(a) t=24 hours, the start of our analysis.
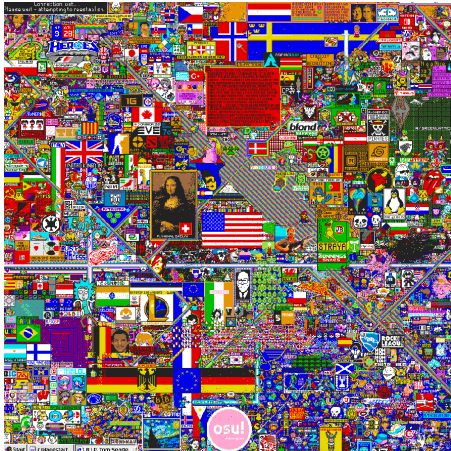
(b) t=39 hours, the end of our analysis.

Figure 1: The r/place canvas during the experiment. Each pixel on the canvas was placed by a Reddit user. Over the 72 hours that r/place was available, more than 1M unique users placed more than 16M pixels.

Understanding Community-Level Conflicts Through Reddit r/place

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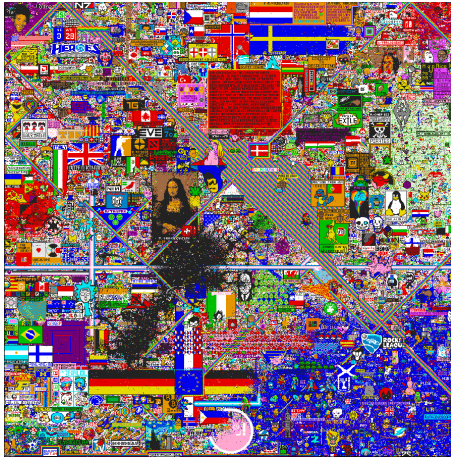Minneapolis, Minnesota

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ABSTRACT

Conflicts between communities in social-networking sites can degrade quality of communication and discourage participation, so understanding conflict dynamics can aid community management. However, studying inter-community conflict is challenging due to the open-ended nature of communication between communities. We study r/place, a 3-day pseudo-experiment on Reddit that provides an opportunity to observe inter-community conflict in a zero-sum environment. We quantify conflicts on r/place, identifying users and communities involved. We find that conflicts on r/place involve multiple communities on both the "winning" and "losing" side, and that communities get involved in conflicts due to geographic proximity on the canvas and due to existing political or cultural conflicts. Examining conflict winners reveals that total number of users is more important than highly-active users. Our results have implications for mitigating negative inter-community conflict on social-networking sites.

INTRODUCTION

Conflict between the communities formed on social-networking sites (SNSs) can feel inevitable [8]. Understanding conflict is important due to its destructive [5] and constructive [4] role in shaping the communication and culture of SNSs. Identifying and studying conflicts is challenging, as community interaction is unstructured and difficult to quantify. We take advantage of a natural pseudo-experiment on Reddit called r/place to study these conflicts. r/place was a collaborative canvas (see Figure 1) that allows us to explicitly visualize inter-community conflicts in a zero-sum environment. Each Reddit

Step 1

Compute pixel conflict score (PCS)
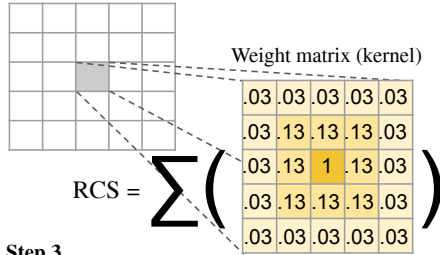
- PCS = (1.5 × # swaps) + # non-swaps

10mins of placements and swaps

t–10m   ... t–0m

Step 2

Compute region conflict score (RCS)

- 5x5 convolution on PCS score matrix

Weight matrix (kernel)

.03	.03	.03	.03	.03
.03	.13	.13	.13	.03
.03	.13	1	.13	.03
.03	.13	.13	.13	.03
.03	.03	.03	.03	.03

$$RCS = \sum \left(\right)$$

Step 3

Apply conflict threshold and discard small regions

- pixel is in conflict if RCS > 0.35
- contiguous region must have 25+ pixels

Figure 2: Our three-step method for identifying conflict regions on r/place. In step 1, the PCS formula gives extra weight to "swaps"—placements that re-color a pixel to its penultimate color (e.g. red→white→red) compared to "non-swaps"—all other placements. In step 2, the RCS is a weighted average of nearby pixels and is computed at each minute. In step 3, we tuned a conflict threshold (0.35) based on our qualitative assessment of the level of conflict in a region. To control for noise, we remove small conflict regions (regions with <25 contiguous pixels).

[1]github.com/PrateekVachher/r-place-project

user can recolor pixels on the canvas but is rate-limited to one such recoloring every five minutes, which creates an environment where coordination within broader communities is required in order to produce semantically meaningful pictures. As each recoloring overwrites the previous color, the r/place canvas is a zero-sum environment where conflicts between communities are expressed in the pixel placements of hundreds of Reddit users. We identify these inter-community conflicts on r/place using quantitative log data analysis and characterize the identified conflicts using mixed methods. We address two primary research questions in this study:

RQ1: How and why are communities involved in conflicts on r/place?

RQ2: Is having *more* users or having *highly active* users more important for winning a conflict on r/place?

We find that most conflicts involve many communities, and that sheer number of users is the most important factor for predicting conflict "winners"—defined as the side that is able to stabilize the color of pixels in a canvas region. Studying user conflict behavior on r/place provides insight about SNS conflicts and has implications for fostering community collaboration and reducing negative conflicts.

Study platform & dataset. Reddit is a large social media platform where people share links and text posts [2]. The website is organized into "subreddits", communities within Reddit for discussing a particular topic. Inter-subreddit conflict exists but is challenging to quantify [6]. The collaborative r/place project began on April 1st, 2017 (April Fool's Day) and provided Reddit users access to an online canvas of 1000×1000 pixels. Previously-registered Reddit users could edit the color of a single pixel from a 16-color palette. We call these edit actions "placements". After a user's pixel placement, a timer prevented that user from making additional placements for 5 minutes. We acquired the dataset of all 16 million pixel placements on r/place, which includes pixel location, color, timestamp and a user-identifying hash [1]. We analyzed pixel placements only after 24 hours, as by that point the initially "blank" (all pixels colored white) canvas was filled in by various communities. Due to computational limitations, we analyze 15 hours of pixel placements and inter-community conflicts. The canvas is shown at the beginning (24 hours) and end (39 hours) of our study period in Figure 1.

METHODS: OPERATIONALIZING INTER-COMMUNITY CONFLICT

In order to identify conflicts, we first identify conflict regions and track those regions over time as a *conflict*. Second, we identify the pixel placements in a conflict as being associated with the winning side or the losing side. Third, we identify the users and communities associated with each side of that conflict. Finally, we analyze the conflicts and their winners. Our analysis code is on GitHub.[1]

Identifying conflict regions. To quantify conflict, we identify *conflict regions*—sets of nearby pixels that update several times in a small period of time. This process is described in detail in Figure 2. An an example, the conflict regions identified at t =24hrs are shown in Figure 3. We define *conflicts*
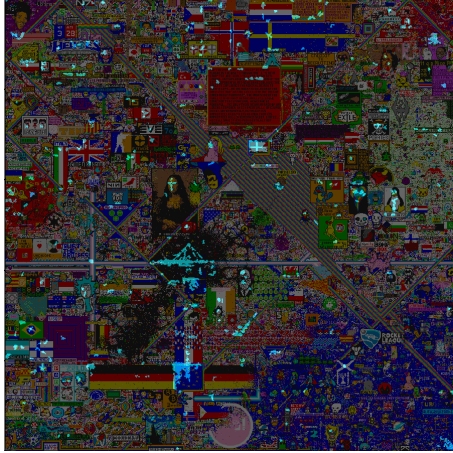
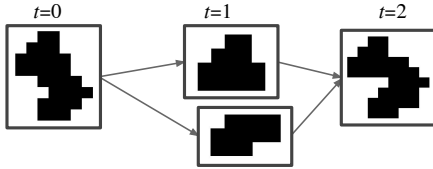**Figure 3: Conflict regions on Reddit /r/place at 24 hours.**

Figure 4: Conflicts are graphs of overlapping conflict regions. In this sample conflict, two non-contiguous conflict regions at $t = 1$ overlap with the conflict region at $t = 0$, so both regions are considered to be in the same conflict. At $t = 2$, these regions merge, as they overlap with a single conflict region.

as conflict regions that persist over time. For each minute, we identify conflict regions at minute t that spatially overlap conflict regions at minute $t + 1$ with at least 25% overlap. Each conflict is a directed acyclic graph of conflict regions over time. A sample conflict graph is shown in Figure 4. A conflict is composed of all of the pixel placements that formed the conflict regions in the conflict graph. Using this process, we identified 23,111 conflicts (mean duration was 13.8 minutes, median 5 minutes). We filter out all conflicts under 100 minutes, as we deemed them too short to be useful for further investigation, leaving us with 405 long conflicts for subsequent analysis.
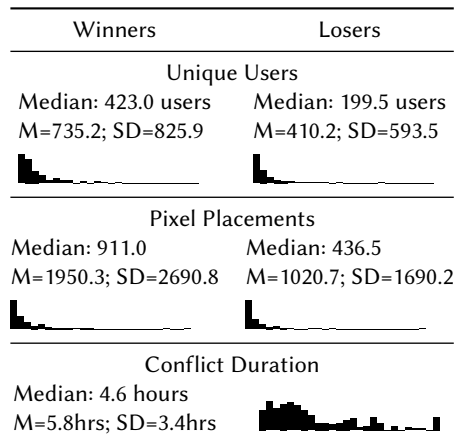
Identifying winners and losers. For identification of winners and losers in a conflict for the specified time of conflict, we classified the individual pixel placements as supporting a "winning" side or a "losing" side. A pixel placement is classified to the winning side when it recolors a pixel to the "winning color"—the color held by this pixel for the longest time relative to other colors during this conflict—and to the losing side otherwise. We classify users as winners or losers by their pixel placements in that conflict: users that place two thirds or more on the winning side are classified as winners, less than one third are losers, and the rest are discarded as "unsure".

Associating communities with conflicts. With winning and losing users identified for each conflict, we link users to specific Reddit communities based on their recent post history. We used the Pushshift Reddit dataset of all Reddit posts and comments and their associated subreddit from January 1, 2017 to April 1, 2017 [2]. While any registered user can place pixels on r/place, we can only link a Reddit username and post history to that user's pixel placements if they have public posts or comments. Thus, we remove from consideration the 200,114 users with no public history (of 1,057,860 total users who placed pixels during r/place). These filtered users placed 17.3% of the total pixel placements. To associate communities with specific conflicts, we used frequency-based odds ratio [7] to identify communities that are disproportionately likely to be commented on by users on the winning or losing side of a conflict. If $f_s(U)$ is the total number of posts and comments in subreddit s by the set of users U involved in the winning or losing side of the conflict, then $OR(U, s) = (f_s(U) \times f_{\bar{s}}(\bar{U}))/(f_s(\bar{U}) \times f_{\bar{s}}(U))$. $f_{\bar{s}}(\bar{U})$ is the count of posts and comments in all subreddits other than s by all r/place users other than those in U. We compute $OR(U, s)$ for the winning and losing user sets and for all subreddits with more than 50 total posts and comments and 20 unique users, recording the top-5 communities and their odds ratios for each conflict. We filter from analysis all conflicts which have less than 10 participants and no community with an odds ratio ≥ 2, leaving 196 community-driven conflicts.

RESULTS: CONFLICT IS A NUMBERS GAME

RQ1: How and why are communities involved in conflicts on r/place?

We used the odds ratios to investigate which communities were involved in the 196 conflicts we analyzed, finding that all conflicts involved multiple communities. We expected that many conflicts

Winners	Losers
Unique Users	
Median: 423.0 users	Median: 199.5 users
M=735.2; SD=825.9	M=410.2; SD=593.5
Pixel Placements	
Median: 911.0	Median: 436.5
M=1950.3; SD=2690.8	M=1020.7; SD=1690.2
Conflict Duration	
Median: 4.6 hours	
M=5.8hrs; SD=3.4hrs	

Table 1: Summary stats for 196 conflicts. Histograms show the approximate distribution of each statistic.

[2] The video demonstrating this conflict merge is available as an example at *https://z.umn.edu/redditPlaceConflictVideo*

Winning Subreddit	OR	Losing Subreddit	OR
r/starcraft	4.78	r/DotA2	4.59
r/heroesofthestorm	2.71	r/music	2.15
r/wow	2.34	r/GlobalOffensive	2.14

Table 2: Example conflict. The top 3 winning communities are related to video games published by the same company. The losing side represents an ad-hoc coalition of alternative interests and other popular video game communities; "DotA2" is a related game and competitor to "Heroes of the Storm".

would be "one-on-one" conflicts, so we isolated for analysis the 28 conflicts where for both the winning side and the losing side the second highest ranking community had an odds ratio less than 70% of the highest ranking. We validated these conflicts for coherence by generating and visually inspecting videos of the conflict, finding that only one of these conflicts incorrectly merged multiple smaller conflicts.[2] Even in these conflicts where one community has a high odds ratio, other communities were also relevant and present, connected by shared fandom, politics, or broader cultural connection. Three examples are BitCoin-related communities and francophone communities conflicting over adjacent canvas space, Japanese and Korean communities conflicting due to geopolitics, and the soccer club Tottenham's logo being replaced by the logo of their rival: Arsenal. We further investigated 9 of the conflicts without an apparent political or fandom cause by searching for relevant posts and comments in the highest-odds-ratio communities during the conflict, finding explicit mentions of the conflict in 8 of them e.g. asking for help from community members. We identified no explicit discussion in the subreddits involved in the 9th conflict, which concerned the logo for video game "Heroes of the Storm", but we still identified related subreddits (see Table 2). This representative example demonstrates our broader finding: that multiple communities are involved in all of the conflicts we identified.

RQ2: Is having *more* users or having *highly active* users more important for winning a conflict on r/place?

A larger group is more likely to win a conflict than a smaller highly-active group: 94% of conflicts were won by the side with more users. No conflict was won without either a higher mean rate of placements per user *or* a higher user count, but most (72%) were won with both. Winning users are more active; at the median, users on the winning side placed an average of 2.08 pixels versus 1.72 for users on the losing side. Of the conflicts where the losing side was outnumbered, losers would on median need to place an additional 4.6 placements per user—a 265% increase—to match the winners.

DISCUSSION & LIMITATIONS

We found that conflicts involve multiple communities, similar to Datta and Edar's finding that subreddits exist in co-conflict clusters that are targeted by similar antagonists [3]. However, unlike Datta and Edar, we observe coalition-building among attackers, which suggests that future work should investigate in what contexts conflict participants *do* collaborate.

Conflicts on r/place are decided by lots of regular users and not by a small number of highly-active superusers. We think the primary cause for this more-equitable environment is the rate-limiting on individual users' actions, which caps the total contribution of a single user. One design implication of our work is that SNSs attempting to manage conflicts could incorporate rate-limiting as a way to democratize inter-community communication. A limitation of this study is a lack of participant perspective; future qualitative work should investigate how r/place participants conceptualized conflict between communities and how inter-community conflicts were resolved.

REFERENCES

[1] Justin Bassett-Green. 2017. Place Datasets (April Fools 2017). https://www.reddit.com/r/redditdata/comments/6640ru/place_datasets_april_fools_2017/

[2] Jason Baumgartner, Savvas Zannettou, Brian Keegan, Megan Squire, and Jeremy Blackburn. 2020. The Pushshift Reddit Dataset. *Proceedings of the International AAAI Conference on Web and Social Media* 14 (May 2020), 830–839. https://www.aaai.org/ojs/index.php/ICWSM/article/view/7347

[3] Srayan Datta and Eytan Adar. 2019. Extracting Inter-Community Conflicts in Reddit. *1* 13 (July 2019), 146–157. https://aaai.org/ojs/index.php/ICWSM/article/view/3217

[4] Karen A Jehn. 1995. A multimethod examination of the benefits and detriments of intragroup conflict. *Administrative science quarterly* (1995), 256–282.

[5] Karen A Jehn, Clint Chadwick, and Sherry MB Thatcher. 1997. To Agree or Not To Agree: The Effects of Value Congruence, Individual Demographic Dissimilarity and Conflict on Workgroup Outcomes. *International Journal of Conflict Management* (1997).

[6] Srijan Kumar, William L. Hamilton, Jure Leskovec, and Dan Jurafsky. 2018. Community Interaction and Conflict on the Web. In *Proceedings of the 2018 World Wide Web Conference (WWW '18)*. International World Wide Web Conferences Steering Committee, Lyon, France, 933–943. https://doi.org/10.1145/3178876.3186141

[7] Diana MacLean, Sonal Gupta, Anna Lembke, Christopher Manning, and Jeffrey Heer. 2015. Forum77: An Analysis of an Online Health Forum Dedicated to Addiction Recovery. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*. ACM, New York, NY, USA, 1511–1526. https://doi.org/10.1145/2675133.2675146 event-place: Vancouver, BC, Canada.

[8] Joseph Seering, Felicia Ng, Zheng Yao, and Geoff Kaufman. 2018. Applications of Social Identity Theory to Research and Design in Computer-Supported Cooperative Work. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (Nov. 2018), 201:1–201:34. https://doi.org/10.1145/3274771