

in the workplace. We end with a discussion considering design of technology to support remix in the workplace as a distinct and complex set of processes co-existing, yet differing, from the dominant dialogue of collaboration and co-production.

RELATED WORK

Examining how digital content is remixed in the workplace advances literatures on creative remix, digital content in the workplace, and technology design for remix practices.

Remixing Digital Content for Creative Expression

Research in HCI and CSCW frequently examines remix (also called ‘creative reuse’ [7]) as a practice related to creativity and creative expression, rather than a practice required to fulfill work-related activities. Scholars studying online content creation and remix communities address how elements of existing music, art, video, and text are transformed into fanfiction, video mash-up, and other creative works [6,22,33]. Knowledge of fair use and copyright can play a role within these communities [14,16,17]. [15] notes how misunderstanding copyright and fair use can lead to a chilling effect, where individuals interpret laws conservatively to avoid legal complications, thereby producing less creative content. However, social norms and practices, rather than explicit legalities and technical permissions [16,17,50], typically influence how individuals perceive, approach, and accomplish remix.

In addition to content creation communities, recent work highlights attitudes toward remix and creative reuse in social networks (e.g., Twitter [28], Facebook [29]). In digital spaces where technical permissions are flexible and dependent on individual understanding, social relationships and social distance influence perceptions of ownership and the ways remix can be accomplished [29]. Missing from these analyses are the ways that hierarchical relationships, common in the workplace, impact remix.

Remixing and Reusing Digital Content for Work

Scholars have examined remix and direct reuse (i.e., using resources again sans modification) of digital content in the workplace [10,32]. However, this research tends to be limited, focusing on direct reuse in new cultural contexts [10] or specifically at reuse of slide decks [32,40,50], rather than remix and other types of digital content (e.g., text documents, spreadsheets) used daily within the workplace. Further, though similar to research in online content creation communities, this work does not frame remix and related processes as creative content appropriation. Rather, direct reuse, typically highlighted over remix, is considered an important aspect of certain workflows, such as the creation and development of slide decks. However, this research does demonstrate that social factors impact how reuse is understood in large organizations. [32], for example, reports on the prevalence of reused presentation elements (e.g., text, images), and how social ties and authority influence information flow and appropriation. By emphasizing direct reuse, digital content appropriation is viewed through a lens

of consistency (i.e., where specific elements, such as text, are fixed and used as-is). In contrast, applying a lens of remix to this type of appropriation positions associated practices in light of change (i.e., where digital content is modified).

Literature on remix and reuse also examines themes related to plagiarism and ownership. In classroom research involving knowledge production novices (i.e., students), reuse is approached through concerns of student plagiarism. Researchers address questions related to plagiarism detection [25], as well as attitudes towards and perceptions of this perceived theft [14,41,42]. Further, some researchers have reflected on textual reuse in academia, examining practices related to plagiarism and self-plagiarism [9]. Ownership as implicated in expressions of territoriality may also create barriers to remix and reuse. For example, researchers in [46] suggest that encouraging feelings of ownership may motivate experts to contribute, but may demotivate and marginalize others, such as novices. This and similar work discusses how experts feel more strongly about content ownership than novices, which can lead to certain, restrictive behaviors (e.g., down-voting novices, reverting novice-produced modifications) [47]. Less frequently, research examines how remix can be leveraged to support learning and efficiency when notions of ownership are not stressed [4]. Workplaces employ individuals on a spectrum of expertise, where novices and experts are expected to work together toward common goals. Our work discusses the importance of supporting meaningful ways that individuals at all levels of expertise can contribute to and remix content.

Though many individuals may be involved or implicated in workplace remix and reuse, workplace literature does not often consider acknowledgement of digital content provenance and co-worker contribution. Similar themes, however, have been explored in work related to creativity, collaboration, and online communities [26]. Remix in the workplace is often examined in the context of direct reuse and collaboration, which involves co-production [23], contribution [37], and visibility of social interactions [13,18,21]. Further, with the concept of microtasks [8,45], scholars have provided a means for understanding knowledge production and individual contribution related to textual artifacts. However, this framework has not been extended to incorporate co-worker acknowledgment and contribution. Research examining microtasks related to other components of content (e.g., style, semantic content) is also limited.

Technology for Remixing and Reusing Digital Content

Technology designed to support remix and reuse focuses on information search and retrieval, as well as detection and tracking of repurposed digital content elements [40,50]. Regarding this latter application, technology designed in response to concerns of plagiarism typically seeks to restrict or extinguish reuse practices [2,19], which could lead to chilling effects, similar to those addressed in [15], and negatively impact workplace remix and related processes.

However, in the workplace, previous research has primarily investigated how technology can facilitate co-authorship and collaboration, particularly for geographically dispersed co-workers and teams. This includes understanding the underlying work needed to place items ‘in common’, so that they can be shared across context and communities of practice [1,3], and designing to support awareness of collaborator activity. Research on co-authoring also highlights the importance of change notifications, version control, commenting, and awareness of contribution (i.e., who wrote what) in the design of technical systems [34]. [30], for example, describes the design and implementation of a file synchronization platform that supports academic collaboration through several features, including awareness of collaborator activity and automatic versioning. Researchers in [49] present a system wherein the entire revision history of a Google Doc is visible and visualized.

Research and design in collaboration, however, miss the distinct complexity and nuance associated with remixing co-workers’ digital content for new purposes. Our work addresses how social practices and norms, as well as technical systems, impact remix of digital content in the workplace. We discuss the importance of context and social practices when remixing content, and how these elements are implicated in the design of workplace technologies.

RESEARCH AIMS

We focused on three areas of exploration in this study. First, we aimed to understand the actions that individuals take to accomplish accessing, sharing, and remixing their co-workers’ digital content (e.g., slide decks, text documents, photographs, spreadsheets) in the workplace. Second, we aimed to consider the various, and potentially opposing, influences that technical permissions (e.g., read, write) and social dynamics (e.g., authority, social norms) have on these actions. Third, we were interested in investigating individuals’ attitudes toward accessing, sharing, and remixing digital content, and how these attitudes impact the actions that individuals take. By considering remix as a set of processes involving access and sharing, rather than a singular process where digital content is modified, we sought to develop insights for design recommendations supporting the entire workflow implicated in remix. This work extends current literature on remix by emphasizing underexplored applications, such as workplace practices, as well as describing social dynamics and the work undertaken to make digital content available for remix.

METHOD

We conducted interviews to investigate remix practices in the workplace, with a broader focus on the work that goes along with this, such as requesting and providing access to content. Inclusion criteria were broad, restricting the study to adults (i.e., individuals 18 years and older) and individuals currently employed. Though students were not eligible to participate in the context of coursework or their studies, several participants were both students and research

assistants or interns. These individuals were interviewed in the context of their work as researchers or employees, rather than as students. In this study, we chose to demonstrate the pervasiveness of workplace remix by removing the specific nature of work (i.e., not focusing on particular occupations) to highlight other workplace components, such as social dynamics and authoritative hierarchies, not frequently addressed in remix literature. We recruited participants using word of mouth and advertisements on Gumtree and Craigslist. Participants were recruited from the United Kingdom and the United States.

Participants

We interviewed 19 adults (14 female). Participants ranged in age from 24 to approximately 50 years old.

	Occupation	Position
P1	User experience researcher	Intern
P2	Topic area expert	Part-time
P3	User experience designer	Intern
P4	User experience researcher	Intern
P5	User experience researcher	Intern
P6	User experience researcher	Intern
P7	Graduate research assistant	Fulltime
P8	Graduate research assistant	Fulltime
P9	Non-profit worker	Part-time
P10	Communication specialist	Part-time
P11	Non-profit worker	Fulltime
P12	Social worker	Supervisor
P13	Warehouse production specialist	Fulltime
P14	Banquet chef	Supervisor
P15	Librarian	Supervisor
P16	Administrative assistant	Fulltime
P17	Non-profit worker	Supervisor
P18	Customer service representative	Supervisor
P19	Financial administrator	Fulltime

Table 1. Participants and occupations.

Participants were employed through a variety of means, including non-profit organizations, hotels, university research laboratories, government organizations, and technology companies. Specifically, individuals worked as chefs, designers, librarians, user experience researchers, financial administrators, program evaluators, social workers, and warehouse production specialists. Despite occupational differences, our participants were predominantly employed as office workers, whose responsibilities included creating new content, such as blog posts, research reports, and presentations. Table 1 lists participants and their

occupations. Approximately a third of our participants were working within academia or had ties to academia – whether previously (e.g., former graduate students) or currently (e.g., current graduate students employed through industry internships).

Some participants, such as those interning for the summer, had been working at their company for only several weeks or months prior to being interviewed; others had been with their company for several years. While most participants were low or mid-level employees (n=14), some were responsible for managing teams. All participants worked in collaborative environments where they were involved as members of small teams or groups, or implicated in responsibilities (e.g., projects, processes) involving several individuals, thus introducing similar social and power dynamics across the individuals we spoke with.

Participants in the United States received a \$25 Amazon voucher following the interview, while those in the United Kingdom received a £20 Amazon voucher. These amounts were comparable given the exchange rate at the time of the study.

Interviews

Eighteen interviews were conducted remotely using audio conferencing software (i.e., Skype, Google Hangouts), and one was conducted in person. Interviews lasted approximately 50 minutes and followed a semi-structured format in which we pursued not only remix and access, but also related concepts, such as workplace values and relationships, and practices around acknowledgment and contribution. We asked participants to describe recent situations in which they had accessed digital content produced by others, made digital content available to others, and remixed their co-workers' content. To examine contradictions between actions and attitudes, we also asked participants questions pertaining to general attitudes, feelings, and beliefs towards shared digital content and remix in the workplace. Though we asked questions about content, resources, and knowledge production in a broad sense, including digital artifacts, physical objects, and ideas, discussion centered around digital materials.

Data Analysis

All interviews were audio-recorded, transcribed and analysed by the two authors. We followed a constructivist grounded theory approach to analysis [5]. Specifically, themes were developed through an iterative process of coding, memo writing, and discussion. Data from interviews were constantly compared to emerging themes and concepts. The interview guide also went through several iterations during the study to sample from our theoretical areas of interest and reach saturation of those concepts. Specifically, through our consideration of remix in the context of repurposing co-workers' digital content, we came to focus our interview and analysis on remix as a set of processes that involves how individuals gain awareness of and access to resources, make resources available to others, and transform

digital content for new purposes that may also incorporate other appropriated content, in addition to original components. In emphasizing process, we also explore concepts of attachment, acknowledgement, and contribution, particularly with attention to the impact of technical permissions and social dynamics on remix. Themes of our analysis included understanding and obtaining digital content, managing access to digital content, transforming digital content, and community practices and expected contribution surrounding digital content, among others.

Limitations

Our sample comprised primarily of women (n=14) and low and mid-level employees (n=14). This sample is indicative of individuals who self-selected to participate. Future research would benefit from targeting specific occupations and field sites, as our findings are not generalizable to all workplaces. Further, while gender did not influence our emergent themes, we cannot claim that gender does not impact remix in the workplace. Gender, race, and disability status should be considered in future research to promote technological design for workplace remix that is intersectional and inclusive.

FINDINGS

Participants remixed their co-workers' digital content, including text documents and slide decks, for several reasons, including efficiency (e.g., building from a foundation rather than from scratch), learning (e.g., inputting semantic content into a template to understand the structure of a narrative), and authority (e.g., following a supervisor's instructions). Rather than unpacking these motivations, in this paper we focus on how individuals accomplish remix in the workplace. Our analysis considers remix as a set of processes whereby individuals obtain digital content produced by others and transform it for new purposes. Co-worker involvement in these processes ranges from direct contribution, including explanations of how content should be used, to indirect participation, such as contributing content to shared repositories. We begin by describing the ways in which individuals obtain digital content for remix, in addition to the work involved in making content available for remix by others. We then discuss how individuals transform digital content for new purposes. Finally, we examine the attitudes and actions surrounding acknowledgement and contribution of digital content remixed in the workplace.

Making Digital Content Available for Remix

Several actions associated with obtaining digital content for remix emerged through analysis. For example, participants gained awareness of digital content available to them through onboarding processes and interactions with co-workers. Participants also described obtaining content from shared repositories comprising of group resources and resources associated with or belonging to specific co-workers. While norms differed across participants and the teams they worked within, context played an important and general role in indicating which digital content was available for remix, and

how perceived ownership of that content, as well as of previously repurposed content, was to be understood. In this section, we consider how availability is underpinned by awareness and access, both in terms of technical permissions and social norms.

Building Awareness of Shared Digital Content

For many participants, digital content that might be remixed as part of work was distributed across various servers, digital repositories, and co-workers. Participants' abilities to obtain this content was impacted by company procedures, technical permissions, and social norms. Even when access was technically permissible, the breadth of digital content distributed across shared repositories and the lack of clear direction regarding where to find it could hamper an obvious prerequisite for remix: awareness of a resource's existence. Though awareness could be facilitated by company onboarding processes, co-workers were often more directly implicated in the disclosure of digital content. For example, P5 learned about resources by *"being vigilant during meetings... I learn about it through discussion and meeting and hearing people talk about it, and asking."* Similarly, P3 gained awareness of digital content available for remix by observing the *"resources that people are asking for."* In these cases, technical access to digital content was coupled with social interaction in order to be discovered.

Receiving Direct Access to Digital Content

In other cases, participants were neither aware of, nor had access to, digital content that they might remix. By necessity, co-workers were involved in participants' abilities to obtain these resources, often through providing both awareness and access. P8, for example, described how the director of her lab granted access to shared digital repositories and servers soon after disclosing that they existed. In other cases, co-workers proactively sent resources to participants, including digital content that participants were not aware of, as part of project onboarding processes, as well as a means of making content available for future remix. Instances of direct sharing often carried implications for how digital content might be remixed, and supported understanding of the content's importance and meaning through the social context surrounding sharing. P4, for example, described how another intern *"was showing me some templates for the way they like to do their stacked R charts in the group. So, he sent that to me as a 'When you get results, make sure you put it in this format.'"* Similarly, P8 described a time her lab director shared *"a slide that he himself used in a presentation, and, even though I could use different colors or whatever, he wanted the slide to have the same structure and feel."*

Obtaining access to resources through direct sharing was not always a guided experience. Consequently, participants were not always aware of the context surrounding digital content and were, therefore, responsible for making sense of associated meaning and value. P1 described feeling *"a bit overwhelmed"* with the access she was given during onboarding. She discussed how her team *"gave me access to*

[a shared OneNote notebook] and I thought, 'Okay. Might be relevant to me.' I don't know why I have access. And then I just wanted to see if it's something that I should know about or something that would help me to get started." Similarly, P7 described how she *"peeked at a bunch of the different folders"* to understand the content available to her through her technical permissions when she *"first got added to these different accounts and drives."* While access to digital content may lack direct guidance from co-workers, P4 described learning team norms from watching colleagues. She said, *"The afternoon of my first day was 'Here's where everything goes. Do it this way.' I think, working with one of the other interns who was on this group last year, so getting to work with him and see how he manages his projects is a good template or something to follow. I kind of knew what the expectations were from the group."*

Requesting Access to Digital Content

Some participants described how gaining awareness of content led them to seek access to it. In rare cases, access was not granted. P2 described how the founder of his start-up talked about the company's pitch deck, but did not provide access to the deck, even after he asked for it. Typically, however, access was provided. The specific ways in which this was done impacted how digital content was available and could be remixed. P3, for example, asked her supervisor for a presentation *"template and, so, he found something that he really liked that he thought was pretty successful. And he shared a copy of it with me, so then I could update it on my own."* Continuing, P3 mentioned uncertainty regarding the presentation's provenance, saying that she was *"pretty sure it was [by] someone within our team."* Similarly, P1 asked a co-worker for documents, even though she *"could have found them somewhere in the shared resources, but I was just so unfamiliar with how SharePoint works that I asked him to mail it to me and he did."*

Co-workers responded to requests for access in several ways. Some individuals shared only the requested resource with the participant. P9, for example, described how his co-workers only shared links to documents with him. Though he explained how this was *"less overwhelming for me to get those links than go through the full labyrinth of folders and documents,"* he did, however, acknowledge that he might not be aware of other relevant documents due to his co-worker's sharing practices. However, when co-workers provided access to folders or digital repositories, they frequently did so without providing additional context. Consequently, participants performed work to determine which digital content was relevant and available for remix. This often involved making sense of entire spaces. For example, P2, after asking for a specific project document, discussed obtaining access to a folder. He said, *"I had all these crazily named JPEGs and the whole, you know, final project version JPEGs had all these iterations on there that [my co-worker] just haphazardly updated...I had to sift through it, make heads or tails of what she put up there, and then I had to identify which things were important for me..."*

Participants also discussed how privacy and confidentiality meant that access had to be withheld. When resources were withheld, permanently or prior to modifications made to facilitate sharing, they were frequently stored within digital spaces associated with specific individuals. These included folders that were labelled with particular people's names within shared repositories. These 'named' spaces typically had technical permissions such that any member of the team had the ability to access them (as will be discussed in the next section), however, in some cases access was restricted to certain individuals. P12, in particular, described how her named space within her department's shared Google Drive was only accessible to herself and to her supervisor, thus excluding the team of eight individuals she oversaw. P12 described times when her employees asked for content she had stored in this space; saying, *"Like, Oh, [P12], I know you did this presentation, and I need that – I need some of the information that you used. Do you mind if I use it?"* Following these requests, P12 often moved digital content from her named space to the departmental one, thereby granting her employees access. Prior to making content accessible, she reviewed it for confidential information, removing it when necessary *"because I don't want that to fall back on me, since I'd get written up for sharing something that I shouldn't have shared."* Similarly, P15 kept tight permissions on several named spaces within a larger group repository. These spaces contained brainstorming documents, rather than confidential ones, where she had *"an idea, but I haven't fully hashed it out."* Though contribution and remix were expected within the shared repository, P15 only made her documents available for remix if *"an idea has been polished and it's pretty much at the point of being able to be presented or has been presented before..."*

Social Expectations surrounding Remix

For some participants, storage of and access to content in shared digital repositories was *"just assumed"*. As P7 explained, *"you're part of the community, you're sharing resources with other people. And that's just part of being in the community."* Similarly, P15 described, *"there's an understanding that we're going to reuse the stuff in some shape or fashion, at some point."* Obtaining resources from these spaces did not necessarily involve obtaining a co-worker's permission or guidance regarding how to remix it. Digital content in group areas of shared repositories was not considered owned, so remix was perceived as flexible. P12, discussing a group repository for images, considered remix in terms of ownership; saying, *"No one has ownership of, you know, the pictures. So, it's usually, yeah, everyone can use them."*

While participants were confident that this content was available for remix, they often highlighted their intention before acting. This could, as P15 described, mean raising awareness of remix in *"a roundabout way"*, where co-workers *"might have asked, 'Hey, I'm thinking about doing that program, did you have a good response to it? How would you recommend for me to use the materials? Which*

ones do you think work best? What did you like about them? What did you not?'" Raising and maintaining awareness of how digital content is repurposed may also prompt co-workers to share additional context about content and how it should be remixed.

Shared repositories were occasionally viewed as barriers to workflow and quality due to unchecked practices surrounding remix of available content. P11, for example, described how open technical permissions and flexible social norms created an environment where individuals freely, and inappropriately, remixed available survey documentation without understanding its context. She explained, sarcastically, how *"everybody and their mom [had] access to the Survey Monkey [surveys], so they could do whatever they want. And they'd send things out and change things without having any training of any sort in developing surveys or creating and designing for research questions or any of those sorts of things."* Broad, group access to digital content without technical permissions or social practices restraining or guiding content availability impacted how remix was accomplished, which was not always viewed positively.

Participants also described feeling unable to remix digital content, despite awareness of resources and granted technical permissions. P13 discussed how all employees at his company used one account – and, therefore, one set of technical permissions – to access a shared Google Drive. Only certain employees, typically managers (i.e., P13 not included), used these permissions past simple viewing, such as uploading and editing content.

P14's relationship with a shared repository at his workplace was vastly different. As a banquet chef, he was one of a handful of individuals who added new recipes or directly modified existing ones in the shared space. This included adding or updating recipes that his employees had developed; though, as P14 mentioned, in those situations, he *"will give credit – if I didn't create the recipe, then I will give credit to whoever did it."* Despite having the same access permissions as all other chefs, social norms dictated that others go through P14 to contribute new recipes to make them available for remix. In other cases, actions were restricted by technical permissions rather than social norms. P18, for example, described how her employees had technical permissions that enabled them to view and download documents from the server, but not ones that permitted them to modify or upload digital content.

While co-workers might share group spaces in shared repositories, they also shared digital content in spaces marked clearly as their own (e.g., named spaces). Even where access was available, most individuals did not remix content from co-workers' named spaces (and often did not find this content relevant). However, exceptions did exist. In these cases, permission to remix was often explicitly sought. As P14 explained, *"As proper etiquette and protocol...when you want to go into someone's personal folder, we need to ask first and give a reason as to why... Then you have access*

to it.” While participants were typically aware of resources and technically had access, social norms indicated that availability for remix was not inherently assumed.

Occasionally, however, remixing co-workers’ content involved obtaining resources from named spaces without asking. P15 described *“a kind of a last-minute type situation”* in which she did not ask to remix documents in her co-workers’ named spaces and, instead, searched indiscriminately through all technically accessible folders to locate digital content. Searching her co-workers’ content without the specific context of that content, however, meant having to *“wade through the different things.”* She continued, *“...the information wasn’t necessarily all on point.”* Similarly, P12 discussed searching her employees’ named folders out of necessity; saying, *“Especially if I’m looking for something that I know one of them might have did. And then I won’t have to recreate it, then I’ll go in there and look in their folders.”*

The availability of digital content for remix involves more than awareness and access. Social norms influence how individuals perceive which content can or cannot be remixed. Making digital content available for remix includes technical access and navigation of social practices and attitudes surrounding ownership and expected contribution. Further, awareness of content availability and context, which are frequently mediated socially, influences how individuals approach and accomplish remix in the workplace.

Transforming Digital Content

Understanding content availability for remix is followed by actual modification of available digital content for new purposes. Participants described two types of transformations implicated in remix: conceptual transformation and concrete transformation. Conceptual transformation involves a mental shift in how individuals perceive digital content. Specifically, in order for content to be remixed, it must be regarded as modifiable toward a purpose other than the one for which it was initially created. Conceptual transformation is followed by concrete transformation, where individuals modify the semantic, structural, or stylistic content of a digital resource, or incorporate it into other digital content.

Conceptual Transformation

Remixing co-workers’ digital content involved a conceptual shift in how that content was regarded. P7 described how her lab doesn’t *“really have a study design template, but what we tell students is, like, this person has done one. This is a really good example. You should use that as a template, basically.”* Conceptual transformation involves understanding the ways in which content available for remix can actually be remixed. For example, some content may only be available for remix as a structural outline, while other content may, instead, provide semantic content that can be repurposed. With our participants, conceptual transformation typically involved completed resources, such as project slide decks, research protocols, and software prototypes, rather

than incomplete resources, such as notes and documents used during brainstorming. Completed digital content was conceptualized as structural and stylistic models, as well as semantic resources.

When treating digital content as structural and stylistic models, participants often looked to appropriate specific elements or features from existing content. P9 remixed a co-worker’s meeting notes to inform the style of his own deliverables. He said, *“...even if I’m not making a meeting notes document I just would feel like, ‘Let me follow this style.’”* By regarding the established style of a completed document as an available component for remix, P9 appropriated document style, as well as company practices. This example of transformation highlights an activity that is not necessarily considered in literature on appropriation and remix: gaining inspiration (i.e., remixing content by using it as a model rather than directly copying and pasting) [12]. Identifying which features of a resource were relevant and available for remix was not always as straightforward as conceptualizing the remix of a specific style.

In addition to structural and stylistic elements of digital content, participants described conceptually transforming semantic content from available resources. Unlike stylistic and structural content, which was more likely to be understood as a resource to be repurposed in its entirety, semantic content was often conceptualized for remix in piecemeal (i.e., remix involved repurposing only certain portions of existing content). However, even when used in its entirety, semantic content was often conceptualized as a piece to be juxtaposed with other instances of existing content. This type of remix was typically undertaken for analysis or evaluation, with multiple resources produced by a number of individuals being combined in new ways. For example, P11 conceptually transformed a hodgepodge of completed materials (e.g., surveys, reports, slide decks) into data points for remix in a company-wide program evaluation. We also saw examples of semantic content being conceptually transformed for creative activities. P12 described how several images from a shared repository were conceptualized as resources to be combined in the making of a new picture, saying, *“If I want to make a collage with twelve or nine pictures, then...I’ll do that.”*

While these examples involved participants obtaining and repurposing content individually, co-workers were also implicated in the conceptual transformation of their own digital content for remix by others. When P4’s co-worker shared a stacked R chart of his study results, he mentioned that she should use the resource as a stylistic template when she had her own data to present. Similarly, P5 described how the manager of another group, which *“had sort of done what we were trying to do to some degree”*, shared the guidelines his team had created for a specific procedure. P5’s group could then use the completed guidelines as a way to *“help scaffold our documents and our work.”* Both P4 and P5’s colleagues accomplished the work of conceptual

transformation. Specifically, these co-workers provided the specific context for the components of the resources that could be transformed. Sans co-worker involvement, this work falls to the individual undertaking remix, and is supported by awareness of digital content context, such as document type, semantic content, author, and location.

Concrete Transformation

Conceptual transformation was followed by modifications to co-workers' digital content in order to remix it. Specifically, this process, which we call concrete transformation, involved modifications to the structural, stylistic, and semantic properties of digital content. Participants described the ways in which they modified resources for remix. For example, participants modified their co-worker's digital content with their own semantic information. This action was often accomplished by removing existing semantic information from a resource and replacing it with semantic content prepared by the participant. Frequently, stylistic and structural properties of digital content were kept intact. Following the conceptual transformation of a completed slide deck to a stylistic and structural template, P3 described changing her co-worker's presentation with *"the obvious,"* which involved updating the *"title, update your name, information. Putting in new information, like just setting up the final presentation and getting everything ready."* Similarly, P2 modified an email script created by his co-worker. Though he kept the company description intact (a component of the script not conceptually transformed for concrete transformation), he modified the remainder of the message to reflect his own authorial voice. These examples demonstrate how existing semantic content can be modified or removed as part of remix without additional changes to structure or style. This type of remix frequently involved slide decks, spreadsheets, and text documents.

Concrete transformation also involved incorporating co-worker's digital content into participant-created digital content. P3 described this process as integration. She discussed incorporating her co-workers' code into her own project; saying, *"...it's been really nice for my project to just look at how other [employees] are doing – how other people are doing the same – not the same work. But, like, tackle similar projects. Problems. And, so, it's been really nice to kind of, like, look at that and integrate it into some of my work."* Similarly, P4 discussed incorporating the group's preferred style of results into her own work; saying, *"When you're dealing with numbers, it's probably easier to start a fresh one and make sure you put all of your own data in [a spreadsheet] and then try to recreate what someone else did."* This example, similar to P9's appropriation of a document's style discussed in the previous section, demonstrates how individuals accomplish remix for inspirational or modelling purposes, such as applying or integrating style and structure to their own, existing digital content. Remix also involves interweaving semantic content from various co-worker or original resources to create something new. P15, for example, described how her co-

workers remix materials that she created; saying, *"They see how successful something was, so they've taken stuff and maybe adapted it, adding a few things to here or there, but just more or less using some of the materials that I've uploaded... No one's done a project – or done the presentation exactly the same...but they have, you know, done their twist on it..."* Though concrete transformation is necessitated by the broader processes surrounding remix, its spectrum of associated actions, ranging from minimally to exceptionally transformed, holds implications for how individuals acknowledge the contribution of digital content obtained from co-workers.

Acknowledging Contribution

Remix was complicated by considerations of ownership, authorship, and credit. P4 described remix through the perspective of co-worker contribution and potential collaboration. *"Is it just a passing off the resource – like, 'Here, you can have this,' and a transfer of ownership? Or is it more like, 'I'm going to maintain my ownership and we can collaborate'?"* Continuing, she talked about how some digital content facilitated collaboration, where co-workers were implicated in further participation, while others *"end after the transfer is initiated. So, you have someone else's resource and it's now your resource. And you can use it."* Sans collaboration, practices surrounding remix involved interpreting the value of contribution, which was influenced by aspects of digital content availability (e.g., access, awareness) and transformation (e.g., type, degree).

In some shared repositories, efforts were made to recognize contribution. P3 discussed how she personally makes *"sure that if I borrow someone's code, that I attribute it properly."* However, efforts such as these could be lost over time. P14 described how modifications to existing recipes on his department's shared web portal were credited to the chefs involved, but failed to indicate that the creators of the initial recipe were maintained in the recipe's acknowledgements. In other cases, the norm was for attribution to be omitted. P15 discussed how she did not acknowledge herself, or others, for workplace presentations or workshops. Talking about presentations, she said, *"You know, to be honest, I'm the type of person who doesn't put an author at all... I actually just kind of start presenting. I say, 'Oh, hey, I'm going to talk to you guys about whatever today,' and I don't really say, 'Oh, a co-worker came up with this.'" She elaborated, "I don't know if it's extremely important to any of us whether or not, you know, one changes the author name..."*

Some participants described acknowledging contribution as a way of supporting a sense that, while digital content was broadly available, the opportunity for remix was appreciated. P10 *"always felt that every time I quote someone and they know that I've quoted them, or they know that I've talked about their example with someone else, they're happy to hear that."* Similarly, P5 described forgoing formal acknowledgement when another group provided process guidelines for him to remix because *"the work's all recent*

enough where I'm sure everyone's very aware that we borrowed from another team." These examples suggest that acknowledging digital content contribution involves a sense of gratitude in the context of social currency, rather than explicit attribution of content or idea provenance.

Participants also described how concrete transformation impacted their perceptions of contribution and acknowledgement. Digital content repurposed as templates were, as P4 described, not "huge" contributions: *"That's a nice thing to give to someone so they know how to format things."* Similarly, the single presentation slide P08 obtained from her lab director for integration into her slide deck was not viewed as a contribution deserving of formal acknowledgement, likely due to its limited impact on the entirety of the presentation, which P08 perceived as belonging to her.

Acknowledging Ideas

Many of our participants with ties to academia discussed social practices around acknowledging ideas. P4 described, *"I think we have these opportunities to be like, 'Yeah, I just thought of this,' or you could say, 'As a group, this was shared.'"* Similarly, P8 discussed how she was *"not going to steal somebody else's project, but, for example, if somebody dropped an idea and I believe it's worth it, I can go talk to that person and be like, 'Hey, can I work on this?' ...And I can pick it up and start working on it. You know, it turns out to be something I work really hard in and they have no involvement, you can probably mention them – or not. Depending on how valuable or how much was their input on the project."* Participants without academic connections did not exhibit the same notions regarding acknowledgement of ideas as meaningful contributions. For those participants, the contribution of digital content was key, though not necessarily formally acknowledged or acknowledged at all.

DISCUSSION

Workplace interactions impact individuals' attitudes and perceptions of available digital content and actions. While related research in the workplace emphasizes groupware, collaboration, and direct reuse, our analysis demonstrates that remixing digital content is a complicated phenomenon involving navigation of social practices and technical permissions. We consider remix as a set of interwoven processes, rather than a series of distinct actions. Specifically, remixing digital content in the workplace involves obtaining content through awareness of availability and context, performing work to make digital content available to others, transforming digital content conceptually and concretely, and acknowledging the contributions of digital content and co-workers. We discuss the importance of context, as well as social dynamics and practices, to remix in the workplace. We then consider how the broader processes of remix inform design of technology.

The Importance of Context

The context of digital content is constructed through digital repository organization, technical permissions, and social

practices and norms within workplaces and between co-workers [39]. The context of digital content and the ways in which it is constructed impact how individuals gain awareness of materials, understand their availability for remix, and accomplish transformations as part of this process. Context might be provided by indicators such as storage location, including the choice of a particular Cloud repository [48], but can also be provided when other technologies, such as email, are used for sharing. Differences in storage and sharing practices impact degrees of context. For example, co-worker guidance and workplace practices are often implicated in direct (e.g., indication or explanation of a material through an email) and indirect (e.g., observing co-worker habits and actions) disclosure when context is high. High degrees of context facilitate awareness and understanding of digital content existence, meaning, value, and availability for remix and distribution.

When the context surrounding resources is limited, individuals are responsible for making sense of digital content through the content itself, including its location and, potentially, proximal materials (e.g., resources stored in the same or nearby spaces). Consequently, when materials are obtained with less context, individuals have less clarity regarding meaning and value, as well as the ways the digital content can or should be remixed. Limited context impacts how individuals obtain digital content and accomplish remix. Resources obtained from shared, group repositories are often liberally obtained and repurposed. These spaces indicate a particular sense of remixability, in which individuals may feel it is their right to remix stored content. Generalizations to understanding context, however, may lead to inappropriate occurrences of remix. Thus, when facing a low degree of context, individuals may raise awareness surrounding their intentions to remix, which may prompt co-workers to disclose additional context.

Social Dynamics in Remix

Social practices are integral to individuals' perceptions of context. Though these practices may be visible when reusing or repurposing physical objects [24,27], they are largely invisible within technical systems. For example, obtaining physical objects frequently involves the act of taking, in which an object is removed from its location. Obtaining digital content, conversely, involves the act of downloading, which enables individuals to obtain resources without removing those resources from their digital location. While some technologies try to increase visibility of downloads (e.g., displaying quantity of downloads), context surrounding who has downloaded a resource and where they have downloaded it to are typically absent. Asking to take physical objects also acts as a forcing mechanism to the issue of providing context [20]. Further, some physical practices (e.g., dog-earing a page of a book) or the effects of time (e.g., a worn or scratched surface) that inscribe context in physical artifacts do not exist in digital spaces.

Social norms, rules, and practices do not travel with digital content, but can be associated with digital repositories or conveyed through interactions with people. When digital content is stored in locations, such as named spaces, obtaining permission for remix is a prerequisite to accomplishing the process. Conversely, content in shared, group spaces is governed by social norms dictating expected contribution and use. These expectations underpin weak perceptions of ownership in these spaces, contrasting previous research [38], and impact social practices surrounding how individuals ask permission for or raise awareness of remix. Though resources in shared, group spaces may inherently be perceived as remixable, digital content in named spaces is approached more conservatively. Using names often mediates how digital content is accessed and obtained due to perceptions of belonging to others, which warrants respect and conversation (e.g., asking) prior to remix. Individuals may deviate from these practices when they perceive their authority as bestowing upon them a right to do so, or extenuating circumstances force their hand.

Social practices, ownership, and perceptions of an inherent right to remix also impact how digital content is transformed for remix. Many digital spaces and artifacts are restricted to technical permissions no more nuanced than read-write access (i.e., anyone with both permissions can modify spaces and content in abandon). Social norms and practices are, therefore, necessary for mediating how content is obtained, contributed, and remixed. While social reinforcements, such as gatekeepers responsible for maintaining, updating, and adding shared materials, may keep repositories and content from descending to chaos, they may also restrict actions too greatly. Technical permissions alone do not capture the complexity of practices related to remix, which are often social in nature, and may face unforeseen consequences if norms are challenged or broken.

Designing for Remix in the Workplace

Workplace technologies increasingly innovate to introduce intelligent and adaptive features that support productivity and collaboration. However, designing for remix in the workplace also means acknowledging the intelligent work conducted by co-workers to make digital content available to others. Similar to work describing the artful ways that households organize themselves [44], the analysis presented here indicates that co-workers undertake a great deal of work when making digital content available. This effort is not necessarily captured by digital content or technical systems, thus highlighting challenges associated with conceptual transformation and taking content out of context.

Recent features in productivity tools such as Microsoft Office's 'Tap' and the Google Suite's 'Explore' aim to support people in obtaining resources, but further innovation should incorporate ways of helping people perform the work involved in making resources available to others. This involves navigating interwoven and occasionally conflicting technical permissions, social practices, and digital content.

Systems able to intelligently determine or question semantic content may reduce risk associated with moving resources from named to group spaces, such as unintentionally sharing confidential information. Further, systems that assist in raising awareness of remix [40,50], which is largely invisible in current workplace technologies, could increase context-seeking opportunities and feed back into a system or repository to embellish the context around specific digital content.

Given the propensity for only certain components of digital content to be repurposed, systems highlighting those elements may be able to reveal content connectivity and malleability, as well as workplace trends. This may support joint interpretation of an object [1], as well as understanding of how it may be remixed. Technologies such as Slack and Microsoft Teams could support remix through features enabling individuals to navigate chats and threads through specific content. Specifically, having access to conversations across shared channels surrounding a particular resource could illuminate how that resource has changed over time. Context is essential to the interpretation and remix of digital content. Thus, when recommending digital content to users who are producing content, or even simply returning search results across shared repositories, highlighting information (e.g., author, repository, others who have accessed or repurposed it) would support remix through disclosing more about the resource in question.

Finally, remix could be supported by providing flexible tools once content is obtained. Technology that supports modularity within digital content could assist with remix of specific stylistic, semantic, and structural elements. Though it is difficult to predict how digital content might be divided, supporting users in the broad set of processes related to remix, such as through manipulation via an interface or direct end-user programming, could facilitate some of the more mundane aspects of concrete transformation.

CONCLUSION

Remix is a complex set of processes where individuals navigate technical systems and social dynamics to use co-workers' digital content toward new purposes. Co-workers may be implicated in these broader processes of remix through their involvement in raising awareness about content, making content available, and conceptually transforming content for reuse. The amount of co-worker involvement, in addition to the perceived contribution of digital content, impacts how individuals perceive acknowledgement and credit in workplace remix. Further, the context of digital content impacts how it is understood to be available for remix, as well as the work that goes into making it available. Designing technical systems to convey the nuance of context, as well as to acknowledge the tensions between social dynamics and technical systems, may support workflow and the remix of materials in the workplace.

REFERENCES

1. Liam Bannon and Susanne Bødker. 1997. Constructing Common Information Spaces. In *Proceedings of the Fifth European Conference on Computer Supported Cooperative Work*. Springer, Dordrecht, 81–96. https://doi.org/10.1007/978-94-015-7372-6_6
2. Alberto Barrón-Cedeño. 2010. On the Mono- and Cross-language Detection of Text Reuse and Plagiarism. In *Proceedings of the 33rd International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR '10)*, 914–914. <https://doi.org/10.1145/1835449.1835687>
3. John Bowers. 1994. The Work to Make a Network Work: Studying CSCW in Action. In *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work (CSCW '94)*, 287–298. <https://doi.org/10.1145/192844.193030>
4. Julia Cambre and Scott Klemmer. 2017. Standing on the Shoulders of Peers: Tournament-Style Remixing in Project Courses. In *Companion of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17 Companion)*, 155–158. <https://doi.org/10.1145/3022198.3026353>
5. Kathy Charmaz. 2014. *Constructing Grounded Theory*. SAGE.
6. Giorgos Cheliotis, Nan Hu, Jude Yew, and Jianhui Huang. 2014. The Antecedents of Remix. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '14)*, 1011–1022. <https://doi.org/10.1145/2531602.2531730>
7. Giorgos Cheliotis and Jude Yew. 2009. An Analysis of the Social Structure of Remix Culture. In *Proceedings of the Fourth International Conference on Communities and Technologies (C&T '09)*, 165–174. <https://doi.org/10.1145/1556460.1556485>
8. Justin Cheng, Jaime Teevan, Shamsi T. Iqbal, and Michael S. Bernstein. 2015. Break It Down: A Comparison of Macro- and Microtasks. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*, 4061–4064. <https://doi.org/10.1145/2702123.2702146>
9. Christian Collberg and Stephen Kobourov. 2005. Self-plagiarism in Computer Science. *Commun. ACM* 48, 4: 88–94. <https://doi.org/10.1145/1053291.1053293>
10. Tim Coughlan, Rebecca Pitt, and Patrick McAndrew. 2013. Building Open Bridges: Collaborative Remixing and Reuse of Open Educational Resources Across Organisations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*, 991–1000. <https://doi.org/10.1145/2470654.2466127>
11. Stuart Cunningham, Jonathan Weinel, and Darryl Griffiths. 2014. ACERemix: A Tool for Glitch Music Remix Production and Performance. In *Proceedings of the 9th Audio Mostly: A Conference on Interaction With Sound (AM '14)*, 7:1–7:7. <https://doi.org/10.1145/2636879.2636888>
12. Claudia Eckert, Martin Stacey, and John Clarkson. 2000. Algorithms and Inspirations: Creative Reuse of Design Experience. In *Greenwich 2000 International Symposium: Digital Creativity*, 1–10. Retrieved from https://s3.amazonaws.com/academia.edu.documents/30921285/a_i.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1515011241&Signature=MTUcflKDV1JBszuJ6Jhg7oleZb0%3D&response-content-disposition=inline%3B%20filename%3DALGORITHM_MS_AND_INSPIRATIONS_CREATIVE_REU.pdf
13. Thomas Erickson and Wendy A. Kellogg. 2000. Social translucence: an approach to designing systems that support social processes. *ACM transactions on computer-human interaction (TOCHI)* 7: 59–83.
14. Cori Faklaris and Sara Anne Hook. 2017. Attitudes About “Fair Use” and Content Sharing in Social Media Applications. In *Companion of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17 Companion)*, 171–174. <https://doi.org/10.1145/3022198.3026343>
15. Casey Fiesler. 2013. The chilling tale of copyright law in online creative communities. *XRDS: Crossroads, The ACM Magazine for Students* 19: 26–29.
16. Casey Fiesler and Amy S. Bruckman. 2014. Remixers’ Understandings of Fair Use Online. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '14)*, 1023–1032. <https://doi.org/10.1145/2531602.2531695>
17. Casey Fiesler, Jessica L. Feuston, and Amy S. Bruckman. 2015. Understanding Copyright Law in Online Creative Communities. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*, 116–129. <https://doi.org/10.1145/2675133.2675234>
18. Tom Gross, Wido Wirsam, and Wolfgang Graether. 2003. AwarenessMaps: Visualizing Awareness in Shared Workspaces. In *CHI '03 Extended Abstracts on Human Factors in Computing Systems (CHI EA '03)*, 784–785. <https://doi.org/10.1145/765891.765990>
19. Stefan Gruner and Stuart Naven. 2005. Tool Support for Plagiarism Detection in Text Documents. In *Proceedings of the 2005 ACM Symposium on Applied Computing (SAC '05)*, 776–781. <https://doi.org/10.1145/1066677.1066854>
20. Jane Gruning and Siân Lindley. 2016. Things We Own Together: Sharing Possessions at Home. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*, 1176–1186. <https://doi.org/10.1145/2858036.2858154>
21. Carl Gutwin and Saul Greenberg. 1998. Design for Individuals, Design for Groups: Tradeoffs Between Power and Workspace Awareness. In *Proceedings of the 1998 ACM Conference on Computer Supported*

- Cooperative Work* (CSCW '98), 207–216. <https://doi.org/10.1145/289444.289495>
22. Sarah Hallacher, Jenny Rodenhouse, and Andres Monroy-Hernandez. 2013. Mixsourcing: Turn This into That. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '13), 2841–2842. <https://doi.org/10.1145/2468356.2479539>
 23. Wendy Ju, Arna Ionescu, Lawrence Neeley, and Terry Winograd. 2004. Where the Wild Things Work: Capturing Shared Physical Design Workspaces. In *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work* (CSCW '04), 533–541. <https://doi.org/10.1145/1031607.1031696>
 24. Sunyoung Kim and Eric Paulos. 2011. Practices in the Creative Reuse of e-Waste. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11), 2395–2404. <https://doi.org/10.1145/1978942.1979292>
 25. Romans Lukashenko, Vita Graudina, and Janis Grundspenkis. 2007. Computer-based Plagiarism Detection Methods and Tools: An Overview. In *Proceedings of the 2007 International Conference on Computer Systems and Technologies* (CompSysTech '07), 40:1–40:6. <https://doi.org/10.1145/1330598.1330642>
 26. Kurt Luther, Nicholas Diakopoulos, and Amy Bruckman. 2010. Edits & Credits: Exploring Integration and Attribution in Online Creative Collaboration. In *CHI '10 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '10), 2823–2832. <https://doi.org/10.1145/1753846.1753869>
 27. Leah Maestri and Ron Wakkary. 2011. Understanding Repair As a Creative Process of Everyday Design. In *Proceedings of the 8th ACM Conference on Creativity and Cognition* (C&C '11), 81–90. <https://doi.org/10.1145/2069618.2069633>
 28. Catherine C. Marshall and Frank M. Shipman. 2011. Social Media Ownership: Using Twitter As a Window Onto Current Attitudes and Beliefs. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11), 1081–1090. <https://doi.org/10.1145/1978942.1979103>
 29. Catherine C. Marshall and Frank M. Shipman. 2015. Exploring the Ownership and Persistent Value of Facebook Content. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (CSCW '15), 712–723. <https://doi.org/10.1145/2675133.2675203>
 30. Catherine C. Marshall, Ted Wobber, Venugopalan Ramasubramanian, and Douglas B. Terry. 2012. Supporting Research Collaboration Through Bi-level File Synchronization. In *Proceedings of the 17th ACM International Conference on Supporting Group Work* (GROUP '12), 165–174. <https://doi.org/10.1145/2389176.2389202>
 31. Charlotte Massey, Thomas Lennig, and Steve Whittaker. 2014. Cloudy Forecast: An Exploration of the Factors Underlying Shared Repository Use. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '14), 2461–2470. <https://doi.org/10.1145/2556288.2557042>
 32. Yelena Mejova, Klaar De Schepper, Lawrence Bergman, and Jie Lu. 2011. Reuse in the Wild: An Empirical and Ethnographic Study of Organizational Content Reuse. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11), 2877–2886. <https://doi.org/10.1145/1978942.1979370>
 33. Naoko Nitta and Noboru Babaguchi. 2011. Example-based Video Remixing Support System. In *Proceedings of the 19th ACM International Conference on Multimedia* (MM '11), 563–572. <https://doi.org/10.1145/2072298.2072371>
 34. Sylvie Noël and Jean-Marc Robert. 2004. Empirical Study on Collaborative Writing: What Do Co-authors Do, Use, and Like? *Comput. Supported Coop. Work* 13, 1: 63–89. <https://doi.org/10.1023/B:COSU.0000014876.96003.be>
 35. Lora Oehlbeg, Wesley Willett, and Wendy E. Mackay. 2015. Patterns of Physical Design Remixing in Online Maker Communities. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15), 639–648. <https://doi.org/10.1145/2702123.2702175>
 36. Jarno Ojala, Sujeet Mate, Igor D. D. Curcio, Arto Lehtiniemi, and Kaisa Väänänen-Vainio-Mattila. 2014. Automated Creation of Mobile Video Remixes: User Trial in Three Event Contexts. In *Proceedings of the 13th International Conference on Mobile and Ubiquitous Multimedia* (MUM '14), 170–179. <https://doi.org/10.1145/2677972.2677975>
 37. Celeste Lyn Paul, Kris Cook, and Russ Burtner. 2014. The Economics of Contribution in a Large Enterprise-scale Wiki. In *Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing* (CSCW Companion '14), 205–208. <https://doi.org/10.1145/2556420.2556475>
 38. Emilee Rader. 2009. Yours, Mine and (Not) Ours: Social Influences on Group Information Repositories. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '09), 2095–2098. <https://doi.org/10.1145/1518701.1519019>
 39. Abigail J. Sellen and Richard H. R. Harper. 2003. *The Myth of the Paperless Office*. MIT Press.
 40. Moushumi Sharmin, Lawrence Bergman, Jie Lu, and Ravi Konuru. 2012. On Slide-based Contextual Cues for Presentation Reuse. In *Proceedings of the 2012 ACM International Conference on Intelligent User Interfaces* (IUI '12), 129–138. <https://doi.org/10.1145/2166966.2166992>
 41. Judy Sheard and Martin Dick. 2011. Computing Student Practices of Cheating and Plagiarism: A

- Decade of Change. In *Proceedings of the 16th Annual Joint Conference on Innovation and Technology in Computer Science Education (ITiCSE '11)*, 233–237. <https://doi.org/10.1145/1999747.1999813>
42. Judy Sheard, Martin Dick, Selby Markham, Ian Macdonald, and Meaghan Walsh. 2002. Cheating and Plagiarism: Perceptions and Practices of First Year IT Students. In *Proceedings of the 7th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE '02)*, 183–187. <https://doi.org/10.1145/544414.544468>
 43. Claudio Soriente, Ghassan O. Karame, Hubert Ritzdorf, Srdjan Marinovic, and Srdjan Capkun. 2015. Commune: Shared Ownership in an Agnostic Cloud. In *Proceedings of the 20th ACM Symposium on Access Control Models and Technologies (SACMAT '15)*, 39–50. <https://doi.org/10.1145/2752952.2752972>
 44. Alex S. Taylor and Laurel Swan. 2005. Artful Systems in the Home. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '05)*, 641–650. <https://doi.org/10.1145/1054972.1055060>
 45. Jaime Teevan, Shamsi T. Iqbal, and Curtis von Veh. 2016. Supporting Collaborative Writing with Microtasks. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*, 2657–2668. <https://doi.org/10.1145/2858036.2858108>
 46. Jennifer Thom-Santelli, Dan Cosley, and Geri Gay. 2010. What Do You Know?: Experts, Novices and Territoriality in Collaborative Systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*, 1685–1694. <https://doi.org/10.1145/1753326.1753578>
 47. Jennifer Thom-Santelli, Dan R. Cosley, and Geri Gay. 2009. What's Mine is Mine: Territoriality in Collaborative Authoring. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '09)*, 1481–1484. <https://doi.org/10.1145/1518701.1518925>
 48. Amy Volda, Judith S. Olson, and Gary M. Olson. 2013. Turbulence in the Clouds: Challenges of Cloud-based Information Work. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*, 2273–2282. <https://doi.org/10.1145/2470654.2481313>
 49. Dakuo Wang, Judith S. Olson, Jingwen Zhang, Trung Nguyen, and Gary M. Olson. 2015. DocuViz: Visualizing Collaborative Writing. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*, 1865–1874. <https://doi.org/10.1145/2702123.2702517>
 50. Jie Zhang, Chuan Xiao, Sheng Hu, Toyohide Watanabe, and Yoshiharu Ishikawa. 2016. Managing Presentation Slides with Reused Elements. *International Journal of Information and Education Technology* 6, 3.