

Responses to remixing on a social media sharing website

Benjamin Mako Hill

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

Andrés Monroy-Hernández

Media Laboratory
Massachusetts Institute of Technology
75 Amherst St
Cambridge, MA 02142

Kristina R. Olson

Department of Psychology
Yale University
2 Hillhouse Ave.
New Haven, CT 06520

Abstract

In this paper we describe the ways participants of the Scratch online community, primarily young people, engage in remixing of each others' shared animations, games, and interactive projects. In particular, we try to answer the following questions: How do users respond to remixing in a social media environment where remixing is explicitly permitted? What qualities of originators and their projects correspond to a higher likelihood of plagiarism accusations? Is there a connection between plagiarism complaints and similarities between a remix and the work it is based on? Our findings indicate that users have a very wide range of reactions to remixing and that as many users react positively as accuse remixers of plagiarism. We test several hypotheses that might explain the high number of plagiarism accusations related to original project complexity, cumulative remixing, originators' integration into remixing practice, and remixee-remixer project similarity, and find support for the first and last explanations.

Introduction

Digital and networked information technologies have facilitated *remixing*, the creation of new content, such as songs and video, using existing content produced by others. Manovich (2005) argues that remixing has taken such a widespread and central role in contemporary Internet culture that has it become, "practically a built-in feature of digital networked media universe." Benkler (2006) describes remixing as a fundamental aspect of "peer production" and argues that if, "we are to make this culture our own, render it legible, and make it into a new platform for our needs and conversations today, we must find a way to cut, paste, and remix present culture."

In the broadest sense, remixing is as old as creativity. Newton's famous quote, "if I have seen further it is only by standing on the shoulders of giants," speaks to the importance of "remixing" others' ideas. Benkler argues that new information technology and the Internet has, through radically decreasing the costs of copying, distribution, modification, and collaboration, increased the importance of remixing as a phenomenon enormously. Although these authors, and others, have spoken to the importance and widespread



Figure 1: Screenshot of the front page of the Scratch online community.

nature of remixing, there is very limited empirical research describing the practice.

Much discussion of remixing has focused on the ways young people engage in remixing. Jenkins (2006) and Ito (2006) have written extensively about children's engagement in media remixing. For example, Jenkins (2006) has written about the way that youth have played a pivotal role in online fan fiction communities to rework characters and events in mainstream media franchises like Harry Potter. These remixers have produced full length novels distributed online, edited each others' work, and tutored each other. In their book, *Born Digital*, Palfrey and Gasser (2008) argue that remixing by "digital natives" is, "already having an effect on cultural understanding around the world." Jenkins (2006) argues that remixing or "appropriation" is so widespread and of such social significance, that it should be among a set of core new media literacy skills taught in schools. Lessig (2007) has implored audiences to prevent "copyright extremism" from "strangling" both children and adults' amateur creativity and has proposed legal outlets to foster "remix culture."

Despite this interest in remixing on the Internet, researchers, like Cheliotis and Yew (2009) have pointed to

a dearth of empirical research on the topic. Cheliotis and Yew's own study of the online remixing community *ccMixer* focused on issues of remixer motivation and the way that contests can frame and limit contributions. Other work has looked at *Jumpcut*, a video sharing community, where Diakopoulos et al. (2007) present interviews with remixers that speak to the existence of unwritten community norms around remixing. In two papers, Seneviratne et al. (2009; 2009) discuss the way that photos from the website *Flickr* are reused and highlight issues of license compliance during reuse, showing that the majority of people do not give the proper attribution when using *Flickr* photos on blog posts. Shaw and Schmitz (2006) describe a system used by the San Francisco International Film Festival to facilitate remixing and describe, both quantitatively and qualitatively, what users produced.

Although these studies represent important steps toward building an empirical understanding of remixing, work to date has focused only on why users remix, what remixing consists of, and how it may be done in compliance with licenses. With the exception of *ccMixer*, each of the remixing communities studied involves users creating remixes primarily from raw materials created outside the community in question although research has suggested that this distinction may be important. For example, Diakopoulos et al. described users uploading film and television snippets in clear violation of copyright while remaining wary of remixing the work of other *Jumpcut* users. In this sense, much previous work largely eschews discussion of the type of collaborative, iterative, or cumulative collaborative work described by Benkler (2006) as peer production or by Murray and O'Mahony (2007) as "cumulative innovation." Finally, all of the studies described have focused primarily in remixing culture in adult communities despite the central role that young people play.

In peer production or cumulative innovation, users are primarily engaged in remixing each others' work and ideas. The result, as Diakopoulos et al. begin to show in their qualitative descriptions, is the emergence of a complex set of social dynamics that frame and motivate users' decisions to collaborate and share. While Seneviratne et al. discuss the way that systems to enforce licensing might be built, implicit in their assumption is that strongly enforced license terms are important for promoting sharing. Even this basic assumption remains largely untested empirically.

This paper represents an attempt to measure and explain reactions of users to remixing in *Scratch*, a large social media sharing community participated in primarily by young people. Although all projects shared on *Scratch* are released under a license that permits remixing, and although explicit *Scratch* community norms make it clear that remixing is always permitted and encouraged, we show that there is a wide range of reactions to remixing in *Scratch*.

This article presents three studies. The first study investigates the range of reactions to remixing by the creators of projects that are remixed and shows that although many users react positively to remixing, an equal number accuse remixers of plagiarism. The second study describes a logistic regression model that explores support for several po-

tential explanations for the large number charges of plagiarism based on differences in antecedant projects and their authors. Our final study makes an initial attempt at establishing the role that the divergence between remixes and their antecedents may play in originators' responses to being remixed.

Scratch

The *Scratch* online community is a public website (See Figure 1) where people from around the world share animated stories, interactive art, and video games.¹ Participants use the *Scratch* programming environment (Resnick et al. 2009), a desktop application, to create projects by putting together images, music and sounds with programming command blocks.

Two and a half years after the website was launched publicly in 2007, close to 100,000 people had shared more than 800,000 *Scratch* projects. Projects have ranged from interactive greeting cards to fractal simulations to animations of lip-synching lizards to video games featuring Obama and McCain. Every month, about half a million people visit the website to browse and interact with projects and other users.² Any visitor can browse the website but must register for an account in order to upload or download projects, comment, show support ("love"), tag other users' projects, or to flag projects as inappropriate. There have been nearly 360,000 accounts created by people with self-reported ages ranging primarily from 8 to 17 years old, with 12 being the mode. Thirty-five percent of users are female.

A primary goal of the *Scratch* online community is to encourage collaboration and remixing. All projects shared on the website are licensed under the Creative Commons (CC) Attribution Share-Alike License³ and a link to a child-friendly version of the license is displayed alongside every project. Users are able and encouraged to download any project, look at or modify its graphics and code, and create new versions — referred to as remixes on the *Scratch* website — which can then be shared themselves.

Study 1: How do people respond to remixing?

In Study 1, we assess *Scratch* users' reactions to having their projects remixed. To do so, we created an algorithm to identify all original-remix pairs in the first 13 months of the *Scratch* community. These pairs were made up of all projects based on another project and its corresponding antecedent. We subsequently coded all comments left by the author of the original project (i.e., the *originator*) on each remixed project.

Our algorithm identified projects based on metadata embedded in projects. As a result, we would not count projects that were conceptually copied by a user who had seen another's work but who did not actually copy code, graphics or sounds. Additionally, as there were over 100,000 projects, we could not feasibly watch and interact with each project

¹<http://scratch.mit.edu>

²<http://quantcast.com/scratch.mit.edu>.

³<http://creativecommons.org/licenses/by-sa/2.0/>

and determine whether the original projects were actually “original” or whether ideas were taken from a source outside Scratch (e.g., a user may have created a Pacman clone).

Procedure

We applied our algorithm to all 136,929 projects created and posted on the Scratch website between the community launch date in March 2007 and April 2008 to identify all derivative projects; a total of 11,861 projects were deemed to be based on other projects. The comments left by originators on the first 3,555 projects were coded by two independent coders who were asked to code all projects into the following categories: *no comment* (projects in which the originator did not leave any comments on the remixer’s project), *positive* (projects in which the originator left positive comments, e.g., “Love what you did with my code! Great idea!”), *hinting plagiarism* (projects in which the originator implied that the remixer had copied but did not state this explicitly, e.g., “I mostly pretty much made this whole entire game”), *plagiarism* (projects in which the originator directly accused the remixer of copying, e.g., “Hello mr plagiarist”, “Copy-cat!”), *negative* (projects with negative comments that were not necessarily related to copying, e.g., “Alright you crap eating thumb sucking baby”), and *none of the above* (projects with comments that were not positive, negative, or relevant to plagiarism, e.g., “is this jarred” or “b for peanut butter jelly time!”).

The first and last categories were mutually exclusive from all others. The other categories were potentially overlapping (an originator could say, “you copied me but I like your addition of the flowers” and therefore count as *positive* comments and *plagiarism*), with the exception of *hinting plagiarism* and *plagiarism* which were mutually exclusive of each other. The coders were found to be reliable (absolute agreement by category: *no comment*=100%; of those that did include a comment, coders agreed on the presence or absence of the following categories at the following rates (absolute agreement): *positive*=87%, *hinting plagiarism*=81%, *plagiarism*=89%, *negative*=93%, *none of the above*=89%). Therefore the remaining comments (n=8,306) were split between the two coders, with each coding approximately half of the remaining projects. For the few projects that the coders disagreed on in the initial third of the projects, they met and came to an agreement on the coding.

Results

Out of the 11,861 projects that were categorized by the algorithm as remixes, we were able to determine that 3,742 (31.5%) of the original creators clicked on and saw the remixed versions of their projects. Of those originators who saw the projects, 2,156 (58%) did not leave a comment. Of those who saw the projects and commented, 261 (7%) accused the remixer of plagiarism, 566 (15%) hinted at plagiarism concerns, 797 (21%) left positive comments, 260 (7%) left negative comments, and 237 (6%) left comments that did not fit into these categories or were uninterpretable.

Discussion

The results from Study 1 indicate that users on the Scratch online community have a wide range of responses to remixing. People who responded were just as likely to leave positive comments (21%) as they were to leave a direct or indirect complaint of plagiarism (22%). These results however, leave open the question of why such a wide range of comments were left by originators. Several potential answers to these questions are explored in Studies 2 and 3.

Implications for design

The Scratch online community was designed explicitly as a platform for sharing and remixing media. Despite the fact the Scratch infrastructure provided the technical facilities to remix content easily, a set of explicit norms and licenses communicated to users through links to a child-friendly version of the pro-remixing license on every project, and continuous proselytizing of remixing by the administrators of the site, many users reacted negatively to remixes and expressed a sentiment that remixers had plagiarized their work.

Creative Commons has described its work, both through the creation of licenses permitting remixing and through the creation of technological systems built around RDF (Resource Description Framework) metadata, as means of reducing permission-asking (Lessig 2004). Like Scratch, many social media and remixing communities use CC’s legal and technological systems. To the degree that our results generalize, our findings suggest that the technical and normative permission to create remixes may be insufficient to supporting positive reactions to remixing in a social media remixing community.

Study 2: When do originators accuse remixers of plagiarism?

There are several explanations for the wide variety of reactions to remixing shown in Study 1. In Study 2, we use the results of Study 1 to construct a variable measuring whether originators have accused a remixer of plagiarism. We use this construct as the dependent variable in a series of fitted logistic regression models to provide initial tests of support for several explanations of why originators may accuse remixers of their work of plagiarism using additional data on projects and their creators.

One difference between Scratch and some other online peer-production communities is that many Scratch projects are constructed at enormous individual effort. On Scratch, users share full-fledged games or animations with code, artwork and sound. This is in contrast to many peer production communities, like Wikipedia, where users usually contribute smaller portions of articles or small fixes. One explanation for the high number of complaints on Scratch may be that Scratch users develop a stronger sense of ownership because of the large amount of individual time and effort creators invest in their projects. This sense of ownership may set users up to be more protective of their work and more likely to accuse remixers of plagiarism. This explanation leads us to our first hypothesis (H2-1): *Originators of larger or more com-*

	Mean	SD	1	2	3	4	5	6	7
1. ACCUSE.PLAG	0.13	0.34							
2. SPRITES	9.05	12.24	0.08						
3. ORIG.REMIX	0.05	0.21	-0.01	0.00					
4. HAS.REMIXED	0.79	0.41	-0.01	-0.07	0.11				
5. FEMALE	0.25	0.43	-0.06	-0.11	0.04	0.11			
6. WEEKS	35.15	14.49	0.01	-0.03	0.08	0.15	0.15		
7. AGE	17.08	10.15	-0.07	0.08	0.01	-0.08	-0.20	-0.16	
8. REMIXER.AGE	15.01	9.58	-0.05	0.01	0.06	-0.09	-0.05	-0.05	0.11

Table 1: Means, standard deviations, and correlations between variables used in the logistic regression analysis in Study 2. The sample includes all remixed projects that had been clicked on and viewed by the originators. ($n=3742$)

plicated contributions will be more likely to accuse remixers of their projects of plagiarism.

In many peer production communities, like Wikipedia, the vast majority of contributions are to existing products and work is primarily cumulative in nature. In our sample of 11,861 remixes from the first year of Scratch’s activity, the large majority of remixes (11,493 or 97%) were based on projects that were created *de novo* while the remaining were second generation remixes. If users feel more protective of projects that are entirely the product of their own work, an explanation for the high number of complaints in Scratch is that because such a large number of Scratch projects are created *de novo*, Scratch users are more likely to feel plagiarized when their work is remixed. This leads to our second hypothesis (H2-2): *Originators will be less likely to accuse remixers of their projects of plagiarism when the remixed project is itself a remix.*

A final explanation extends this reasoning from the project level to the individual. Perhaps the process of creating remixes encourages originators to be empathetic toward remixers and to integrate these users into a “remixing culture” where copied or slightly modified projects are not seen as plagiarism but rather as positive contributions. In our sample, most authors of remixed projects were active contributors who have, at some point in time, created their own remixes. Indeed, only 26% of users in our sample ($n=3,085$) have never shared a remix. It is possible that a large portion of charges of plagiarism come from users who have not been integrated into Scratch’s “remix culture” and are opposed to remixing in general. This explanation leads to the formation of our third hypothesis (H2-3): *Originators will be less likely to accuse remixers of their projects of plagiarism if they have shared at least one remix themselves.*

Of course, other factors are likely to have an important impact on responses to remixing in Scratch that we feel it is necessary to control for. For example, charges of plagiarism may be due, in part, to the large number of projects created by males in our sample (only 25% of originators were female) who may be more likely to accuse others of plagiarism. Additionally, the proportion of projects that are remixes has increased over the life of our study. This suggests that attitudes toward remixing may have changed over time with the potential for a change in plagiarism accusation rates. Finally, younger originators may be more likely to accuse remixers of plagiarism either because they do not

understand that they are giving permission to others to remix by sharing their work, because younger users are more likely to react negatively in general, or for any number of other factors that correlate with age. As a result, we will control for gender, the time period when projects were shared, and age, when testing the above hypotheses.

Procedure

To explore these issues, we used a sample consisting of the 3,742 remixed projects that had been clicked on and viewed by the originators, as described in Study 1. Viewing a project is both a very low bar for involvement in the community and a prerequisite for any type of response to remixing – the subject of our study – even if that response is a decision to not act.

The Scratch online community is run using a custom built web application with data stored in a MySQL database; we collected data for each of our predictors from this source. Our dependent variable is a dichotomous variable (ACCUSE.PLAG), constructed using our results in Study 1, which measures whether originators accused remixers of plagiarism in a non-positive manner. It is a dummy variable that takes the value of 1 when a comment was coded either *plagiarism* or *hinted plagiarism* unless the comment is also coded *positive*. In our discussion, we explain that we explored several alternative specifications of this outcome with very similar results.

Project complexity can be measured either through the amount of programming code or the total number of graphical characters (SPRITES) controlled by these scripts. Because these measures were highly correlated ($r=0.80$) we choose to use SPRITES alone as our measure of complexity. To aid in interpretation in our models below, we report sprites in standard deviation units in our fitted models. To test hypothesis H2-2 regarding the effect of cumulative contribution on responses, we constructed a dummy variable (ORIG.REMIX) indicating if the antecedent project was, itself, a remix. Similarly, we constructed a dummy variable (HAS.REMIXED) indicating if the originator has ever uploaded a remix, to test H2-3.

For our controls, gender is a dummy variable (FEMALE) indicating whether the original author is female and was measured through self-reported data from users’ registration with the Scratch website. We measure time based on upload data in the web application database. Because we had reason

to believe that the effect of time on plagiarism accusations may be non-linear, we included the quadratic form of a variable measuring the number of weeks since the first project was uploaded to the live Scratch website (WEEKS). We were able to measure the age of users (AGE) through a self-reported birth month and birth year fields in the Scratch registration for both the remixer and originator. We marked age data as missing for users with ages under 4 and over 90 (139 observations for remixers and 124 for originators). Ages were calculated at the day the remixed project was uploaded. Both ages are skewed toward younger users with median values of 13 and 12 respectively — several years below the mean. A correlation table with means and standard deviations of all of the variables included in our models is shown in Table 1.

Results

Results of our fitted regression models are shown in Table 2. Model 0 is our unconditional model and Model 1 is our control model which adds variables controlling for the originator's gender, the quadratic term measuring weeks between the original project upload and Scratch's launch, and the age of the originator. The effect of originator gender on the likelihood of plagiarism accusations is highly statistically significant, large, and stable across subsequent specifications. Indeed, our model estimates that, robust to the addition of all of the other controls in our model, the odds of a female accusing a remixer of plagiarism is less than 0.6 times the odds of males doing so. Both parameters in the quadratic terms measuring the number of weeks since the projects were uploaded are statistically significant and robust across specifications. Finally, our measure of originator age also has an effect on the outcome that is statistically significant and robust across subsequent specifications. Controlling for gender, younger students are indeed more likely to accuse a remixer of plagiarism. We tested for a quadratic age term and an interaction between age and gender and found no statistically significant effect of either on the outcome. Although we are skeptical that the effect of age on plagiarism accusation rates is linear, we suspect that this result is a factor of our data which is largely limited to younger users where the relationship may indeed be estimated as such.

Model 2 adds our measure of complexity, a variable measuring the number of sprites in a project in standard deviation units, which we estimate is associated with a higher likelihood of plagiarism accusations. With our controls in the model, we estimate in Model 2 that the odds that an originator of a project will accuse a remixer of their project of plagiarism are 1.23 times higher than the odds that the originator of a project with one standard deviation (12.2) fewer sprites will do so. Consequently, we find support for hypothesis H2-1 in that, even with the addition of controls for age, gender, and when the project was posted, originators are more likely to accuse remixers of plagiarism when the remixed project is more complex.

Model 3 adds the dummy variable indicating whether the original project in question is a remix itself. In our model, we do not find a statistically significant effect of this dummy variable on our outcome. In other words, we cannot reject

the null hypothesis that originators are as likely to accuse remixers of their projects of plagiarism when the remixed project was itself a remix as when it was an original production. As a result, we do not find support for hypothesis H2-2 that, controlling for gender, age, and project complexity, originators will be less likely to accuse remixers of their projects of plagiarism when the remixed project is itself a remix.

Model 4 instead adds to Model 2 the dummy variable reflecting whether originators have ever uploaded a remix themselves. Once again, we do not find a statistically significant effect of this predictor on the outcome. As a result, we also fail to find support for our final hypothesis H2-3 that, controlling for gender, age, and project complexity, originators who have uploaded remixes themselves are less likely to accuse remixers of their work of plagiarism.

As a robustness check, we re-estimated our models on a data set that excluded projects shared before May 15, 2007, the first day that widespread press reports of the Scratch community were disseminated. In the period before, users were a smaller subset who may have been more likely to know each other in person. Our results were not substantively affected. We also estimated models on a data set that did not exclude implausibly high and low ages, and found that our results were similar once again.

We also estimated our models using slightly different alternate specifications of our dependent variable. Because many negative reactions by originators are due to plagiarism but do not explicitly call it out, we used a specification of our dependent variable that was also true for negative reactions that did not specify plagiarism with very similar results. We also reformulated our dependent variable so it only included explicit charges of plagiarism that were not paired with positive messages (i.e., *hinting plagiarism* charges were not included). Our results were, once again, substantively unchanged.

Discussion

We found support for the theory that creators are more likely to accuse remixers of plagiarism if the remixed project is more complex. To the degree that our results generalize to other online communities, charges of plagiarism may be of reduced concern in communities where individual contributions tend to be small.

Surprisingly, our models suggest no effect of whether the project was itself a remix on the rate of plagiarism accusations. This might indicate that Scratch users accusing remixers of plagiarism have a strong conception of “good” (e.g., original and transformative) remixes and “bad” (e.g., plagiarizing) remixes which are simple copies. In line with this explanation, we did not find support for hypothesis H2-3, originators who have uploaded remixes were neither more nor less likely to accuse remixers of plagiarism than users who had never uploaded a remix.

Although included as a control, the effect of age suggests intriguing future research. Future work could be designed to address why younger children may be more likely to complain about plagiarism. For example, one possible explanation is that young remixers do not understand licensing.

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
(Intercept)	-1.904*** (0.049)	-2.159*** (0.312)	-2.301*** (0.315)	-2.302*** (0.315)	-2.287*** (0.325)	-2.155*** (0.335)
FEMALE		-0.534*** (0.127)	-0.496*** (0.128)	-0.495*** (0.128)	-0.494*** (0.129)	-0.489*** (0.131)
WEEKS		0.064*** (0.019)	0.064*** (0.019)	0.064*** (0.019)	0.064*** (0.019)	0.065*** (0.020)
WEEKS ²		-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
AGE		-0.029*** (0.006)	-0.031*** (0.006)	-0.031*** (0.006)	-0.031*** (0.006)	-0.028*** (0.006)
SPRITES (std)			0.210*** (0.042)	0.210*** (0.042)	0.209*** (0.042)	0.205*** (0.044)
ORIG.REMIX				-0.059 (0.247)		
HAS.REMIXED					-0.022 (0.124)	
REMIXER.AGE						-0.018** (0.007)
<i>N</i>	3742	3615	3615	3615	3615	3480
AIC	2888.162	2758.412	2736.849	2738.790	2738.816	2599.331
BIC	2913.072	2882.269	2885.477	2912.190	2912.216	2771.665
log <i>L</i>	-1440.081	-1359.206	-1344.424	-1341.395	-1341.408	-1271.665

Standard errors in parentheses

† significant at $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 2: Taxonomy of logistic regression models on ACCUSE.PLAG, a dichotomous construct representing whether project creators accused the remixer of their project of plagiarism in a non-positive manner.

On the other hand, previous qualitative work suggests that, although significant, other factors may put important limits on the understanding by or desire of users to pay attention to licenses. For example, Diakopoulos et al. showed that adult users on an online video sharing site asked for permission before reusing media, despite licensing considerations which made it clear that such use was legally permissible. Of course, other factors associated with age may also play an important role in the relationship we observe.

Finally, while our framing and the variables in our model attempt to capture aspects of originators and their projects which may affect the probability of originators accusing remixers of plagiarism, aspects of remixers and their remixes almost certainly play an important role in setting up projects for negative feedback by the author of an antecedent.

The high correlation between qualities of remixes and their antecedents makes exploring this comparison difficult in our data set. As one simple effort to probe this explanation, we offer Model 5 (shown in Table 2) as an example which adds a variable to Model 2 that measures the age of the remixer at the time of the remixes' upload. Controlling for originators' gender, the date, originators' age, and the complexity of the remixed project, we estimate that remixes by younger users are more likely to result in accusations of plagiarism. Of course, as discussed above, the effect of age on our outcome is difficult to interpret reliably alone. However, even as a tentative result, this model provides sup-

port for the argument that accusations of plagiarism are influenced by what each remix consists of, and by who the remixer is, as well as by aspects of the person leaving the feedback. We make a further attempt to unpack these results in Study 3.

Implications for design

In Study 1, we showed how a technical capacity to remix and normative statements in support of remixing do not guarantee either positive reactions or an elimination of charges of plagiarism. In Study 2, we unpack our initial results, and evaluate several explanations of the difficulties that designers may encounter when attempting to address these problems.

Our findings support the theory that the importance of systems to address charges of plagiarism may be higher in communities where contributions are smaller. Even within Scratch, where every contribution is in the form of a stand-alone project, differences in project complexity are associated with large differences in the probability that an author will accuse a remixer of plagiarism. Although we cannot speak to causal effects, to the degree that our results generalize to other communities, our findings imply that encouraging cumulative contribution may not result in a lower rate of plagiarism accusations. Although designers may be encouraged to involve more users in remixing as a way of increasing positive attitudes toward remixing, the relationship might be more complex or less tightly associated than some

designers might assume. Scratch's example suggests that increased participation in remixing alone may not correspond to a decreased likelihood of plagiarism accusations.

Study 3: Are plagiarism complaints more common when remixes are more similar?

While the technical and legal ability to remix is constant across the Scratch online community, the nature and content of remixes vary extensively. Some remixes are near or even perfect copies of the project they are based on while others are extensive remixes that bear little similarity.

In Study 2, we explored several explanations for the high number of complaints by focusing on qualities of originators and of the remixed project. Of course, as we alluded to in our discussion of Study 2, originators' reactions to remixes are also likely to be influenced by the nature of the remix and the remixer. Perhaps the most obvious remixer-side explanation for the wide range of responses to plagiarism in Study 1 is that the extent to which remixers rely on the original project varies. That is, users may not mind remixing when the remix is merely inspired by or loosely based on their work but object when the remixed project is nearly identical to their own. Study 3 makes a first attempt to investigate this hypothesis (H3): *Originators are more likely to accuse remixers of plagiarism when the remixed project and its antecedent are more similar to each other.*

Because qualities of remixes are highly correlated with qualities of remixed projects, adding remix-level variables to our logistic regression model in Study 2 was untenable with our data set and methods. Similarly, automatic methods of measuring differences between remixes and their antecedents available to use were found to be unreliable. Hand-coding is possible but requires viewing and interacting with each pair of projects and is extremely time intensive. As a result, Study 3 represents a first attempt to explore project similarity by offering a bivariate comparison between originator reactions and project similarity using a reduced, non-representative, sample.

Procedure

A random selection of 40 originator-remixer project pairs from each of the 6 categories of comments (e.g., plagiarism, hinting plagiarism, no comment, etc.; total $n=240$) were put in a random order and were given to a new pair of coders who were unaware of how these projects were selected, that these projects represented six categories of projects, or that their selection had anything to do with the comments left on these projects. These coders were asked to watch and/or play each of the projects in each pair and to make a judgment of similarity on a 5-point scale (from 1=*can't tell they are related* to 5=*can't tell they are different*). Their responses were highly correlated, ($r=.79$, $p<.001$; Cronbach's $\alpha=.88$), they rated them within one point of each other in 95% of cases, and these ratings were averaged for a final similarity score for each project pair.

Results

We conducted a one-way ANOVA on similarity ratings as a function of the type of comment left. Similarity influenced the type of comment left ($F_{(5,234)}=4.78$, $p<.001$). Since we were specifically interested in assessing whether more similar projects were more likely to lead to plagiarism concerns, we conducted planned contrasts, comparing the similarity scores of the *plagiarism* ($\mu=4.40$, $\sigma=.65$) group with scores in the other groups – *doesn't fit* ($\mu=3.53$, $\sigma=.85$), *negative* ($\mu=3.93$, $\sigma=1.02$), *positive* ($\mu=3.75$, $\sigma=.85$), *hinting plagiarism* ($\mu=3.46$, $\sigma=1.30$) and *no comment* ($\mu=3.65$, $\sigma=1.14$) groups. This analysis revealed that accusations of *plagiarism* were associated with more similar remixes than the *hinting plagiarism* projects ($t_{234}=4.22$, $p<.001$, $d=0.91$), the *doesn't fit* projects ($t_{234}=3.94$, $p<.001$, $d=1.15$), *no comment* projects ($t_{234}=3.38$, $p=.001$, $d=0.81$), *positive* projects ($t_{234}=2.93$, $p=.004$, $d=0.85$), and *negative* projects ($t_{234}=2.14$, $p=.033$, $d=0.55$).

Discussion

This study indicated that plagiarism accusations were influenced by the similarity between the original work and the remix and these findings give tentative support for H3. When remixes were highly similar to the original projects, they were much more likely to elicit an accusation of plagiarism.

Implication for design

Designers of social media remixing systems may be able to decrease charges of plagiarism by remixed users by promoting differentiation between remixed projects and their antecedents. In particular, users might react more positively if a system either created technical affordances to create dissimilar remixes or to highlight differences between apparently similar projects.

For example, in Scratch, remixers begin with an unmodified version of the full source of the project to be remixed. An example of technical affordances to facilitate differentiated project might be a remixing interface that begins with a blank project and treats remixed projects as sources for code and media. However, such design affordances may present negative consequences in other areas of the site by increasing the cost to users of making simple improvements or engaging in more direct forms of collaboration. Another suggestion for Scratch may include a "changelog" facility that allows users to explain substantive differences between a remix and an apparently similar antecedent project. For example, a user who fixes a bug or changes a set of sprites could explain initially unnoticeable changes. By emphasizing differences, both apparent similarity and charges of plagiarism might be decreased.

Conclusions

These studies explore attitudes toward remixing that we believe are important. In Study 1, we show that users react to remixing in a wide variety of ways. Although every project on Scratch is shared under a license that permits remixing,

as many authors of original projects accuse remixers of plagiarism as react positively. Study 2 tested three hypotheses about aspects of antecedent projects and their creators that might be related to reactions to remixing. Although our analysis cannot offer causal explanations, our findings support the theory that the authors of more complex projects tend to accuse others of plagiarism at a higher rate. On the other hand, we do not find support for the hypotheses that authors of original projects that are themselves remixed, or authors who have never published remixes accuse remixers of plagiarism at a higher rate. In Study 3, we present tentative findings that support the explanation that users are more likely to make accusations of plagiarism when projects are more similar.

In this analysis, we make a number of critical assumptions. In general, our framing tends to treat charges of plagiarism as negative and to be avoided. This interpretation is roughly supported in our data set: 32% of comments coded as negative were also coded as explicitly calling out plagiarism while only 2% of positive comments did so. Of course, this does not mean that charges of “copy-cat” are necessarily associated with either bad feelings by users or, more importantly, behaviors that social media designers find problematic. Although our understanding of the coded comments and our experience with the community give us confidence in our framing, further work should unpack these assumptions.

Indeed, promising future work might use attitudes toward and responses to remixing as an independent variable. For example, designers of remixing communities may want to look at the effect that reactions to remixing have on the rate or nature of contributions. It seems unlikely that a community hostile toward remixing or actively involved in calling each other “copy-cats” would be solid foundation on which to build such a culture. Future work will be able to build on the findings in this paper to establish how these attitudes help frame a social environment. Similarly, such work should look at the effect of positive reactions. Although Study 2 focused on charges of plagiarism, positive responses seem as likely to have an effect on remixing rates as negative reactions and accusations of plagiarism. Future work should build on the work in this paper to do so.

Acknowledgements

The authors wish to thank Alex Shaw for useful feedback on a previous draft of this manuscript. Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab with financial support from the National Science Foundation (Grant No. ITR-0325828), Microsoft Corp., Intel Foundation and the MIT Media Lab research consortia.

References

Benkler, Y. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. Yale University Press.

Cheliotis, G., and Yew, J. 2009. An analysis of the social structure of remix culture. In *Proceedings of the fourth in-*

ternational conference on Communities and technologies, 165–174. University Park, PA, USA: ACM.

Diakopoulos, N.; Luther, K.; Medynskiy, Y. E.; and Essa, I. 2007. The evolution of authorship in a remix society. In *Proceedings of the eighteenth conference on Hypertext and hypermedia*, 133–136. Manchester, UK: ACM.

Ito, M.; Okabe, D.; and Matsuda, M. 2006. *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*. The MIT Press.

Jenkins, H.; Clinton, K.; Purushotma, R.; Robison, A.; and Weigel, M. 2006. Confronting the challenges of participatory culture: Media education for the 21st century. Technical report, Chicago, Illinois, USA.

Jenkins, H. 2006. *Convergence Culture: Where Old and New Media Collide*. New York: New York University Press.

Lessig, L. 2004. Keynote address.

Lessig, L. 2007. Larry lessig on laws that choke creativity | video on ted.com.

Manovich, L. 2005. Remixability and remixability. http://www.manovich.net/DOCS/Remix_modular.doc.

Murray, F., and O’Mahony, S. 2007. Exploring the foundations of cumulative innovation: Implications for organization science. *Organization Science* 18(6):1006–1021.

Palfrey, J., and Gasser, U. 2008. *Born Digital: Understanding the First Generation of Digital Natives*. Basic Books.

Resnick, M.; Maloney, J.; Monroy-Hernández, A.; Rusk, N.; Eastmond, E.; Brennan, K.; Millner, A.; Rosenbaum, E.; Silver, J.; Silverman, B.; and Kafai, Y. 2009. Scratch: programming for all. *Communications of the ACM* 52(11):60.

Seneviratne, O.; Kagal, L.; Weitzner, D.; Abelson, H.; Berners-Lee, T.; and Shadbolt, N. 2009. Detecting creative commons license violations on images on the world wide web.

Seneviratne, O.; Kagal, L.; and Berners-Lee, T. 2009. Policy-Aware content reuse on the web. In *The Semantic Web - ISWC 2009*. 553–568.

Shaw, R., and Schmitz, P. 2006. Community annotation and remix: a research platform and pilot deployment. In *Proceedings of the 1st ACM international workshop on Human-centered multimedia*, 89–98. Santa Barbara, California, USA: ACM.