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Increasing Commitment to Online Communities by Designing for Social Presence

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ABSTRACT
The existence and survival of online communities depends upon the commitment and retention of their members. This paper compares alternative ways of designing online sites to increase member commitment. We report the results of two experiments conducted within a Facebook game application. The results show that designs can increase commitment and retention of players either by visually highlighting individual members, or by emphasizing the community as a whole. These designs influence commitment through different routes.

Author Keywords
Commitment, Online communities, Social attachment, Group identity, Facebook games

General Terms
Human Factors

ACM Classification Keywords
H.5.3 Information Interfaces and Presentation: Group and Organization Interfaces: Evaluation/methodology, Web-based interaction.

INTRODUCTION

The social dimension of the Internet is clearly a major part of its attractiveness and success. According to Alexa.com, six of the top 10 sites in the world have a substantial social component, offering user-generated content (e.g., YouTube or Wikipedia) or supporting direct interaction among users (e.g., Facebook or QQ). Despite their popularity, social sites experience high turnover, with most visitors coming only once and leaving after a short period. A recent survey found that most business efforts to build social sites failed, even when firms spent over $1 million on the effort, primarily because of difficulties attracting people to the community and retaining them [25], [26]. Building commitment is a challenge even in the most successful online communities, such as Wikipedia, with almost 3.5 million articles and 1.5 million editors in the English version. Despite its success, most editors do not stick around. Sixty percent never return after the first day of membership [14].

The existence and survival of online communities and their ability to provide resources to users depends upon the commitment level of members. Lack of commitment can lead to conflict, lack of cooperation, decreased contribution, decreased information sharing, and higher rates of turnover [7], [13]. Members who feel greater commitment to an online community are more likely to provide content that others value, such as code in open source projects [5], or edits in Wikipedia [10]. Committed members care about and enforce norms of appropriate behavior. They are the ones who maintain the community and perform behind-the-scenes work to keep the community going [2]. The challenge in virtual settings is that people may have difficulty developing commitment to the group or attachment to other members [6].

This paper compares alternative ways of designing online sites to increase commitment. It shows that simple designs changes that emphasize either individual members or the community as an entity increase commitment, but do so through different routes.

Building Commitment

In this paper, we are principally interested in the behavioral commitment of group members towards their group. According to social psychological research, people can become committed to a group or community in two distinct ways. First, they can develop commitment through the internalization of certain characteristics of the group as an entity (e.g., common interests, ethnicity, group history, norms and stereotypes, and/or competition with outgroups), which is the foundation for commitment to common identity groups. Alternatively, they can develop commitment through interpersonal attraction among individual group members, which is the foundation for commitment to common bond groups [18], [20].

In principle, communities can be designed to enhance members' identity-based commitment by emphasizing the group as an entity and what it stands for or bond-based commitment by emphasizing individuals members (e.g. [11], [16], [20]). For example, Wikipedia emphasizes common identity. It defines itself as "an online community of people inter-

CSCW 2011, March 1923, 2010, Hangzhou, China.

ested in building a high-quality encyclopedia"[2]. It has policies that discourage interpersonal ties, a user interface that makes direct, private exchanges between community members difficult, and subgroups known as WikiProjects defined around common interests and interdependent tasks. In contrast, Facebook is more oriented towards common bonds. It promotes interpersonal ties among individuals and is based on interactions, news fields and exchange of pictures among Facebook "friends." However, Facebook also layers common identities via Facebook groups that are designed to connect users with a common interest.

Prior research in social psychology suggests that bond-based and identity-based attachments have distinct antecedents. Identity-based commitment is derived from identification with the group as an entity. People are more likely to identify with a group if it comprises a well-defined unit with common attributes and clear boundaries [3], [22], is given a common label, insignia or purpose, highlights homogeneity among members, suppresses information showing members as idiosyncratic individuals, and competes with out-groups [17]. In contrast, bond-based attachment is rooted in interpersonal relations among individual group members. This form of attachment is driven by factors that increase interpersonal attraction such as interpersonal similarity, repeated exposure, exchange, communication and reciprocal self-disclosure [1].

Social psychological research suggests that groups founded on common bonds or common identities may each elicit strong commitments, although not necessarily in identical ways. Specifically, common bond groups should display higher levels of interest in individual group members and in within-group communications. In contrast, those in common identity groups should treat individual group members as relatively interchangeable. Preserving homogeneity is a prerequisite for maintaining unity in such groups. For this reason, social psychological research often assumes that these two types of groups are antagonistic and cannot be combined with each other. It is argued that highlighting the presence of individuals should erode the common identity and highlighting the presence of the group as an entity should erode common bonds [21], [24], [23], [11], [16].

Much of the research on identity-based and bond-based commitment has used laboratory experiments to test predictions about the consequences of different types of group commitment. Because of the controlled nature of the psychological laboratory, it is not clear whether methods used to induce identity-based and bond-based commitment there would be powerful in natural environments. Moreover, most social psychological experiments lack adequate measures of long-term behavioral commitment, focusing instead on short-term psychological variables such as self-reported attachment and social influence.

We are aware of only one (unpublished) study that attempted to induce identity based and bond-based attachment in realistic online communities [19]. This research tried to induce identity based attachment in a movie rating site with a design emphasizing subgroups via subgroup icons, frequently updated information about the subgroups, competition among subgroups, and group-oriented communication. In their identity-based design, information about individual members was suppressed (e.g., no member avatars). It tried to induce bond-based attachment with a design that emphasized individuals (e.g., avatars representing individuals, repeated exposure to the same individuals, frequently updated information highlighting individual's behavior, and opportunities for pairwise communication). Results showed that both types of designs increased commitment to an online movie database community, but identity-based attachment was easier to induce and more powerful in encouraging users to return.

While this prior research tested the effectiveness of common identity and common bond approaches to building commitment, it did not examine why the commitment occurred. Nor did it explore whether identity and bond-based designs could be combined. Moreover, the effects of different designs were tested in an environment in which users were already interdependent, in the sense that community success depended on them sharing moving ratings. In the current research, we ask whether bond-based designs (or identity-based designs, for that matter) still work in online communities where users are completely independent.

In the present research we created online group designs that social psychological theory predict would lead to different types of attachment. The goal was to determine whether identity-based and bond-based designs would lead to greater commitment (i.e., longer and more participation), and also to examine the mechanism through which they worked. We expected that the bond-based designs-visually representing the presence of other individuals, repeated exposure to them, and opportunities for stylized communication-would increase commitment through participants' attraction to the other group members, while identity-based designs-representing individuals at the group level, with distinct group name, presence of outgroups and competition among them-would increase commitment through identification with the group as an entity.

H1. Both common identity-based and common-bond-based designs will induce behavioral commitment to an online community, evidenced by longer and more participation in the group.

H2. Common bond-based designs will induce behavioral commitment to the community through interpersonal attraction, evidenced by increased interest in the individuals in the community.

H3. Common identity-based designs will induce behavioral commitment though identification with the group as an entity, evidenced by increased interest in intergroup comparisons.

The relationship between identity-based and bond-based com-

[2] http://en.wikipedia.org/wiki/Wikipedia:What_Wikipedia_is_not

mitment remains contested in the literature. Most theorists maintain that combining identity-based and bond-based designs should be ineffective for commitment. However, there is correlational and experimental evidence suggesting there may be positive spill-over effects with common identities giving rise to the formation of interpersonal bonds [8] and interpersonal bonds forming the foundation for shared identities [19], [15]. To explore this latter possibility, we include community designs that combine bond-based and identity-based features, predicting that this combination would give rise to levels of commitment that are equally or more effective than either one in isolation.

H4. Bond-based and identity-based community designs may be combined, either maintaining or enhancing their effectiveness.

RESEARCH SITE

Facebook, the social networking site launched in 2004, has become the world's largest and most popular social website, with more than 500 million active users worldwide [4]. Facebook features an application platform which allows developers to implement applications and integrate them into the site. Every month, more than 70% of Facebook's users engage with applications [4]. Games are among the most popular, attracting large number of users every day.

The popularity of Facebook games provides the opportunity to pursue our research among a large pool of users in a real setting. The abundance of Facebook applications decreases the time and attention users devote to each application. Increasing commitment to a single application has become an important challenge for their designers.

We deployed a Facebook application version of Tetris®[3] as the platform for our research. Tetris is a popular casual game. We chose a solo and non-social version of Tetris for our experiments in which game players are completely independent. By embedding the identical, non-social game in bond-based or identity-based designs, we can attribute any effects of our manipulations to the designs we introduced.

Figure 1 presents the general design of the Tetris application interface in our study. The interface consists of five areas labeled in the figure. Area 1 is the Tetris game itself, which is the classic version of Tetris. The objective is to reach level 15. Players move up the levels after they clear 10-20 lines. Consistent with general game design paradigm, leveling up is easier in lower levels. As the levels increase, shapes fall more quickly, increasing the difficulty of forming lines. A single game can last between two to more than twenty minutes depending on skill levels of the player. The game area stayed the same in all experimental conditions. Area 2 was dedicated to presenting leader boards which show information about the players with the most achievements. The information inside the boards depended upon experimental condition. Area 3 showed the name of players or their team and the associated icon, depending on the condition. To increase the general attractiveness of the game, we introduced

[3] http://www.tetrisfriends.com/

Figure 1. General design of research site

Table 1. Experimental Design of experiment 1

		Common Bond	
		No	Yes
Common Identity	No	*Self*: control group	*Bond*: inducing bond based attachment
	Yes	*Identity*: inducing identity based attachment	*Bond/Identity*: bond and identity based attachment togther

weekly challenges. The challenges set a clear goal for players. According to goal setting theory, establishing a measurable discrete objective increases motivation and should therefore improve performance [12]. Area 4 announced the weekly challenge, the date the challenge ended, and the current score to beat. The message changed to present the goal of each condition. (e.g., beat the high score from oneself, another player or another team). Area 5 was dedicated to experimental manipulations. As described in more detail below, players in different conditions saw information about their own prior games, information about other members on their team, information about other teams, or information about team members and other teams.

EXPERIMENT I - METHOD

We designed first experiment one following the theoretical guidelines for inducing common bond and common identity. Table 1 presents the experimental design. When players arrived at the application, in all experimental conditions they first had to choose a team, with name and icon, to join from a list of seven options. Players in the non-social control condition instead chose a personal avatar for themselves before starting to play. The personal avatars in the control condition were the same as the team icons in the experimental conditions.

We manipulated bond-based attachment by providing feed-

back about the presence of individuals within the team as well as opportunities for stylized communication with team mates. We refer to this condition as the bond condition in the rest of the paper. Players in the bond condition competed with the other individuals in their team to have the highest score by the end of the week. The challenge standings included ranking, picture, name, and the top score for the top four players plus the participant. Players could click a thumbs-up icon next to each player's name to cheer each other on (Figure 2(b)). The leader-boards in this condition featured information about the individual players in the team.

We manipulated identity based attachment by providing team-level feedback about the player's own team as an entity in competition with other teams. We refer to this condition as the identity condition in the rest of the paper. Players in the identity condition were encouraged to score high to help their team win against other teams. The challenge standings in this condition included information about the top four teams plus the current player's team, including ranking, name, top score, and the icon. No information about individuals in the teams was presented. As in the bond condition, players could cheer on a team by clicking the thumbs-up icon next a team's name (Figure 2(c)). The leader-boards in this condition featured information about team scores.

We included a "Bond/Identity" condition to examine the interaction between a design encouraging identity-based attachment and interpersonal relationships among the individuals. The interface is shown in Figure 2(d). Players in this condition were prompted to score high against their teammates and also to help their team win against other teams. One challenge standings displayed top teammates, while a second one displayed top teams. Players had the option to cheer individuals and/or teams. The leader-boards in this condition featured combined information about the individual players and the teams.

The control condition was designed to include challenge goals without visual cues to the presence of other players or teams. Players were presented with a challenge score to beat based on their own history. They saw information about their last seven games in the challenge period, ordered by score (Figure 2(a)). The goal in the control condition was based on a randomly selected high score in a real team from the bond condition, to control for the potentially motivating influence of constantly increasing scores in social challenges and to offer goals comparable to other conditions,. Cheering was not an option in the control condition because there were no others present, so there was no cheer board. We refer to this condition as "self" in the rest of the paper

EXPERIMENT I - RESULTS

We collected data from users joining the application between March 09, 2010 and March 25, 2010. A total of 931 unique users used the application in this time period. We tracked those users until April 22, 2010. [4] They were randomly assigned to one of the four conditions in round robin order. We

[4]Due to technical problems new users were not able to join after March 25.

(a) Self condition (b) Bond condition

(c) Identity condition (d) Bond/Indentity condition

Figure 2. Interface of different experimental conditions

collected counts and timestamps of all players' game actions such as starting a new game and visiting any leader-boards.

Dependent Variables

We assessed the effect of experimental manipulations on (1) commitment to the site and (2) social engagement. The two measure of behavioral commitment are survival in the game and number of sessions played. Survival consists of the number of days between players join date and their last game. Total number of sessions played was another measure of commitment. We defined a session as continuous play with less than 15 minutes break between actions in the game. Social engagement was measured as the number of times player viewed a leader-board. Viewing leader-boards is a measure of curiosity about the actions of other players and teams.

Statistical Analysis

Number of sessions and lead-board views are count data, truncated at zero and with greater dispersion than expected from a Poisson distribution. We fitted negative binomial regression to predict the effect of experimental conditions on these count data. The significance levels of all pairwise comparisons were adjusted using a Bonferroni correction.

Number of Sessions

Our primary measure of commitment was the number of sessions played in each condition (see Figure **??**). Assigning users to groups significantly increased the number of sessions played by 55%, from an average of 2.41 in the non-social control to an average of 3.74. There were no significant differences between the three "social" experimental conditions.

Survival Analysis

Our second measure of commitment was player survival. Survival analysis uses experimental condition to predict the fraction of the population that will continue to play past a certain time or conversely the failure (dropout) rate for players in each condition. In this analysis, we defined the time intervals in days. The failure event is defined as the last day they played a game. We considered any player who was still playing within three days prior to the end of the experiment as right censored. Kaplan-Meier was used to estimate the survival function. Kaplan-Meier is a non-parametric estimation appropriate for data with non-normal distributions and takes into account missing data because of right censoring [9].

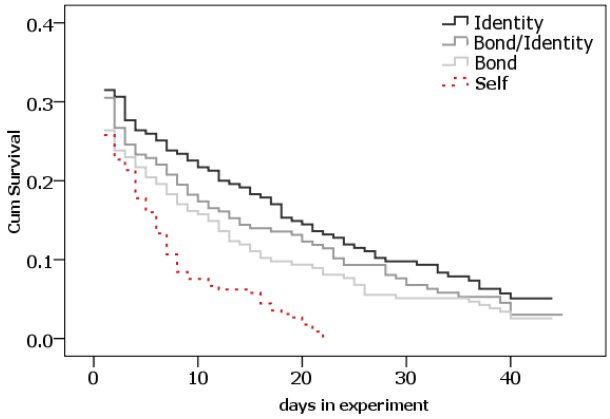


Figure 3. Experiment 1: Survival Analysis

Table 2. Mean Survival Time

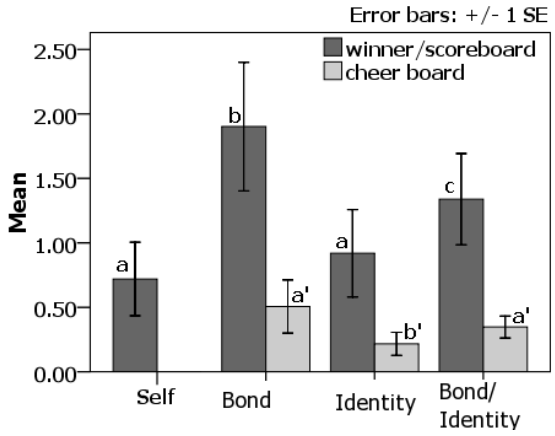
	N	Mean	SE
Self	225	2.99[a]	.31
Bond	235	5.33[b]	.66
Identity	235	7.39[b]	.81
Bond/Identity	236	6.27[b]	.34

† Different superscript (a,b) in the same column indicate significant differences between values ($p<0.05$)

The survival curves are presented in Figure 3 and the average survival times are shown in Table 2. Assigning players to one of the social experimental conditions doubled survival time (See Table 2) and increased the survival rate, but there are no significant differences between the bond, identity or bond plus identity conditions. After 10 days, at least 16% of players in the "social" experimental conditions remained continued playing on the site, while only 7% of players in the control condition remained.

Viewing of Leader-boards

In all conditions, participants could view a list of players with the highest score (scoreboard), and a list of players who won the most challenges (winner-board). Challenge winners were players or teams (depending on condition) with the highest score at the end of each challenge period. To simplify presentation and analysis of the results, we combined views of the scoreboard and winner-board which were available in all four conditions. In the experimental conditions, the players could also view a list of players with the highest number of cheers (cheer-board). Higher attachment to the group as an entity should lead to higher interest in viewing the team-level boards, while interpersonal attraction should lead to higher interest in viewing individual-level boards. The average number of views of each type of information is presented in Figure 4. The analysis shows that players checked information presented on the boards most often in the bond condition, when individuals were represented. Representation of individuals along with teams (the bond/identity condition) had significantly higher social engagement compared with team information alone in the identity condition.



†Different superscript indicate significant differences between values ($p<0.05$)

Figure 4. Experiment 1: Average number views of leader boards in each condition

Mediation Analysis

To evaluate the second and third hypotheses, that bond versus identity-based designs influence commitment through different routes, we ran a mediation analysis. Because viewing of the individual leader boards is an indication of interest in group members (interpersonal social engagement), while

viewing of the team leader boards is an indication of interest in groups (intergroup comparisons); we treated viewing of leader boards as our mediating variable. To evaluate mediation in the bond-based design condition, we compared number of sessions played in the bond and control conditions with and without controlling for views of individual leader boards. We ran a similar mediation analysis comparing sessions played in the identity and the control conditions with and without controlling for views of team leader boards. The mediation analysis is summarized in Figure 5.Path C shows the direct effect of condition on commitment and is significant in for both bond and identity designs. Path A shows how condition predicts social engagement, and path B shows how social engagement affects commitment. Path C shows the effect of condition on commitment while controlling for social engagement. The results indicate that in the bond condition, viewing of leader-boards completely mediated the effect of bond-based design on commitment. In the identity condition, the direct effect remains marginally significant after taking into account social engagement. The result supports our second hypothesis and partially supports our third hypothesis.

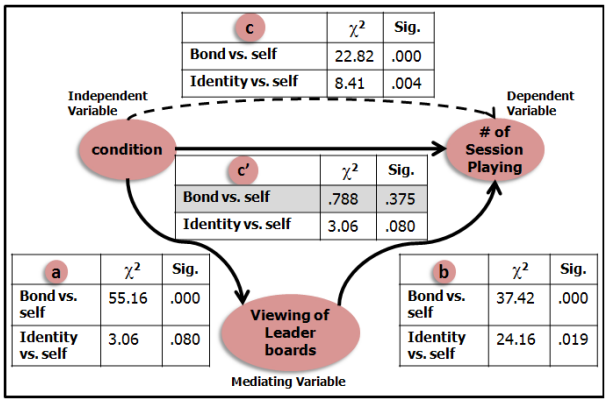


Figure 5. Experiment I: Mediation analysis

EXPERIMENT 1 - CONCLUSIONS

The results provide evidence supporting Hypothesis 1, that both identity and bond-based designs increase commitment. Presence of others as part of a team increases social engagement and curiosity about other players. Hypothesis 2 was also supported: commitment produced by a bond-based design is mediated by interest in group members. Hypothesis 3 is only partially supported: commitment produced by an identity-based design is partially mediated by interest in the group as an entity. Hypothesis 4 stated that bond and identity-based designs can be integrated and would enhance each other. While we did not observe any significant enhancement effects in the bond/identity condition, results show that identity and bond-based designs do not necessarily undercut each other out. The effect of the combined condition on players' commitment was similar to the effects of the bond-only or identity-only conditions. In terms of social engagement, participants in the combined condition showed more interest in viewing leader-boards than did those in the identity condition. Thus, adding individual-level information to team information increased social engagement. Our first experiment has two limitations: (1) In the self condition, there was no representation of teams and no competition with others; the goal was to beat ones personal high score. Therefore, we cannot distinguish the influence of teams from influence of social competition. (2) The leader-board controls in the combined condition did not distinguish teams and individuals leader boards. Players had to click on one set of buttons to access information about either teams or individuals. Therefore, we cannot distinguish interpersonal versus intergroup social engagement and compare the combined condition with each isolated condition.

EXPERIMENT 2 - METHOD

We designed Experiment 2 to address the limitations of the first experiment. In order to address limitation (1), we added a new condition where players competed with everyone on the site but without any representation of teams. We refer to this condition as global (see Figure 6). In the global condition, the challenge standings included the four top players on the site plus the current player, but no players were associated with a team. Because the leader-board drew from a much larger pool (the entire site vs. seven team members in the bond condition), the turnover of individuals on the leader-board was much higher than in the bond condition and players are not exposed to the same people repeatedly. We expected that bond-based attachment would not form as readily in this condition as in the bond condition.

In order to clearly distinguish the effect of combining identity and bond-based attachment on social engagement, we separated individual leader-boards from team leader-boards. This allowed us to compare interest in individual teammates with interest in other teams' as entities.

In addition to these experimental design changes, we also moved from the classical version of Tetris to a two-minute version of the game where the objective was to score as many points as possible in two minutes. The change was a result of a usability study we conducted showing that Facebook game players are more interested in short-duration games. The game was changed across all conditions and resulted in higher rates of participation overall.

EXPERIMENT 2 - RESULTS

Experiment II ran from May 28, 2010 until June 25, 2010. A total of 3869 unique players joined the experiment during this period and were randomly assigned to one of the five conditions using a round robin procedure. Dependent variables were the same as used in Experiment 1.

Number of Sessions

The analysis of commitment in terms of number of sessions played replicated Experiment 1. Players who were assigned to groups in the bond, identity and bond/identity conditions played significantly more than those in the self comparison condition, increasing sessions played by 17%, from an average of 1.57 to 1.83 per player. However, players in the global comparison condition also played more than those in the self condition, and did not differ from those in the other bond, identity and bond/identity conditions, where players

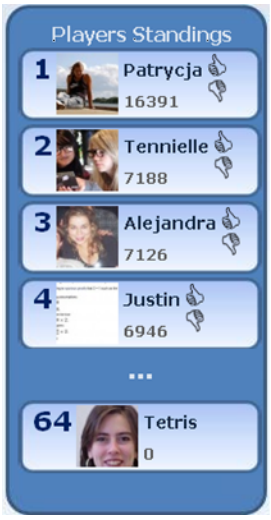


Figure 6. Global condition

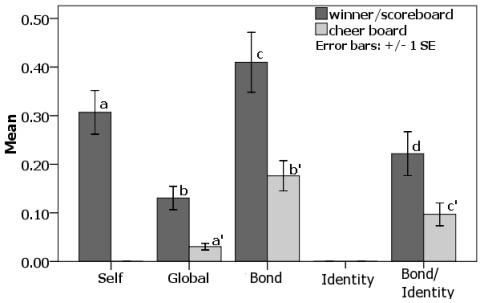
were assigned to teams. These results suggest that mere presence of others increased liking of the game and led to a similar level of commitment as belonging to a team.

Survival Analysis

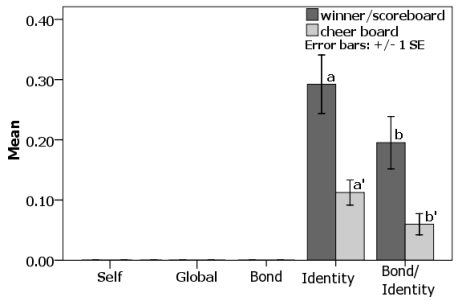
We applied the same procedure as Experiment 1 to assess the survival rate of players in each condition. In contrast to Experiment 1, we did not observe a significant difference among the conditions in survival. This might be an result of the change to the shorter version of the Tetris game

Viewing of Leader-boards

In Experiment 2 we separated individual and team leader-boards to assess the effect of the design on social engagement, measured by the number of leader-board views. Similar to Experiment 1, players in the control condition were significantly less interested in viewing leader-boards than those in the bond condition (See Figure 7(a)). Players in bond condition also viewed the leader boards significantly more than did players in the global comparison condition, suggesting that although the global condition did not differ from the experimental conditions in terms of commitment, it differed in terms of social engagement or interpersonal attraction. Players in the bond condition viewed the individual leader boards significantly more than did those in the bond/identity condition, suggesting that adding team-level information undercut players' interest in individuals. This result clarifies a similar result in Experiment 1. Moreover, comparison of team leader-boards shows that players in the identity condition viewed the team boards significantly more than did those in the bond/identity condition (See Figure 7(b)). The result suggests that that adding individual-level information to team-level information undercuts players' interest in the team. Incompatibility of bond-based and identity-based designs or information overload could provide alternative accounts for these results.



(a) Individual leader boards



(b) Team leader boards

Figure 7. Average viewing of leader boards

Cheering

Limited stylized communication was available in all experimental conditions through cheering and booing of players and teams. Table 3 shows the average number of cheers and boos and the percentage of cheers in each condition. Results suggest that the three social conditions showing teams (i.e., bond, identity and bond/identity) engendered a different type of social relationship among players than the global comparison condition. Players in all three team conditions cheered significantly more than players in global condition. Players in the team conditions were also significantly more likely to cheer than boo others, while in the global condition the players were equally likely to cheer and boo others. This result provides another indication that social engagement was lower in the global condition compared with the team conditions despite similar levels of commitment in terms of retention and game play[5]

Table 3. Cheering and Booing

	Cheering & Booing		% of Cheers
	Mean	SE	
Global	.10	.03	52%
Bond	.20	.03	74%
Identity	.21	.04	67%
Bond/Identity	.32	.05	75%

[5]Cheering did not differ among experimental conditions in Experiment 1. Due to lack of space and non-significant differences, we did not report that in the paper

Mediation Analysis

As in Experiment 1, we conducted a mediation analysis to evaluate whether the experimental designs influenced commitment through social engagement. The path diagram is shown in Figure 8. We found that social engagement in the form of leader-board viewing fully mediated the effect of the bond condition on number of sessions played. This result supports Hypothesis 2. However, team leader-board viewing did not mediate the effect of the identity condition on commitment, providing no support for Hypothesis 3. Additionally, the mediation analysis shows that in the global condition, leader-board viewing did not mediate the commitment effect. Different factors seem to drive commitment in the global condition than in the bond condition. Even though similar information about individuals was presented on the leader-boards in these conditions, the absence of a well-defined team and lack of repeated exposure to the same individuals resulted in lower social engagement and bond-based commitment in the global condition compared to the bond condition. In the global condition, presence of others and competition with them increased liking for the game, and therefore commitment, but did not create interpersonal ties among players as in the bond condition.

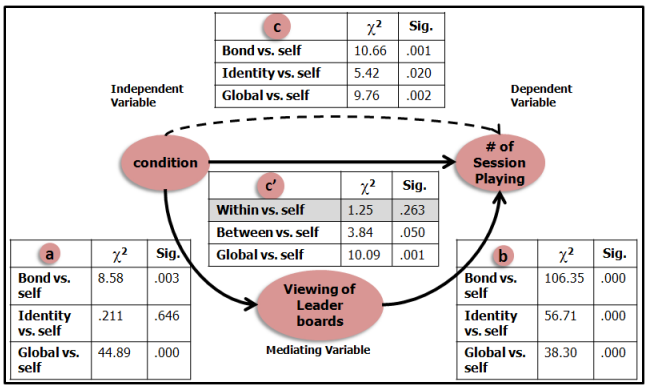


Figure 8. Experiment II: Mediation analysis

EXPERIMENT 2 - CONCLUSIONS

The results of Experiment 1 were largely replicated. Presence of others and competition with them as teams or individuals increased the number of game play sessions. By adding the global competition condition, we were able to distinguish the effect of attachment to a group versus mere presence of others. Although both can increase behavioral commitment, they increase commitment through different paths. Presence of others increased behavioral commitment but did not affect social engagement. Being associated with a team led to interpersonal attraction towards people in the team which encouraged returning to game.

DISCUSSION AND FUTURE WORK

Table 4 summarizes the findings from Experiment 1 and 2.The results of our studies support the idea that social presence of others can be manipulated on-screen to foster the formation of common bonds and common identities, and that this visual presence leads to greater commitment to the site and increased and sustained participation. We also showed that visual representation of people and groups leads to similar levels of commitment, it does so via different routes, illustrating the theoretical processes involved. In the bond-based condition, with team association and repeated exposure to individuals, commitment is mediated by interest in individual group members.

Contrary to traditional views on combining common bond and identity, we showed that the integration of the two did not undercut behavioral commitment. However, our straightforward way of combining these two designs also did not enhance commitment and undercut social engagement. Although the bond/identity condition increased total social engagement compared to either the bond or identity condition, the interest in individuals in the combined condition was less than in the bond condition and interest in teams was less than in identity condition. It may be that a more integrated display, which embedded individual images in team iconography or vice versa, would have a more enhancing effect. The combined design also may have overloaded players because of the additional viewing options.

One of the features of the global comparion condition in Experiment 2 was that top players were chosen from a large pool of players. As a result, the top players frequently changed in contrast conditions where top players were chosen from a team of seven players (i.e. players in the bond and bond/identity conditions were repeatedly exposed to the same people, especially during the same challenge period). This difference in repeated exposure could also have contributed to the lower social engagement in the global condition. In general, the global condition could be perceived as a team with a very large number of members (in contrast to the smaller teams in the experimental conditions). Future work will investigate the effect of group size on inducing identity and bond based attachment.

Although team attachment and competition with others successfully increased commitment, we still observed low return rates in general. We believe that increasing the salience of teams and communication among team members will further improve commitment. We are planning on increasing team prominence by allowing the players more voice in the team selection process. Currently, communication among the players is limited to cheering or booing. Encouraging communication among a group of people who do not have prior contact is challenging. Future research will investigate the effectiveness of different forms of stylized messaging to increase communication.

In sum, our research makes three novel contributions to theories of community attachment: (1) Bond and identity-oriented designs induce increased behavioral commitment through different routes. Both experiments showed that bond-based designs increased commitment through social engagement with other players while this engagement wasn't needed for identity-based attachment. (2) Bond-based and identity-based designs don't undercut each other at the level of behavioral commitment. Previously, the two were assumed to be antagonistic [16], [23]. However, they do undercut each other at

Table 4. Summary of research findings

	Experiment1	Experiment2
H1: Bonds and identity-based community designs increase behavioral commitment	**Supported**: longer survival and more game play in bond, identity or "combined" conditions comparing with "self" condition.	**Partially supported**: more game play in bond, identity or "combined" conditions comparing with "self" condition, but not the global condition.
H2: Bond-based community designs induce behavioral commitment by increased interest in the individuals	**Supported**: Interpersonal attraction fully mediates effects of bond-based designs on commitment	**Supported**: Interpersonal attraction fully mediates effects of bond-based designs on commitment
H3: Identity-based community designs induce behavioral commitment by increased interest in intergroup comparisons.	**Partially supported**: Group-based attraction partially mediates effects of bond-based designs on commitment	**Not supported**: No evidence of mediation
H4: Bond and identity-based community designs may be combined, either maintaining or enhancing their effectiveness.	**Partially supported**: survival and game play in "combined" condition are the same as to that in bond and identity conditions. But, less social engagement in "combined" condition than bond condition.	**Partially supported**: survival and game play in "combined" condition are as high as in bond and identity conditions. Evidence of social engagement being "split" between individuals and groups: Levels of board views are lower than in bond and identity condition, respectively, but combined the evidence of engagement is high in board views as well as cheers.

the process level. Combining bond and identity features in the user interface caused people to engage less with other individuals than they did in the bond-only design, and less with teams than in the pure identity-based design. (c) Bond-based attachment can be elicited without rich interaction. Prior research has assumed that rich interaction is essential to produce this kind of attachment [18], [24].

DESIGN IMPLICATIONS

In the current work, we provide practical contribution to inform the design of online communities. We were able to show that small changes in showing the presence of other can have large effects on behavioral commitment, e.g., doubling survival. We systematically varied onscreen representations of teams and individuals in a way that strongly affected behavioral commitment and social engagement, even in the context of a non-social task (i.e., a solo game). The design implication is that on-screen presence is a powerful cue for the formation of online communities, and that the nature of this cue triggers the formation of qualitatively different kinds of communities (common bond, common identity, and a hybrid form which combines elements of both). These different designs may map on to the different goals that online communities may seek to achieve. Most research and practice about social bonds in online settings leverages existing social ties or examines sustained interaction. Our research shows that merely framing the presence of others so that the user interface highlights individuals is sufficient to induce bond-based attachment, while highlighting groups induces identity-based attachment.

Increasing return rate and commitment is an important goal for most online communities. Either bond-based or identity-based ways of enhancing social presence increase return rates. However, a high degree of social engagement might not always be required and might even harm the utility of some communities, by distracting members from their task.
Wikipedia's policy that Wikipedia is not MySpace makes this explicit. Using common identity-based may be more useful in these circumstances. On the other hand, communities that rely on members' interpersonal communication and involvement may require a high level of social engagement in addition to behavioral commitment. Health support communities are one case where members are looking for strong support from other people. Here bond-based designs are more useful. However, in all communities, it appears that encouraging the formation of shared identities and common bonds, in isolation or combination, may help the communities increase the return rate of their members, either through fostering the formation of interpersonal relationships or through fostering attachment to the group as a whole.

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