The choice of complete anonymity versus pseudonymity for aggression online

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Abstract Anonymity is a factor that could lead to disinhibited behavior which is something that could cause damage to many online communities. Anonymity is a generic term and should be analyzed further into different states such as pseudonymity and complete anonymity. In this paper a survey was conducted in order to determine the differences between the two anonymity states in relation to aggression. The findings show that in general, there is no difference in how aggressive a user responds between the two or when users answer with their real names. However, when the differences were tested in context of how strong of an opinion users felt they had about a topic, users that selected "extremely strong" as their opinion, were found to respond more aggressively under the state of pseudonymity. Based on the evidence of this exploratory study, user-centered design could improve online community behavior by changing the design process, specifically to the approach of anonymity.

1 Introduction

Anonymity is a well known contributor to aggression online because of the way that it helps individuals to act in a disinhibited way [14] [38] [31] [32] [40] [16] [26] [29] [35]. Solutions about reducing this negative effect of anonymity in social networking media have yet to be found. Furthermore, there seems to be a void in literature and our understanding of the effects of pseudonymity or complete anonymity in relation to aggression and how these two anonymity states differ from each other.

Aggression can affect every aspect of online interaction and social networking media are no exception. The potential in economic damages but also human life is immense as can be seen by examples of cyberbullying and other ways of online aggression. One case was the suicide of a female teenager that fell victim to a mother pretending to be a 16-year-old boy [3]. So it becomes obvious that the danger is real for the victims but it is not hard to imagine why a company's reputation could be at stake if aggressive incidents persist within their community.

Yet, online communities enable people experiencing a conflict to engage in dialogue with people outside their borders, discuss their situation, and reach peaceful resolutions [2]. Communities such as online support groups have tremendous potential in handling specific conditions of distress [4]. Dialogue and communication is at the center of these online communities for achieving their goals. Aggressive acts online may disrupt these dialogues and cause unrepairable damage to these communities. Hence, it may be beneficial to understand the causes of online aggression and find ways of reducing it.

One way of regulating aggression in online communities is increasing the policing force that consists of moderators, administrators and all those alike within the community. This has the potential to resolve any problems when and if they occur but it is not a preventing measure. Put simply, it can heal the symptoms but it does not eradicate the cause. Another downside about moderating in order to reduce violence online, is that it requires labor which in turn produces additional cost for the companies. In order to make an aggressive occurrence preventable, a shift in the way that software engineers are trained to think and work today is needed. Software engineers need to two ask questions about their software and their design interfaces. How does the software affect the interaction between the users and what can we do to change it and make it more efficient towards the software engineer's initial goal?

There are several examples in which when these questions have been addressed in similar studies, significant results were observed for the procedures in question. We now know that, emotional states can be determined by body movements through unobtrusive mechanisms which if implemented could improve collaborative environments by building more meaningful interactions among their members [13]. Another example is the importance of thoroughly investigating cognitive and affective factors, when designing interactive media that may be critical for the future development of virtual environment applications [37]. Arguably, and in a similar way, user behavior can be predicted with the case of anonymity and aggression and interaction can be engineered towards reducing aggression online.

This paper examines the viability for software engineers to decide whether or not to provide users with the option of complete anonymity or pseudonymity and expect a reduction in the aggressive exchange of messages within a network.

2 The concepts

2.1 Online aggression

Aggression and its subcategory of online aggression, is the delivery of an aversive stimulus from one person to another, with intent to harm and with an expectation of causing such harm when the other person is

motivated to escape or avoid the stimulus [12]. Among human beings this can take a variety of forms of violence such as mental, verbal or physical.

Availability, abundance and the free nature of online services provide an individual with the perfect set of tools to hurt someone. Sometimes the damage maybe even too hard for even moderators to contain. Online studies on aggressive games have been conducted in order to determine if in fact there is any correlation between games and aggressive behavior but results have yet to produce a definitive answer. One study showed that neither the disposition of the opponent nor the aggressive level of the game type affected participant aggression [28]. Still, with so much variety of online gaming and so many options about anonymity for each game, results can be hard to generalize for all circumstances.

This variety of circumstances points to the fact that aggressive behavior can be depended in a number of situational factors and experiences. Examples of these factors can be the presence of violent objects such as a gun [7], or experiences within a military setting which provide the social context where servicemen learn aggression, violence, and murder [8]. But, the most prevalent theory that clearly makes the connection between aggression being affected by situational factors is the frustration-aggression theory. The theory states that frustration can lead to anger, and that anger triggers a hostile action [5].

In cases of online 'inappropriate' behavior the presence of voice communication has proven to significantly affect the way people act as it was discovered in a research study regarding the well known prisoner's dilemma game [10]. If these situational factors that lead to frustration and in turn aggression were to be understood, software engineers could in theory develop the 'perfect' environment in which it could provide the user with the least amount of friction and best user experience for actually preventing aggression up to a certain level.

2.2 Online Anonymity

Anonymity refers to the state of an individual's personal identity, or personally identifiable information, being publicly unknown. There are a couple of different issues that arise with the case of anonymity such as the informative effect, group pressure effect and enforcement effect [21]. Some of the effects are positive for communities while others are not. As an example, the presence of cues to identity positively affects interpersonal perceptions, but at the same time decreases perceptions of solidarity or entitativity [33]. Hence, the decision whether to provide users with the option of anonymity has advantages and disadvantages. In another example, research has shown that in votes and debates, people voting anonymously are more likely to change their vote and less likely to conform with the group's norm, behavior consistent with preventing groupthink type behavior which could lead to ineffective and even risky decisions [1]. Providing the option of anonymity for a social networking brainstorming

group is the right choice according to the above study. Another study's result that seems to agree with the above has shown that individuals under anonymity states have reduced concerns about being positively evaluated by others, and this creates an impersonal, task-oriented focus for group interaction [20].

On the other hand when using anonymity the negative effects might be too overwhelming for the stability of a community. The main effect of anonymity as a general term is that it is often associated with aggression. Even though an individual's identity might be traceable, simply the heightened feeling of anonymity appears to be enough to promote disinhibited behavior [38]. There is also a widespread agreement that anonymity removes accountability out of the equation of online communication and therefore reducing the core values of democratic tradition [9] [17]. Other studies on group decision support systems have shown other issues that could arise with the presence of anonymity such as the loss of credibility and influence [27] and loss of accountability [11]. In addition anonymity in GDSS could be addressed as something multidimensional and could be subjective and context-dependent [24].

To be able to balance these positive and negative effects, an understanding of anonymity is essential. From a technical standpoint anonymity can be divided into anonymity, unlinkability, linkability, undetectability, unobservability, pseudonymity and so on [23]. Arguably these states of anonymity are not perceived by the casual user and so for the purpose of this study three states were examined closely. The anonymity states were, pseudonymity where a nickname is used instead of a name, complete anonymity where a user is denoted simply as anonymous and the state where anonymity was absent and a user uses his or her real name. The later was the control in this study.

2.2.1 Factors for disinhibited behaviour and complete anonymity

A number of factors contribute to the way people act while under the influence of anonymity. The reduced social cues model was one of the first models that were developed to describe the nature of computer-mediated communication. It argues that the reduced social contexual information could have certain effects for groups such as effects of disinhibition and liberation [19] [18]. A relevant theory coined the online disinhibition effect described the way people feel less restrained while online as well as a number of factors such as dissociative anonymity, invisibility, asynchronicity, solipsistic introjection, dissociative imagination, and minimization of authority [31] [32]. The factors that are interesting for this paper and are more associated with anonymity are dissociative anonymity but also dissociative imagination.

Dissociative anonymity could be best explained as the sense of protection that one has under an ostensibly anonymous blanket while dissociative imagination describes the feeling of escapism, to throw away mundane

concerns without having to worry about the consequences. The two may sound similar but the later adds to the individual's perception a sense that the online space exists in a different realm beyond reality where different rules may apply, even for one's online artificially created persona which is one's pseudonym. Essentially the nickname takes on a life of its own. Studies in real life conditions such as the Stanford prison experiment have demonstrated the power of one believing that they are actually someone else, essentially internalizing a role [42].

For the state of complete anonymity where an individual is completely anonymous one can claim that dissociative anonymity as a factor plays a big role. In fact dissociative anonymity is so strong that an individual might even convince him or herself that he or she has no responsibility of the online actions [31].

2.2.2 Pseudonyms & Disconnecting with the Online Self

On the other hand, when it comes to the use of pseudonyms there seem to be more than two factors at play. Aside from the dissociative anonymity, there is also the second factor of dissociative imagination which describes the idea of one depicting that their online alter ego exists beyond the realm of reality and therefore it could act in a different manner than one's real self. It is easy to understand how dissociative imagination is associated more with the use of characters with nicknames/pseudonyms and not with complete anonymity since there needs to be a character creation process in order to contribute as a factor.

According to the above remarks an individual could grow an attachment to his or her pseudonym self and become more aggressive just because the same rules that apply in the real world do not apply in the online world. On the other hand a user with complete anonymity is lacking the factor of dissociative imagination and therefore his or her actions may be less aggressive.

2.2.3 Pseudonyms & Connecting with the Online Self

On the opposite side of the seesaw research on IRC nicknames and impression formation seems to suggest that nicknames are an inherent part of their Net-identity, and even of their real-life identity [6]. People find the need to describe their traits, characteristics and appearances with their nicknames and try to find the optimum way to do so. In a way they try to encapsulate part of their personality into a nickname creating an online extension of their real selves and not a completely different and independent alter ego.

In fact the research that was mentioned above shows that people grow a long term attachment with their nicknames [6]. Usually they prefer to keep the same nickname and identity which, for the most part is connected with the part of real self which they wish to share with others. In addition,

the same study concluded that most people when selecting a nickname do not base their decisions in collective values but rather values related to one's self.

Similar to the above, another study seems to agree with the idea that users adapt their avatars to reflect their own appearance and users who perceive their avatars to be similar to their own appearance experience as a result heightened private self-awareness [36]. Essentially the study suggests that avatars which increase their owners' self-focus may have an influence on online behavior in the context of social computing.

2.2.4 Disconnecting versus Connecting with the Online Self

There are two conclusions that can be extracted from the above remarks about online anonymity and aggression. The first, is that complete anonymity is an anonymity state where dissociative anonymity as a factor could heighten disinhibited behaviour and in turn could lead to aggression. The second conclusion though, is contradicting. When it comes to pseudonymity by using nicknames/pseudonyms, there are two powers at play. The first is that people try to include part of their personality into the online persona that they are creating while the second, dissociative imagination, tries to drive the creating process beyond the realm of reality. The question is, which one of these two powers wins over and therefore how pseudonymity differs from complete anonymity in relation to aggression.

From a design perspective the benefits of knowing these differences for software engineers can be extremely important because by simple changes in the design, i.e. shifting from completely anonymous users to users with pseudonyms or vice versa, can have a significant effect on the level of aggression that a community produces through its users. In addition, if by these alterations aggression can be reduced, moderation costs for social networking media could also decrease [35].

3 Method

In order to be able to pinpoint how different anonymity states affect aggression as factors a survey was created. Surveys consist of systematic and standardized approaches for collecting information [22]. This standardization is ideal for collecting similar data from groups that can be then interpreted comparatively, which in turn reduces the researcher's subjectivity and produces highly reliable results. This survey aimed to explain if complete anonymity and pseudonymity have an effect on how users react and communicate through an online social network, specifically about how much more aggressively they might behave. In addition the survey would also explore any potential differences in the effects that complete anonymity and pseudonymity may have on a user's interactions.

The population of interest was users with social networks and therefore the survey was conducted through Facebook as an application in the form of a survey. Therefore everyone with a Facebook account that had sufficient knowledge, about how to use a Facebook application could take part in the survey. The sample was obtained with convenient/snowball sampling methods. This was done in order to reduce the negative effects of both sampling methods. The survey was advertised in several academic and non academic groups on Facebook informing participants that the survey was about interactions and interface design. The second sampling method provided users with the ability to invite their friends into the survey. This snowball sampling method is preferable for social networks especially when individuals are sensitive about their privacy and show unwillingness to participate in surveys without a friend of theirs opting-in first. According to the theory of six degrees of separation, each individual had a statistical probability to be chosen using the snowball sampling method. Although the topic still debatable, repeated studies have shown that the distance between one person and another in a social network is approximate to six [39] [41]. The application was originally written in English but later on translated to Greek as well. The translation was exact and the sentences retained the original meaning that they had in the English language. Depending on the facebook language settings or operating system settings, the language was selected automatically for the users.

Figure 1: The first page of the survey

The first page of the survey informed the participants that this was a scientific research survey, that there are no right or wrong answers, to answer honestly, answer as they would answer in a real life situation, and to complete all the questions in the survey. In order to ensure the final, all the survey was programmed with javascript code that would prompt a user with an error message in case there was a question that was not answered in the survey. Software tracked the progress of each individual

through the survey recording if it was completed successfully or not.

Figure 2: The second page of the survey

In the second page, people were asked to answer a series of questions about highly controversial topics, as well as basic demographics such as their gender and age group. The idea behind the use of highly controversial topics was that people will have a bigger incentive to act aggressively in the hypothetical scenarios in the later stages of the survey. In addition the topics that were picked had more or less two poles in which people could decide which side they were on. The topics were, death penalty, abortion, and animal rights. As an example, participants were prompted with the question "Do you believe in the death penalty?" with possible answers "yes" or "no". In addition underneath that question there would be another which asked "How strong is your opinion about the death penalty?" with possible answers "somewhat strong", "very strong", and "extremely strong". The reason behind this type of question was that it was suspected that individuals that felt they had a strong opinion about the topic of each scenario may be affected more by the different anonymity states. Finally, after the individual finished answering the same questions about the other two topics they were asked to type in a nickname for themselves. The nickname could be anything that they wanted aside from any clear association with their name or surname.

The next stage of the survey was a series of three scenario based questions, based on the three different topics. Each scenario was prompted separately on a single page. The system was evaluating the answers that

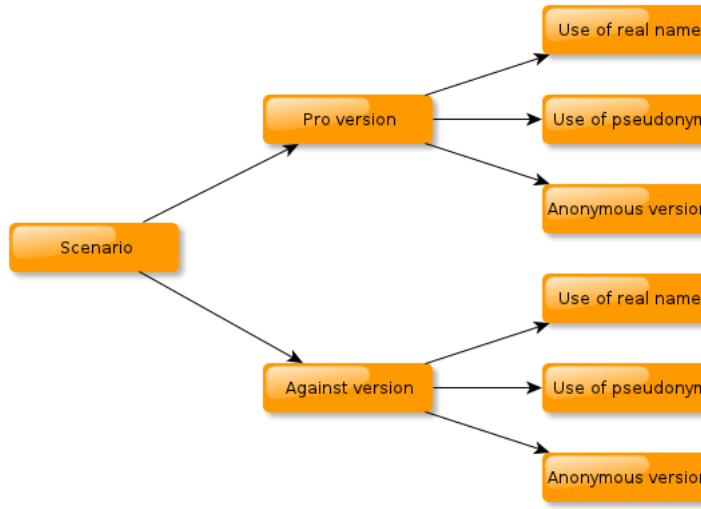

Figure 3: Possible scenario variations, answers remain the same for all cases

the users gave in the second page of the survey and created scenarios according to the user's alignment in a specific topic. For example if someone was pro-choice he or she would have received a scenario about a childhood friend that was raped, resulting in an unwanted pregnancy and that the parents of the pregnant female wanted her to keep the baby due to religious beliefs. In the case of somebody being pro-life the scenario would be the opposite (see figure 5 in Appendix). The user's task was to write a message to the parents in response to their decision, trying to explain his or her feelings about the parents wishes. It was suspected that by making a situation personal for the user he or she would be more inclined to act aggressively. The participants had a list of already prepared answers which they could choose from. A note should be made here that regardless of the alignment of a user for a specific topic, pro-life or pro-choice, the answers were exactly the same in order to avoid any bias. The answers were four. They had a form of a personal message and moved progressively from the first being extremely polite to the last being extremely rude and aggressive. The answers in between the two extremes are lesser versions of the extremes and stand for polite, rude or barely aggressive. The reason for the four point Likert scale was to force users to decide if they would respond politely or rudely. The choice was reinforced by research that was conducted on flame wars. A flame war is when one or more users engage in provocative responses overshadowing regular forum

discussion. Online flaming is most clearly associated with the expression of antagonism [34]. Based on this if a user would decide to answer with the third or the fourth choice it would potentially start a flame war or even trigger an exchange of unpleasant messages.

The scenarios were created to cover the anonymity states in question, including our control state which is the absence of anonymity. In effect, variations of the scenarios were created for someone answering with their real name, for someone answering with their nickname and finally for someone answering completely anonymously for all three scenarios, abortion, death penalty, and animal rights. Regardless of the anonymity state, the questions were exactly the same aside from the part which defined how a user sends the message i.e (see figure 6 in Appendix). if in the abortion scenario the case was about pseudonymity, it would prompt "You are writing to her parents explaining your feelings about the matter and you sign your message with your nickname instead" . In addition the answers in the likert scale were no different from each other in all the different anonymity states aside from the signature at the end of the message which would alter depending on the anonymity state.

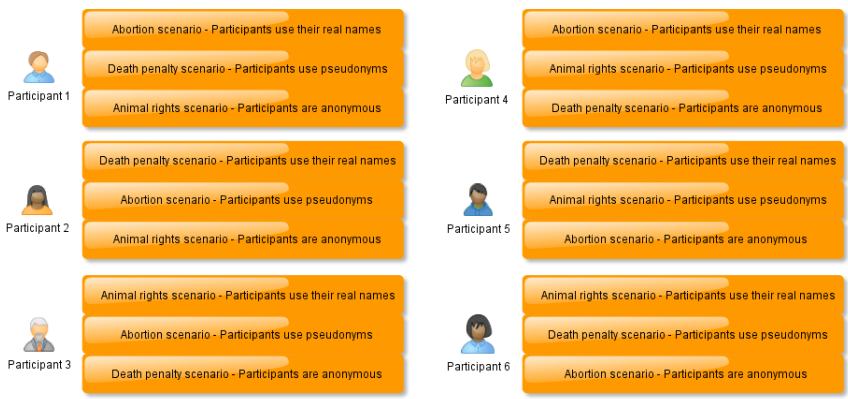

Figure 4: Possible variations of the order that an individual received the questions under each state

The reason behind this was that each individual would receive scenarios in different anonymity states. Essentially participants were randomly assigned to different anonymity variations of the scenarios. In effect, participants might have answered the scenario about abortion with their real name while other participants might have answered the same scenario with their nickname. The only thing that stayed as a constant for all the subjects was the order of the scenarios according to the anonymity state. The first scenario was always based on the control anonymity state

where anonymity was absent, the second was based on pseudonymity and the final was based on complete anonymity. Hence, differences between responses could be analyzed later on between different anonymity states and different scenarios but also within the same scenarios but between different anonymity states. Therefore if people gave more aggressive answers due to different scenarios and not because of the different anonymity states it could be determined in the analysis later on. On the other hand if in all three scenarios we see the same pattern that could be indicative of the anonymity factor having an effect on the users' responses.

A pilot study of 10 people was conducted in order to determine any errors with the survey. Errors in the text and the system were fixed after reviewing the pilot results and feedback from the participants. The anonymity states for each scenario were highlighted with bold colors in order to avoid having users that might have missed the different anonymity states.

Hypothesis	Hypothesis statement
H_1	The way people respond is significantly different between the anonymity states of the study
H_2	There are significant differences between males and females in the way they respond under anonymity states
H_3	Users with stronger opinions in topics will respond more aggressively under different anonymity states
H_4	Scenarios affect the differences between different anonymity states
H_5	The state of pseudonymity may produce more aggressive results compared to the case of complete anonymity

Table 1: Main hypotheses of the study

4 Results

The total participants that took part on the survey were 290 of which 163 successfully went through the entire content of the survey, filling out all the questions until the end. Almost all of the nonresponse cases occurred in the first page of the survey. Therefore, all the data used for the analyzes below consisted from the 163 participant sample and the rest was excluded from the study. Of the 163 participants, 87 were males and 76 were females or percentage-wise 53.4% men and 46.6% women. This is similar to the percentages of men and women in the world population according to the

National Institute for Demografic Research (Institut national d'études démographiques). Most of the participants fell under the 20-30 age group which accounted for 70.6% of the total sample. The 13-20 age group accounted for 11.7%, the 30-40 for 12.9%, the 40-50 for 2.5% and the 50+ for 2.5% of the total sample. Especially for the categories of 40-50 and 50+ because the sample was so small, any correlation analysis with age groups had to be treated with caution and scepticism. Finally, although there were no questions asking the participants about their country of origin since the survey was not designed to test for geographical differences, an attempt was made to trace back individuals to their country of origin through their account identifiers. A note should be made here that some of the participants did not publicly reveal their location and therefore their information was coded as *Unknown*. In terms of geographical distribution per continent, based on a seven continent model, Europe accounted for 68.71%, North America for 12.27%, Asia for 6.75%, South America for 2.45%, Africa 1.64 %, Australia for 0.61% and Unknown for 7.36%.

The missing values that were found for the answers from all the data available were 3, one answer for each anonymity state has not been properly received. These errors can be attributed to faulty communication that could have occurred between the client sending the information and the server receiving it, i.e. session timeout. These 3 missing answers account for 0.6% of the total 489 answers that were received from all the scenarios and anonymity states combined and were not expected to have a significant effect to the analysis that followed. Hence, they were registered as missing values in the statistical analysis tool that was used.

4.1 Analysis as one group and within group differences for all scenarios

Because of the way the survey had been designed, the data could have been analyzed in various ways. At first, the data was treated as coming from one group of participants and analysis was performed for within group differences. This type of analysis was chosen because the participants progressed through the different anonymity states which could be perceived as treatments. The group consisted of all the scenarios being answered in all of the anonymity states. The median and standard deviation values were, for the control state $M = 1.85, SD = 1.031$, for pseudonymity $M = 2.06, SD = 1.059$, and for complete anonymity $M = 1.98, SD = 1.009$. The first hypothesis was that there would be differences between the different anonymity states. A Friedman's test showed no statistically significant differences between the different anonymity states, $\chi^2(2) = 4.671, N = 160, p = 0.097$. Although the H_1 hypothesis according to the above had been rejected, it could be due to the fact that the answers to the questions were based on various scenarios. If that is the case, analysis between groups across each individual scenario should yield different results. This analysis is presented later on in this paper.

Correlation tests were also conducted to see any possible relationships between genders and how they answered the questions. No statistically significant correlations were found for the states of Absence of anonymity $\rho = 0.082, N = 162, p = 0.303$, Pseudonymity $\rho = 0.128, N = 162, p = 0.105$, Complete anonymity $\rho = -0.010, N = 162, p = 0.903$.

One of the original hypotheses was that there might be some sort of relationship between how strong the users feel that their opinion is about a topic and how they respond to certain situations. Since in all of the scenarios the problems are personal for the individuals, what might affect how aggressively they respond would lie in how strong of an opinion users felt they had about each topic. Spearman tests were performed. The tests failed to show any statistically significant correlation between how strongly opinionated a user was about the topic related to the scenario and the aggressive response for the two anonymity states of complete anonymity, $\rho = 0.083, N = 162, p = 0.296$, and the state where anonymity was absent, $\rho = 0.068, N = 162, p = 0.393$. On the other hand, there was a statistically significant correlation for the state were pseudonymity was present, $\rho = 0.288, N = 162, p = 0.000$. This could also be seen at the Table 2 where the more participants felt that they had a stronger opinion about a topic, the more abrasively they would answer in the scenarios.

Strength of opinion / Response	Very polite	Polite	Rude	Very rude	Total
Somewhat strong	29	17	3	5	54
	53.7%	31.5%	5.6%	9.3%	100%
Very strong	20	22	8	7	57
	35.1%	38.6%	14.0%	12.3%	100%
Extremely strong	13	14	12	12	51
	25.5%	27.5%	23.5%	23.5%	100%

Table 2: Percentages of responses per strength of opinion for the pseudonymous state

4.2 Analysis as three different groups according to the different topics of scenarios

After completing the first way of analyzing the data, there was a need to see if the different topics that scenarios were based could have affected the results. In other words individuals for example, might have felt the need to be more polite in the case of the death penalty scenario, while in the case of the abortion scenario they might wanted to act more aggressively. Since each individual answered each topic in one of the different anonymity states, the data were split according to each topic and the same analysis

was conducted but this time for each group separately.

Starting off with the scenario about abortion, a non-parametric one-way analysis of variance test was performed. The Kruskal-Wallis test failed to show a statistically significant difference between the different anonymity groups, $K = 1.383, df = 2, N = 162, p = 0.501$. Similarly, Kruskal-Wallis tests failed to show statistically significant differences for the death penalty scenario, $K = 2.081, df = 2, N = 161, p = 0.353$, and for the animal rights scenario, $K = 5.529, df = 2, N = 163, p = 0.063$.

4.3 Analysis as three different groups according to different states of opinion for the answers of the participants

In the first analysis, within groups analysis, a correlation was discovered between how strong of an opinion individuals felt they had about a specific topic and how aggressive their answer was. In the case of the pseudonymous state where a statistically significant correlation was found, the decision was made to divide the groups according to how strong their opinions were. The outcome of this was three different groups that contained answers for all three scenarios and anonymity states but were divided based on how strong of an opinion users felt they had about each particular topic. In other words, a user might have answered that he or she had an extremely strong opinion about the death penalty but very strong for the topics of animal rights and abortion. In effect that means that his or her answer for the death penalty scenario was moved to the group with the rest of the extremely strong opinion cases while the other two were moved to the group with the very strong opinion cases. Hence, each group contained answers from all three topics, and anonymity states but all of the answers came from individuals that had the similar state of opinion about each of the topics. Since we found that the different topics do not affect the outcome of the answers this analysis will show how the strength of opinion about the topics can affect the participants' answers.

The first group consisted of answers to scenarios that came from users that their beliefs on the topic were "somewhat strong" according to the questionnaire. A Kruskal-Wallis based on the ordinal four point Likert scale, showed no statistically significant difference between the different anonymity states, $K = 0.338, df = 2, N = 149, p = 0.844$.

The next group to be tested was the one for those topics that the participants felt that their opinion was "very strong". Again Kruskal-Wallis analysis was conducted for the ordinal data where no statistically significant differences were found although the value of p was significantly lower than in the previous test, $K = 2.141, df = 2, N = 162, p = 0.343$.

The final group that was tested was the one that consisted of answers from participants that felt that their opinion about the topics was "extremely strong". In this case the Kruskal-Wallis test showed a statistically significant difference, $K = 7.254, df = 2, N = 175, p = 0.027$. Post hoc

Anonymity State	N	Mean Rank
Absence of Anonymity	64	79.64
Pseudonymity	51	103.05
Complete Anonymity	60	84.12
Total	175	

Table 3: Mean Ranks of Kruskal-Wallis test for the group with users that felt they had an extremely strong opinion about the topics

Anonymity States	Difference in Mean Ranks	Least Significant Difference between Mean Ranks
Absence of Anonymity – Pseudonymity	23.41	22.766
Absence of Anonymity – Complete Anonymity	4.48	21.795
Pseudonymity – Complete Anonymity	18.93	23.099

Table 4: Difference in Mean Ranks & Least Significant Difference for the group with users that felt they had an extremely strong opinion about the topics

tests for Kruskal-Wallis were conducted in order to determine where the significant difference lied between the groups. The least significant difference between mean ranks was determined between all three groups and it was compared with the mean ranks from the Kruskal-Wallis test with an $alpha = 0.05$ [25] [30]. The results are shown in table 3 and 4. As can be seen in table 4, the difference in the mean ranks between the case where anonymity was absent and the case of pseudonymity was higher than the least significant difference between the ranks and therefore, this is where the statistically significant difference between the groups was. Looking at the percentages for the answers of these two groups, it was obvious that people that had answered with their pseudonyms chose more aggressive responses than when compared to the cases where people sent the messages with their real names.

5 Discussion and Conclusions

Looking at the results we can see that up to a point they coincide with the previous empirical findings on anonymity and aggression. Even in cases where no statistically significant differences were found the means for each anonymity state were slightly higher than the mean of the control state. Since previous studies never compared the difference between pseudonymity and complete anonymity this paper had to rely on theoretical foundations of literature in order to form its hypotheses and assess the expectations for the results.

As can be seen in the literature, aggression is affected by a number of situational factors [5] [7] [19] [18] [8] [10] [31] [32]. According to this study's findings, just having the option of speaking out anonymously or pseudonymously does not lead to an aggressive response alone. Under the right circumstances though, the presence of pseudonymity can contribute to aggressive exchange of messages which would have been absent or of lesser effect if complete anonymity was used instead.

There is an undoubtedly strong correlation between how strong of an opinion users feel they have about a topic and their aggressive response in the case of pseudonymity. That correlation had to be further explored in order to determine the level of association and as it can be seen by the results, individuals that feel they have an extremely strong opinion about a specific topic can and will become more aggressive in the way that they respond in their messages. Therefore the initial suspicion that dissociative imagination plays a big role in the case of nicknames has been partially confirmed. In addition, it should be noted that while there was no statistically significant difference between the case where people used their real names and the case of complete anonymity, the mean ranks of anonymity were slightly higher in every test. That fact gave the case of complete anonymity a unique feature of being the intermediary between the state where anonymity was absent and pseudonymity. In other words, since it was no different in comparison to the other two states, although the other two states differed from each other, we could conclude that it lies somewhere in-between.

Of course all of the above apply only to the case where individuals felt they had an *extremely strong* opinion about a topic. For the rest of the cases the differences were not significant enough although, this does not mean that it should not be taken seriously. The study has not explored how one shifts from having a *very strong* opinion to an *extremely strong* and therefore assuming that a social network contains only individuals with moderate beliefs could be hasty and inaccurate.

5.1 Recommendations

According to the results and conclusions of this research, several suggestions can be made for the software engineers designing social networking

media. The first and most important, is knowing the population of the social network. Understanding their beliefs and how strong the users opinions are or even how many extremists a network has is important regardless of the use of anonymity or not.

The second decision that has to be made after establishing a sufficient knowledge of the population is the necessity to use anonymity in the network. After deciding that anonymity has to be used because of certain benefits that it might bring to the community, the third and final step is considering the use of pseudonyms or complete anonymity.

In communities where highly controversial topics are being discussed and a limited amount of the population feels that has an extremely strong opinion about the topics, pseudonymity can be used, while taking into account that a certain part of the population might be susceptible to the aggressive effect that was shown in this study. On the other hand, complete anonymity is recommended for communities where debates take place regularly, and users that feel they have strong opinions about topics can be found in a big percentage of the population. However, determining how strong someone's opinion is about a variety of topics might pose a challenge. In this study a three point likert scale was used but larger scales may work too.

In any case, due to the results that were brought to light by this exploratory study, caution is advised for the use of pseudonymity. Software engineers that maintain online communities where aggressive incidents are common might want to consider investigating if pseudonymity might be the cause.

5.2 Limitations

There are certain limitations that may come with this study and caution is advised when results have to be generalized for the Facebook population. There might be a nonresponse bias from the participants that quit in the first page of the survey even though that could still be attributed to initial curiosity and afterwards unwillingness to participate in the survey especially because of the lack of any incentives for the participants. Another thing to consider is that even though still under debate, convenience sampling is not as exact as random. In a comparison study of convenience and random samples of older adults differences were larger in some domains than others but remained small to moderate in magnitude [15]. In addition even though through the six degrees of separation all individuals had a non-zero chance for being invited to the survey, certain individuals closer to the first participants had higher chances than the ones further apart in the chain.

Another thing that was not tested and might have produced some interesting results, is the numerical association of a specific message with the user. In forums where discussions might occur with complete anonymity, users would be unable to follow if one message was written by the same

person, and could be confusing. One solution to counter this could be to assign each individual with a random number id which could not be traced back to the individual but the individual could submit messages with the same numeric identifier as many times as they want. The immediate question that arises is if that numeric identifier would have the same effect as a nickname affecting the outcome of the message because of dissociative imagination, or would it be perceived by the user at the same level as complete anonymity?

5.3 Final thoughts

The concepts discussed in this paper show the potential benefits of understanding the effects of the design on the user interaction especially for the case of anonymity and aggression. While these questions have been answered about anonymity and aggression in this exploratory study, further investigation of the phenomenon is needed. As demonstrated in this paper reducing aggression is not impossible and it could be achieved with a simple software alteration, changing pseudonymity over anonymity. Further research and aspects that affect aggression online have to be explored in order to enhance our understanding of the digital environment and its effects on the user interactions. Since the goal of the social networking software is to serve the interactions of users, we should not just focus on understanding how these interactions relate to the interface and the architectural design but also find ways to alter the environment in order to make the future of online communication safer, more pleasant and more effective.

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Appendix

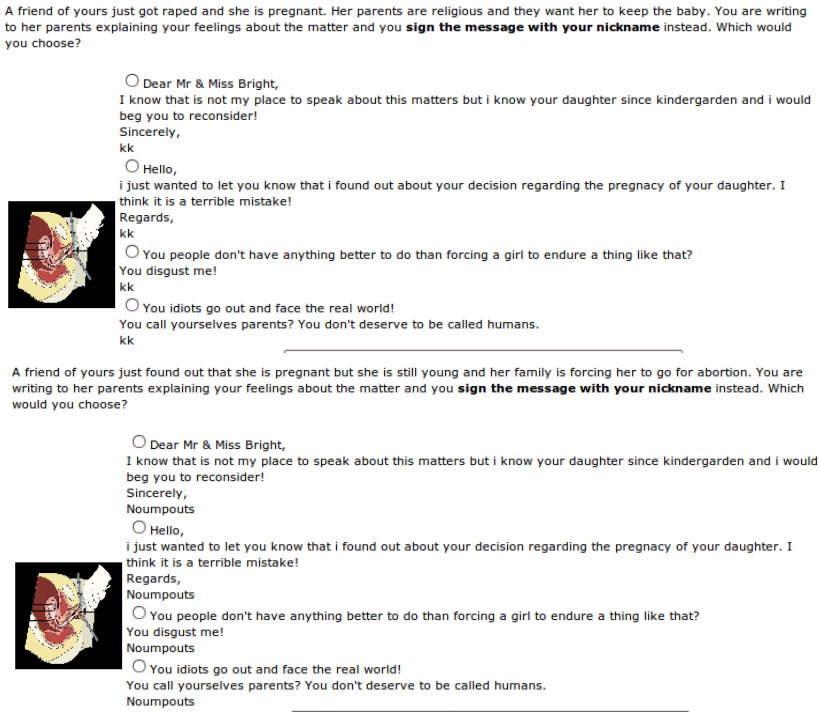

Figure 5: Both sides of the abortion scenario

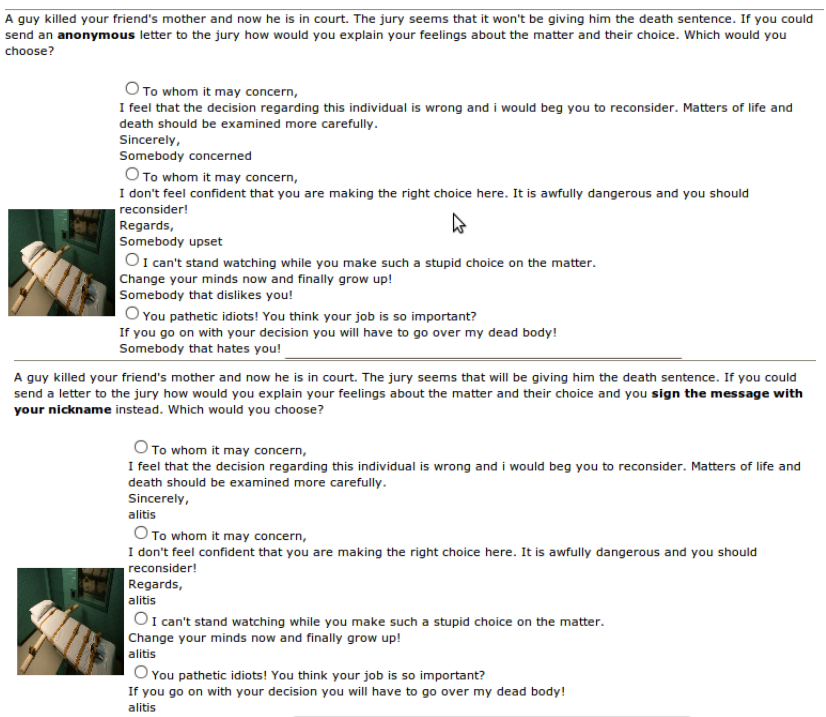

Figure 6: Both sides of the same scenario through different anonymity states

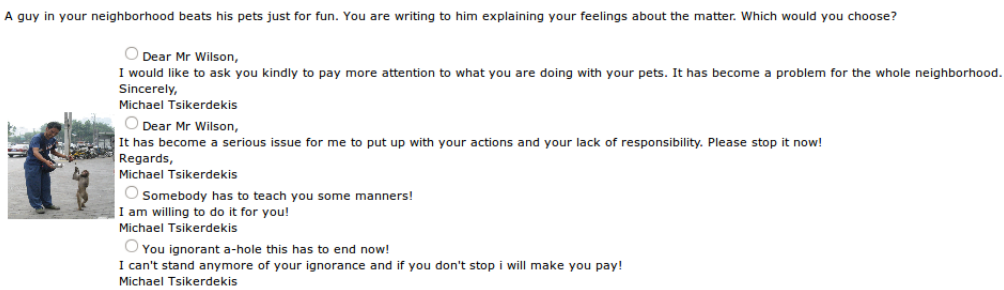

Figure 7: Animal rights scenario for participants that were pro animal rights under the state where participants used their real names