particular, we emphasise the need for such applications to attract achievers and explorers, while either minimising socialisers and controllers, or redirecting these roles for a more positive impact on collective design.

2. Motivational psychology and cyberworld user types

Bartle (2003) identified four types of VW users: explorers, achievers, socialisers and killers. With the emergence of new cyberworld phenomena such as SNSs, these user types maintain some relevance as categories for types of behaviour that may be exhibited by users. This section reviews the motivational psychology that distinguishes each category, and considers which types of behaviour need to be harnessed for CI to emerge.

2.1. THE PSYCHOLOGY OF ACTIVATION

Activation is associated with electrical activity in the brain (Moruzzi and Magoun, 1949). Conditions of activation range from sleep and sleepiness to high levels of excitation. These conditions have been found to accompany changes in performance proficiency on a variety of tasks, with intermediate levels of activation most conducive to performance (Heckhausen and Heckhausen, 2008).
Activation psychology is relevant to our study of cyberworlds and design because it is closely associated with curiosity, creativity, exploration and aesthetic appreciation. Berlyne developed the most extensive theory of motivation based on the principles of activation and arousal (Berlyne, 1960). Berlyne distinguished between states of high and low arousal, suggesting that high arousal results in focused (specific) exploratory behaviour while low arousal leads to diverse exploration or curiosity. He used his findings to develop a psychology of aesthetics that describes how observers can be pleasantly stimulated by artworks or designs because they can bring their activation to an optimal level. A work of art or a design can also be experienced as unattractive or repellent if the observer finds it too novel or complex. Berlyne also distinguished between arousal levels and positive or negative hedonic (pleasure) values resulting in approach or avoidance tendencies to arousal. Once a certain threshold has been crossed, positive hedonic values build to a peak as arousal potential increases. Any subsequent increase in arousal potential leads to a decline in hedonic value and eventually to increasing negative values.

The psychology of activation is thus closely associated with design, exploration, creativity, novelty, and pleasure (the ‘fun-factor’). Exploratory behaviour is relevant in new cyberworld types such as SNSs that permit individuals to explore other people’s pages, create their own pages and gain pleasure from these experiences. Furthermore, exploratory behaviour is likely to be important to harnessing CI in design as exploratory activities can gather information on how the cyberworld works and how various design tasks can be completed and can identify unexpected features or ‘bugs’ in applications (Bartle, 2003).

2.2. ACHIEVEMENT MOTIVATION

Achievement motivation drives humans to strive for excellence by improving on personal and societal standards of excellence (Heckhausen and Heckhausen, 2008). Achievement motivation determines how individuals evaluate the tasks set before them and how they select which tasks they will work on. Atkinson (1957) defined achievement motivation in terms of conflicting desires to approach success (success-motivation) or avoid failure (failure-motivation). Success-motivated individuals will choose tasks of moderate-to-high difficulty to challenge themselves and progressively increase their skill-sets.

Achievement motivation is relevant to CI in a number of ways. First, the opportunity to self-select and work on tasks independently has a positive effect on task motivation. This is important because CI relies on voluntary participation. Secondly, a majority of motivators of CI participants are
achievement related. These include participation to contribute to a wider cause, for the challenge, for career advancement, for reward, or out of a sense of duty (Maher et al, 2010; Malone et al, 2009). Supporting achievement-oriented behaviour is likely to be a critical to harness CI and design because they are the behaviours that will meet the design goals of the CI application.

2.3. AFFILIATION MOTIVATION

Affiliation refers to a class of fundamental social interactions that seek contact with formerly unknown or little known individuals and maintain contact with those individuals in a manner that both parties experience as satisfying, stimulating and enriching (Heckhausen and Heckhausen, 2008). Individuals high in affiliation motivation tend to initiate fewer acts that might spark conflict. This has the adverse effect of meaning that they also initiate less cooperative acts. Specific affiliation related goals include: being in the company of others; cooperating; exchanging information; and being friends. Affiliation motivation is relevant to almost all cyberworlds including VWs, SNSs and CI applications. Almost every type of cyberworld permits some form of communication, whether synchronous or asynchronous, and supports the formation of relationships and friendships.

Socialising behaviour maintains its relevance in recent cyberworld settings, but there is an important caveat with respect to CI applications. Individuals high in affiliation motivation without correspondingly high achievement motivation may not be interested in the achievement-related tasks that are the aim of the CI application. Rather they may make use of any available communication tools for unrelated social interaction. This can be to the detriment of the community’s work focus.

2.4. POWER MOTIVATION

Power can be described as a domain-specific relationship between two individuals, characterised by the asymmetric distribution of social competence, access to resources or social status (Heckhausen and Heckhausen, 2008). Power is manifested by unilateral behavioural control and can occur in a number of different ways. Legitimate power, for example, is derived from norms internalised by one individual telling them that another individual is authorised to regulate their behaviour. Effective use of legitimate power assists the organisation of communities and allocation of work tasks. In contrast, coercive power is exerted if one person is in a position to withdraw the opportunities of another to satisfy their motives. Bartle’s ‘killer’ user type
describes this latter type of power. Killers in his system use the tools provided by the game to impose on others, literally by killing their avatar or otherwise hindering their freedom of action.

In this paper we replace the killer user type with ‘controlling’ behaviour. Controlling behaviour comes in two types: ‘leadership’ which constructively organises action in the cyber-society and the ‘killer’ which prevent those actions from going ahead. For CI applications it is desirable to minimise the latter, while still encouraging the former.

3. Cyberworlds that support mass participation in design

Now that we have an understanding of the different behaviour types of cyberworld users, this section discusses three categories of cyberworld with respect to the behaviour types they support. Note that individual users may exhibit, or be encouraged to exhibit, more than one behaviour type. The categories of cyberworld discussed in this section are VWs, SNSs and specific CI applications. A number of examples of each are discussed, with particular reference to three examples that incorporate design tasks: LEGO Universe, myLEGO Network and LEGO Factory.

3.1. VIRTUAL WORLDS

VWs are related to architecture and design because they are characterised by the use of the place metaphor. Recent studies (Merrick et al, 2011) and applications (Rosenman et al, 2006) have shown that the combination of design and modelling tools, communication tools, and artificial intelligence in VWs makes them suitable platforms for supporting collaborative design, including human-human collaboration and human-computer co-creativity. Open-ended VWs in which participants can create new buildings or artefacts are particularly relevant to design. A number of these exist at present, including Second Life, There, Kaneva and Moove Online. However, these worlds do not have specific design-related goals. As such they tend to provide more support for socialisers, explorers and controllers than achievers. While this does not necessarily preclude the emergence of CI, this section focuses instead on a forthcoming VW called Lego Universe that takes a different approach.

Lego Universe is a new massively multiplayer online role-playing game with a unique combination of open-ended content creation and game-play. Users interact with the game using their own LEGO figure avatar. The game combines design/building, play and connection with friends in a 3DVW platform. Design/building is both a means of completing challenges and a reward for completing challenges. For example, a player might build a rocket
ship to use in a battle. If the player wins the battle they will be rewarded with LEGO bricks that they can use to create their own home, pets or other objects on their own virtual land. These creations can be brought to life using the LEGO visual programming language to implement behaviours.

The unique combination of challenges and design in a multiuser world means that Lego Universe requires achievement-oriented behaviour, socialising, exploration and leadership behaviours of its players.

3.2. SOCIAL NETWORKING SITES

A social network (Freeman, 2006) is a social structure made up of individuals (or organisations) called nodes. Nodes are connected by links such as friendship, kinship, common interest, financial exchange or beliefs. Originally, social networking referred to people in real life interacting with others. More recently, websites are being used for social networking as well. SNSs are web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system. These sites provide a platform for people and organisations interested in a common subject to connect and interact with each other. People can share pictures, videos, comments and web-links, among other items.

The MySpace 08 report lists six types of SNS users (MySpace, 2008):

- **Essentialists**: use SNSs to connect with friends and family (38%).
- **Transumers**: join groups connected to their hobbies (28%).
- **Connectors**: pass on information and links whenever they come across something they find interesting (10%).
- **Scene Breakers**: find new bands and talents online and share them through the site (5%).
- **Collaborators**: use SNSs to create social events (5%).
- **Netrepreneurs**: use the SNSs for making money (4%).

If we re-evaluate these categories in terms of the four motivation types discussed in Section 2 then we can see that essentialists, transumers, connectors and scene breakers can be classified in the activation and affiliation categories. Only collaborators and netrepreneurs (<10% of users) can be classified in the achievement-motivated category. This suggests that SNSs such as mySpace and FaceBook in their current forms may not be suitable for supporting CI unless they can be adapted to better harness achievement-motivated individuals. One example of a SNS that seeks to do this is MyLEGO Network.

MyLEGO Network is a social networking game for children. When users
sign up, they create their own LEGO figure avatar. They can then create and personalise their own page with stickers and music. For safety purposes, because the site is for children, users can only communicate with each other via pre-written text so messages are limited to in-game content. Users may choose to participate in the game aspects of the network. In addition to humans, the MyLEGO network is populated with non-player characters. These characters trade LEGO blueprints in return for LEGO bricks that users can ‘grow’ on their home page. Once a blueprint is purchased, the model it describes can be built by locating and trading for its components. Players who create a variety of different models are rewarded with ranks. This draws on their achievement motivation to design/build. There are also different types of badges available for players who have completed certain specialist challenges. This supports both achievement and exploration-oriented behaviour.

3.3. COLLECTIVE INTELLIGENCE APPLICATIONS

CI applications may be VWs or SNSs, or may be in other forms. One example a CI application that doesn’t fall in the previous categories is LEGO Factory. Using LEGO Factory, people can design their own original custom LEGO model using the LEGO Digital Designer software. They then upload the model to www.legofactory.com from where they or others can purchase all the physical bricks and elements required to build the model in real life. The LEGO Digital Designer software automatically generates instructions for the new model. In this way, LEGO draws on the collective design abilities of a much wider community than their own paid designers to generate new LEGO products. To draw on the achievement-related motivation in their community of designers LEGO holds competitions such as the Design byME Contest. LEGO Factory does not include built-in communication tools, but communication between designers is supported by the Design byME forum. The separation between the communication and design tools means that there is also separation between the achievement and affiliation related tasks. This permits achievers to focus on design tasks without interruption, but to communicate with others when required.

LEGO Factory is unique as a CI application because it supports and motivates a collective of novice designers to undertake the creative tasks of building design. This is quite different to CI applications such as Google Cities in 3D and Google Building Maker where the design tasks are often constrained to simulating existing physical buildings, or computer game modding which requires a certain level of expertise by participants.
4. From mass participation to collective intelligence in design

Section 2 identified achievement-oriented behaviour as most critical for CI to emerge in cyberworlds, followed by exploration to a lesser extent. Socialising and controlling behaviours may be useful, but are less critical. This section discusses how different technological components of cyberworlds can encourage or discourage each type of behaviour.

4.1. TECHNOLOGIES FOR EXPLORATION

Explorative behaviour is supported by cyberworlds that focus on world-oriented technological components that add depth, volume and complexity to a world (Bartle, 2003) rather than user-oriented components. Specific components that can encourage curiosity and exploration thus include:

- Large/complex worlds that require extensive exploration;
- Allowing anyone to design and extend the world. This means new content is constantly being added to explore;
- Many small tasks that can be solved easily;
- Commands that produce complex or entertaining outcomes.

4.2. TECHNOLOGIES FOR ACHIEVEMENT-ORIENTED BEHAVIOUR

World-oriented technological components also support achievement-oriented behaviour. Technologies for promoting achievement motivation include:

- Large/complex worlds with many challenges to achieve;
- Limited navigation options. This forces users to focus on tasks in their immediate area.
- Adequate navigation and user help tools such as detailed manuals and world maps. This permits users to focus on tasks without struggling with their orientation in the world;
- A straightforward, easy to understand interface;
- An extensive level or class system with rewards for achievement;
- Large and complex tasks that take longer time to complete.

4.3. TECHNOLOGIES SUPPORTING SOCIALISING BEHAVIOUR

Socialising behaviour is supported by communication technologies. The technological components suggested in this section should thus be included cautiously in a CI application to avoid encouraging too much socialising behaviour. Communication technologies are useful in CI applications, but it should be directed specifically for desired tasks, limiting their uses for pure social purposes. In addition, achievers often find a way to communicate if
required, even if they are not specifically supported by the CI application.

Technological components for supporting socialisers include:
- Communication facilities, including text, voice and other multimedia data, as well as emotes;
- World designed with effective chance encounter so that people are more likely to encounter each other;
- Increased methods of navigating between different world locations;
- Maximising the number of simultaneous players per server.

4.4. TECHNOLOGIES FOR LEADERS

As with socialising behaviour, the leadership sub-type of controlling behaviour is required in a limited way to provide organisation, direction and leadership in CI. The killer sub-type is generally undesirable. Many different types of ‘killers’ exist and there is a large body of computer security literature concerned with reducing the impact of this user type (Kabiri and Ghorbani, 2005). This section focuses instead on technological components associated with the leader sup-type. These include:
- Communication and coordination facilities;
- Group formation and management tools;
- Task planning, allocation and management tools.

5. Conclusion and future

This paper has reviewed four human motivations relevant to CI and design: activation, achievement, affiliation, and power. We argue that for CI to emerge, cyberworlds need to support achievement-oriented behaviour and exploration to the greatest extent, and support a limited amount of leadership and socialising behaviours to diversify the collective.

Based on the current study, our research will further the investigation of cyberwords for collective design to specifically focus on the support of CI in design activities and for design purposes, in two main directions:

1. Further understand the potential of these four user types for collective design, in relation to different process models of designing; and explore more complex design scenarios where participants take on roles across different user types.

2. Develop technology spaces for the facets of cyberworlds that contribute to the support of collective design, including design and modelling tools, communication tools, artificial intelligence, level system, motivation, governance and other related facets; and understand how these facets
support the design, communication, motivational and educational requirements of collective intelligence applications.

References