Online Feedback Exchange: A Framework for Understanding the Socio-Psychological Factors

Eureka Foong[1], Steven P. Dow[2], Brian P. Bailey[3], Elizabeth M. Gerber[1]

[1]Northwestern University
eureka@u.northwestern.edu
egerber@northwestern.edu

[2]University of California at San Diego
spdow@ucsd.edu

[3]University of Illinois at Urbana-Champaign
bpbailey@illinois.edu

ABSTRACT

To meet the demand for authentic, timely, and affordable feedback, researchers have explored technologies to connect designers with feedback providers online. While researchers have implemented mechanisms to improve the content of feedback, most systems for online feedback exchange do not support an end-to-end cycle, from help-seeking to sense-making to action. Building on extant literature in learning sciences, design, organizational behavior, and online communities, we propose a conceptual framework to highlight critical processes that affect online feedback exchange. We contribute research questions for future feedback systems and argue that online feedback systems must be able to support designers through five activities that happen before, during, and after the feedback exchange. Our framework suggests that systems should address broader socio-psychological factors, such as how intent should be communicated online, how dialogue can support the interpretation of feedback, and how to balance the tradeoffs of anonymizing feedback providers.

Author Keywords

Online feedback exchange; feedback; design methods; online communities; social networks; crowdsourcing

ACM Classification Keywords

H.5.3 [Group and Organization Interfaces]. Computer-supported cooperative work.

INTRODUCTION

Some of society's most pressing, complex problems are issues of design. Design issues can be addressed when designers seek feedback and understand how their design meets (or fails to meet) its goals throughout the iterative design process [3,12,76]. However, designers often face difficulties regularly reaching users in a timely manner, particularly when they have limited social and financial capital [22,36]. Recently, HCI researchers have explored the use of online feedback exchange to meet the growing demand for authentic, timely, and affordable user feedback [4,35,36,38,49,72,77].

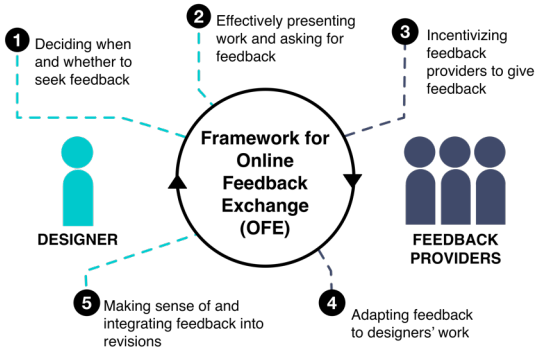

Figure 1. Five activities to consider when designing platforms that support online feedback exchange.

Online feedback exchange (OFE) includes a class of methods for engaging with users online. OFE systems allow individuals to present design work and receive information from distributed feedback providers intended to improve their work performance [36,49]. These providers may include individuals in online task markets, (e.g., Amazon Mechanical Turk), social networks (e.g., Facebook), or online communities (e.g., Reddit) [35,78]. While many HCI researchers have explored the potential of crowdsourcing feedback [19,22,39,73], the approach presents unique challenges compared to conventional face-to-face feedback. OFE systems must grapple with how to manage the scale and diversity of feedback, how and whether to identify feedback providers and receivers, how to encourage contribution, and how to provide adequate context. Recent work has focused on improving the quality of feedback from diverse feedback providers [49,54,75]. Applying theory from the learning sciences, they have studied ways to structure OFE and elicit expert-like feedback [29,49,76].

While this success has yielded numerous systems to meet needs for higher quality feedback, few systems support OFE end-to-end, from the time a designer decides to seek feedback to making sense of and taking action on the feedback, and from both the designer's and feedback providers' perspectives. Kraut and Resnick [42] and Grudin

CHI 2017, May 06-11, 2017, Denver, CO, USA
 ISBN 978-1-4503-4655-9/17/05$15.00
DOI: http://dx.doi.org/10.1145/3025453.3025791

[30] argue that for online systems to be adopted and used, developers must consider the different activities from start to finish and the multiple stakeholders involved. Hence, for OFE to become a sustainable and practical source of feedback for designers, it is not enough to focus on improving the quality of feedback [29,49,76] from diverse feedback providers [49,54,75]; developers must consider socio-psychological factors throughout the end-to-end cycle. For example, systems must consider how designers start using an OFE system, how the system incentivizes providers to give quality feedback [42], and how designers interpret feedback from different providers.

Decades of research on formative assessment (e.g., [33,46,66]), design practice (e.g., [15,27,36,47]), and HCI (e.g., [51,54,75]) can inform the design of OFE systems throughout the end-to-end, iterative feedback cycle. For instance, studies in design and learning show that students can be initially apprehensive to seek feedback [33,35]. Moreover, studies of workplace assessment find that whether providers give feedback depends on the salience of an issue [46]. Nevertheless, each of these areas do not sufficiently account for the unique challenges of OFE from end-to-end. Frameworks of formative assessment assume that feedback providers are readily available domain experts [33]. Likewise, crowd-based design frameworks emphasize how designers should prepare for feedback, with little consideration for how systems should support reflection afterward [35]. Although system developers could incorporate knowledge from these domains, practitioners and researchers would greatly benefit from a conceptual framework that integrates these considerations throughout the end-to-end, iterative feedback cycle.

Inspired by a synthesis of multidisciplinary literature in HCI [40], we contribute a conceptual framework that integrates socio-psychological factors critical to developing OFE systems that support an end-to-end feedback cycle (Figure 1). For developers, the framework illustrates key design considerations, while for researchers, it suggests fruitful directions for empirical research and system experimentation. The framework highlights five activities that can affect the design and use of OFE: 1) deciding when to seek feedback, 2) effectively presenting work and asking for feedback, 3) incentivizing feedback providers to give feedback, 4) adapting feedback to designers' work, and 5) making sense of feedback and integrating into revisions. We provide examples of features from 25 OFE systems that support/hinder the activities. By understanding the challenges facing OFE, HCI researchers can develop and refine OFE systems that support end-to-end iterative feedback cycles and lead to design solutions that better satisfy user needs.

BACKGROUND

Online Feedback as a Method of Design Evaluation

Multiple scholars have advocated for design processes that involve end users. The participatory design model [65] calls on organizations to collaborate with worker unions and design systems that account for the abilities of these workers. Service and co-design faces additional challenges [56]; ethnographies and face-to-face interviews are used to first visualize various components of a product, service, or experience and determine areas for improvement. Through studio critique, designers develop deeper understanding of design principles by openly presenting work to mentors and peers for feedback [18]. In contrast, usage-centered design focuses on modelling user roles and tasks to develop abstract prototypes [13]. Under this framework, user involvement is more selective than substantial. Similarly in reflective design, exemplary designers rely on prior experience with users to imagine and anticipate how the design will be used [15]. Central to each of these frameworks is varying levels of contact with actual or potential end users, who provide insight into the use and need of a system, product, or service.

Although designers may prefer using rich methods of inquiry described above [22,35], it can be costly and time-consuming to recruit users as participants. Thus, designers increasingly turn to online feedback to test their designs at scale and with reduced cost [53]. Inevitably, one evaluation method will not yield all the insights needed to answer one's questions about a particular design [71]. For example, while A/B testing enables easy comparison between two design alternatives, usability tests help designers understand why users face difficulties using a system [31].

OFE systems help individuals understand the strengths and weaknesses of their design work by presenting it to a large network of distributed feedback providers [35]. Systems such as *UserTesting* [80] and *Loop 11* [81] provide video recordings of paid crowdworkers' responses to a website design. For $40, designers on *FeedbackArmy* [82] can receive written responses from 10 crowdworkers in as little as one to three hours. Systems such as *Verify* [83] enable designers to reach thousands of feedback providers, whose only touchpoint with a design may be a single screenshot of a website. Other systems, such as *MURAL* [85] and *InVision* [86], allow designers to present and share wireframes with their social network; however, it is unclear what design expertise these feedback providers possess. OFE systems also exist in other domains, such as writing (e.g., *WEBook* [87] and *ABCtales* [88]). In short, systems for OFE are abundant, allowing designers to quickly seek feedback at scale from diverse providers. Our contribution is a conceptual framework in which to situate, compare, and refine the class of systems for OFE.

Challenges Facing Online Feedback Exchange Systems

Even though OFE promises a fast, affordable method for design evaluation, it faces at least five challenges that make it unique from face-to-face feedback methods in design practice and the classroom. Unlike feedback exchange in participatory design, co-design, and studio critique, OFE can involve interactions with anonymous and

pseudonymous feedback providers. Whereas interviews and usability testing are limited to small groups of feedback providers, OFE has the potential to involve thousands of users. Making sense of such rich data can be time-consuming [22]. Furthermore, online feedback providers participate for reasons beyond helping a designer, from establishing a professional identity [54] to earning pay for micro-tasks [78]. Because providers may not learn about the design task in depth, designers have the added challenge of explaining their choices clearly to an audience separated by time and distance. Furthermore, feedback providers have varying levels of design expertise and their responses often only address superficial aspects of design work [54,75].

Although prior frameworks for effective feedback exist in individual domains (e.g., design [17], learning sciences [33]), they do not sufficiently account for the open questions that arise for OFE. Hence, an integrated framework is needed to address these unique challenges. For example, research on online identity and help-seeking could predict the influence of anonymity on OFE. Research on peer review and crowdsourcing could illuminate how systems should allocate attention from multiple feedback providers to designers. Extant work on online communities could help researchers understand the participation of varied feedback providers. Because online feedback providers may not be design experts, researchers would benefit from a deeper understanding of design rationale, online coordination, and learning.

Initial research on OFE has primarily focused on addressing the last of these challenges by studying the crowd's perspective and how a lack of grounding and expertise may result in low quality feedback [49,77,79]. Applying research on the benefits of scaffolding on learning, Luther and Yuan [49,79] found that non-designers give more helpful feedback when given a list of design principles (e.g., layout, visual hierarchy). Similarly, our work showed that directing workers' attention to specific aspects of a graphic design produces better feedback [77]. Greenberg and colleagues [29] found that asking non-experts questions about a crowdfunding campaign significantly improved the specificity of feedback. Prior work has framed OFE as a challenge of quality, whereas in this paper, we surface the challenges and opportunities for OFE by framing it from the perspective of an end-to-end design feedback cycle.

Designing OFE Systems to Support End-to-End Design

Design is an iterative process in which designers repeatedly test new understandings of the problem and their solutions [64]. Ideally, OFE systems support feedback exchange throughout the entire process. However, by framing OFE as only a challenge of feedback quality, researchers may ignore other critical issues [36]. In a prior study exploring crowd-based design activities, we found that designers feel apprehensive about seeking feedback [35], which suggests that fear can prevent initiation of an exchange. Further, some designers improve their designs with feedback while others do not, suggesting that there are challenges with sense making [77]. Moreover, understanding systems from multiple stakeholders' perspectives is critical for adoption and use of computer-supported cooperative work systems [30]. Researchers stand to neglect these and likely other challenges designers face should they continue to see OFE solely as problem of feedback quality. The community would benefit from a conceptual framework that integrates findings from related fields of study.

Related Work on Formative Assessment and Design

Because recent work on OFE draws heavily on learning theory [76,77], we also adopt this domain's definition of feedback. Learning scientists define feedback as information provided by a feedback provider about one's understanding with the intention of improving one's performance [33]. With this definition, feedback has antecedents and consequences for both the receiver and the provider [46,66]. Similarly, designers use in-person critique sessions to obtain feedback, which include elements of performance and reflection [69]. However, unlike assessment in a classroom, designers must also evaluate their concepts with feedback providers who may not be domain experts [22]. Furthermore, designers may not have the opportunity to clarify the meaning of the critique [22]. Below, we discuss other challenges surrounding OFE.

Seeking Help and Presenting Work

In order to receive feedback, learners must incur social evaluation costs and seek help [33]. However, approaching task markets, social networks, and peers for help can be daunting when designers lack social or financial capital [35]. Beyond seeking help, designers must also form a request for feedback; how work is presented can impact the outcome of a critique or of the design process [18,55]. Moreover, learning scientists find that feedback that references an individual's goals can increase their motivation to take action [33,66]. The current literature on OFE does little to address these concerns.

Participating in Online Communities and Crowd Work

While online feedback can be obtained from paid crowd workers, not all crowds are financially compensated. Encouraging contribution remains a challenge for online communities [42,75]. In a study of help requests on Facebook, Lampe and colleagues found that posts that explicitly requested for help received more responses than general status updates [44]. Likewise, supervisors in organizations are more likely to provide feedback when a subordinate's performance is salient or when their performance depends on the subordinate [46]. In contrast, the majority of OFE research to date relies on crowd workers without examining how feedback providers can be incentivized to give critical feedback.

Reflection and Problem Solving in Design

While reflection is key to design [15,47,64,67], little OFE research has yet addressed how designers reflect on feedback. This is a considerable gap because feedback can

Distinguishing Dimensions of OFE Systems	Features and Examples of OFE Systems
Options for personalizing a request	Free-form requests (*Five Second Test*), structured tasks (*Verify*)
Methods for representing work	Single image (*Deviant Art*), multiple images (*Dribbble*), interactive multimedia (*Notism*), written description of project (*Behance*)
Crowd genre	Paid community (*UserTesting)*, unpaid community (*Lomography, ABCtales*), feedback providers chosen by feedback seeker (*MURAL, InVision*), panel (*Please Critique Me)*
Rewards for giving feedback	Money (*Loop 11*), feedback credits *(Feedback Roulette* – inactive), community recognition (*DeviantArt*)
Mechanisms for connecting with designers	By feedback provider's choice (*Pixalo, HelpMeViz*), by assignment (*Beta Family, Feedback Roulette* – inactive)
Information provided to feedback provider	Project information (*Concept Feedback* – inactive), profile of designer (*Dribbble*), design variations (*Verify*)
Mechanisms for providing feedback	Text (*fotocommunity, Conjure.io*), rating (*Concept Feedback* – inactive), vote/like (*Photo.net*), annotation (*Red Pen, Notable*)
Anonymity of feedback provider	Anonymous (*Feedback Army* – inactive), identifiable (*WEBook*)
Mechanisms for making sense of feedback	Filter by topic (*Notism*), voting mechanism (*Concept Feedback* – inactive), summary statistics (*Behance*)

Table 1. OFE systems can be distinguished on several dimensions. This is a list of the 25 online OFE systems that we used and interpreted based on the framework. Some systems have since become inactive and are marked in the table.

be easily misinterpreted [8]. For this reason, many researchers recommend that designers be skeptical of users' opinions and use dialogue to uncover users' underlying needs [63]. Nonetheless, we know little about how designers reflect on online feedback and take action.

METHOD

The goal of our framework is to help HCI researchers understand aspects of feedback exchange that should be supported in a system. Although we are not the first to propose a framework on feedback (e.g., [33,66]) or crowd-based design practices (e.g., [35]), our contribution is an integrative framework that accounts for the unique constraints of online feedback exchange. Similar to the work of Kittur and colleagues [40] who used existing literature to highlight new areas of research, we employed a combination of taxonomy development from the groupware systems literature (e.g., [2,6]) and interdisciplinary framework building [52], which we describe below.

Literature Review and Analysis of Existing Systems

Our framework is based on a literature review and the authors' collective experience as designers, instructors, and computing researchers. First, we developed a landscape sample (as cited in [6]) of 25 OFE systems (see Table 1). We conducted an online search using combinations of terms including "feedback," "design," "review," "critique," and "user feedback" in Google.com in November 2015. This resulted in 25 platforms. We included systems in which many users received feedback from more than one person. Although designers use social networking sites, such as Facebook or Twitter, to collect feedback, we excluded these sites as they have uses beyond the presentation of work. We included multi-use systems only if they focused on creative work (e.g., *DeviantArt* [89], *WEBook* [87]). We also limited our search to systems reliant on the English language.

In order to develop a framework that could suggest new research areas, we adopted Malone and Crowston's [52] approach to framework building. As a group, we listed dimensions of features distinguishing these 25 systems (see Table 1) [2]. Next, we abstracted these features so that we could connect them to literature in different disciplines [52]. We found it simplest to situate the features within broader processes before, during, and after the feedback exchange. For example, we reframed the dimensions "Options for Personalizing a Request" and "Methods for Representing Work" as the activity of "Deciding When and Whether to Seek Feedback." Then, we identified challenges within each activity and reviewed relevant literature. In this case, we cited literature in learning to describe the challenges of seeking feedback, and literature in design and organizational behavior to propose ways to overcome these challenges. We repeated this for the remaining activities.

Although this method was informal and we likely missed some systems, the examples help illustrate points in the framework and demonstrate how practitioners can overcome challenges in designing an OFE system. We noticed the systems were in a state of rise and decline; three systems are no longer active and new systems have been created since conducting the survey. Some systems may be

in decline because they do not adequately support OFE for end-to-end design. This further justifies the need for a conceptual framework that helps OFE research mature.

FRAMEWORK FOR ONLINE FEEDBACK EXCHANGE

We organize our framework around five activities that occur before, during, and after the exchange of online feedback. This is based on prior research in learning science on three components of effective feedback: how one's work relates to one's goals, how it compares to standards of performance, and how one should improve [33]. Within each activity, we propose design considerations for OFE systems. A summary is provided in Figure 1 and Table 2.

Deciding When and Whether to Seek Feedback

From a learning standpoint, feedback not only benefits performance but influences the development of self-regulation skills, which include knowing when and how to seek help [33]. Because this requires effort, individuals weigh the costs and benefits of seeking feedback before asking for help [33]. Poor experiences seeking feedback, such as receiving harsh criticism online [78], can further distort a designer's perception of the utility of feedback. These costs make seeking feedback one of the most difficult challenges of OFE [35]. Therefore, a OFE system must be able to lower the costs of seeking help.

Choosing How to Present One's Status Online

Differences in status between designers and feedback providers may lead to differences in help-seeking behavior. Goffman's sociological theory of self-presentation proposes that individuals suppress behaviors that undermine one's identity [28]. Similarly, organizational research suggest that seeking help can be costly when interacting with individuals of differing status [48]. In these cases, maintaining the perception of one's identity and power can discourage help-seeking. Both men and women in one study [48] sought help most often from equal-status rather than unequal-status peers. In short, the desire to assert one's status in a situation can hinder help-seeking.

In online communities, signals of status can affect the amount of attention and feedback one receives. For example, new users on *Dribbble* invest significant effort following and emulating popular designers to attract attention to their own work [54]. Similarly, many systems distinguish work based on user reputation. *ABCtales* [88] and *fotocommunity* [90] display the most popular work in the community on the homepage. Nevertheless, status can also be an important indicator of feedback quality. In a study of *PhotoSIG,* photographers preferred receiving

Activity	Considerations for Developers	Examples of Future Research Questions
1. Deciding when and whether to seek feedback	Difficulties seeking feedback can prevent designers from seeking help in the first place.	How does displaying status influence feedback-seeking behaviors? How does prototyping affect the experience of seeking feedback online? How much control should designers have over selecting feedback providers?
2. Effectively presenting work and asking for feedback	The way a designer shares work can elicit different types of feedback.	How does sharing multiple works-in-progress influence OFE? How can systems encourage designers to describe their goals and design intent?
3. Incentivizing feedback providers to give feedback	Feedback providers may not feel compelled to provide feedback when it is negative or when problems are not particularly salient.	How does anonymizing feedback providers influence the ability of designers to interpret critique? How should systems balance discussion around more and less popular work?
4. Adapting feedback to designers' work	Feedback can address various aspects of a design project, the process of designing, a designer's identity, or a designer's strategies, influencing how designers apply it to improve their work.	How can OFE systems intelligently generate critique rubrics for different designs? What forms of online feedback encourage effective, task-specific critique?
5. Making sense of and integrating feedback into revisions	Differences in the way designers interpret feedback can influence the improvements they make.	How can systems support dialogue with feedback providers? How should systems support sense making? How does the timing of feedback influence reflection?

Table 2. A framework for understanding the socio-psychological factors affecting the exchange of online feedback. We highlight five activities that impact the success of OFE and offer takeaways for system developers as well as questions for future research.

feedback from users with the same or higher levels of experience [75]. Similarly, feedback written by providers with less expertise was judged to be less helpful [74].

While research suggests that status should be deemphasized in an OFE system, how could this be implemented without removing useful cues for distinguishing feedback quality? Researchers should clarify the relationship between status and feedback-seeking behaviors. Is it the prominence of reputation or the difference in status that affects the likelihood of seeking feedback? Researchers could also investigate alternative methods of distributing feedback that are independent of reputation. For example, *Feedback Roulette* [84] allowed designers to receive feedback by contributing feedback.

Making it Easy to Create and Iterate on Prototypes

Design relies on iteration [15]; it is only through proposing solutions that designers understand the problem space and explore new solution ideas. However, producing new designs can make seeking feedback resource intensive [26]. Hence, designers can use low-fidelity prototypes to lower the costs of design [26]. Low-fidelity prototypes that convey only the key functions of a design enable designers to divide large tasks, take continual action, and experience control amidst uncertainty [27]. Moreover, producing multiple prototypes helps designers produce more divergent ideas [21]. Hence, the ease with which a designer can create prototypes may influence their likelihood to seek feedback.

In our review, some OFE systems provide tools to create web or application prototypes from wireframes (e.g. *InVision* [86]) or from hand-drawn sketches captured using a mobile phone (e.g., *POP* [91]). Currently, studies of OFE assume that designers post complete designs, (e.g. posters to advertise an event) rather than prototypes (i.e., sketches of these posters) [77]. As a result, we know little about how producing prototypes affects the experience of seeking feedback online. Researchers should investigate how much the ease of posting prototypes at different levels of fidelity influences feedback-seeking. System developers should consider going beyond providing tools that streamline prototyping and develop ways to encourage posting prototypes "early and often" as is advised by practitioners.

Discovering the Target Audience

According to Nelson-LeGall's model of help-seeking, individuals need to be able to identify helpers before asking for help [58]. However, designers may only discover their target audience through the process of receiving feedback [22]. They need support assessing their projects' needs and whether their target users can be accessed online [35]. Even when designers are able to articulate the help they need, they can fail to recognize who has the expertise to help them online [61]. In short, selecting feedback providers who are available to help takes effort and can increase the costs of seeking feedback.

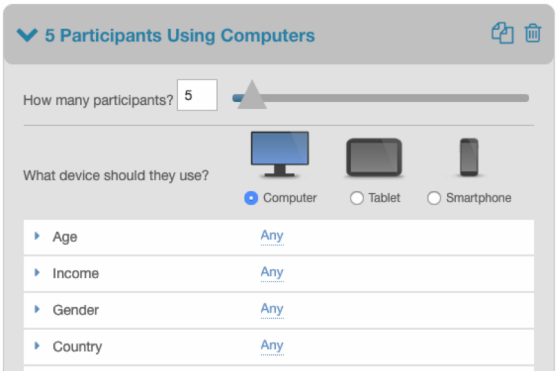

Figure 2. A *UserTesting* screenshot shows how it enables designers to specify feedback providers, but not understand who would be a suitable target audience for the project.

Some OFE systems, such as *Beta Family* [92] and *UserTesting* [80], help designers locate feedback providers who resemble their target audience (see Figure 2). Nevertheless, the designer must determine the characteristics of their target audience. *Behance* [81] provides a statistical overview of users who have commented on a designer's work, but does not summarize those characteristics to help a designer better understand the target audience. Moreover, recent studies of OFE study crowds that participate based on convenience, rather than on resemblance to the designer's target audience [77,79].

OFE systems have yet to develop features that orient designers towards the target audience early in the design process. Researchers should study how summarizing the characteristics of the target audience affects feedback-seeking. How much control should designers have over selecting feedback providers? Apart from that, system developers should test new ways for designers to explore the characteristics of their target audience.

Effectively Presenting Work and Asking for Feedback

Apart from being a structurally complex activity, design is often collaborative [55]. The challenge with coordinating design work is managing the communication between individuals with different understandings of the problem [55]. Malone and Crowston [51] argue that individuals who rely on shared resources find ways to manage these interdependencies by developing strategies, such as making implicit knowledge explicit. The type of designs that are presented can also affect the kinds of feedback that a designer receives. Creating sketches and conceptual prototypes helps designers understand how the concept looks and feels, rather than how well it is implemented [45].

However, not all feedback is effective; for example, feedback targeted at the process and self-regulation strategies of the individual are more effective than feedback targeted at the self or the task [33]. Ultimately, the way design work is presented can result in feedback that leads to different outcomes.

Sharing Multiple Works-in-Progress

The framing of feedback tasks can affect the type of feedback that is provided. Crowds are more likely to give process feedback when shown low-fidelity prototypes, which orient them toward the design process [34]. Compared to wireframes or full designs, feedback in response to low-fidelity sketches is also more detailed [34]. Several portfolio websites allow designers to upload lower-fidelity design work. On *Behance* [93], designers can upload work to a "Work-in-Progress" page, whereas designers on *Dribbble* [94] can use the "work-in-progress" tag. Nevertheless, both systems do not seem to emphasize these features. By default, users view and upload finished projects to *Behance* [93].

Besides that, presenting multiple variations of a prototype encourages providers to give critical feedback [68] and designers to compare feedback comments [21]. While some systems enable users to upload multiple variations of the same design, few explicitly ask users to do so. For instance, *Red Pen* [95] and *InVision* [86] allow users to upload new versions of a single image within a larger project, but these images represent revisions to the design, rather than alternative design approaches.

Hence, there is an opportunity for system developers to encourage sharing of design sketches and early prototypes. Because designers may feel uncomfortable sharing their sketches [22], it may be helpful for systems to explain that sharing sketches can lead to more helpful feedback. Further research is needed to examine the effectiveness of this strategy. Apart from that, researchers should investigate the effectiveness of such explanations as well as the representation of alternative design approaches online.

Clarifying Design Intent and Goals to Feedback Providers

Designers are expected to effectively present their design to others [18]. This includes being able to explain the intent behind one's design and the evolution of the work [18]. Although several approaches for representing design intent exist (e.g., Design Space Analysis [50]), recording it can detract from other design activities [1]. One way to resolve these issues may be to focus on making the designer's goals more explicit. Learning scientists find that effective feedback explicitly addresses an individual's goals [33]. Goals may also be helpful to designers when they are prioritizing the feedback received [12]. Therefore, encouraging designers to state their goals may help them communicate with feedback providers.

In some OFE systems, designers are able to share project details but are rarely asked to explain their design choices. When uploading work for review on *Behance* [93] and *Photo.net* [96], designers can include information on the tools used to create their work, but are not encouraged to explain their design intent. In the future, researchers could explore how OFE systems can explicitly support the communication of design intent with lightweight features, such as a statement of intent, inclusion of influential exemplars, mood boards, and/or annotation.

Incentivizing Feedback Providers to Give Feedback

When researchers focus on optimizing the characteristics of online feedback, it is easy to overlook the contexts that lead crowds to provide or withhold feedback in the first place. Our recent work suggests that crowds with different motivations produce different feedback [78]. Paid crowd workers are more likely to provide suggestions to designers, compared to members of a design forum who provide process-oriented feedback. Furthermore, not all individuals who seek feedback receive it. On *PhotoSIG* [75], feedback providers are incentivized to post comments by receiving a boost to their online reputation. Nonetheless, members of the community still reported wanting to receive more feedback. Hence, it is critical for researchers and system developers to consider the contexts in which crowds are motivated to participate in OFE.

Choosing to Anonymize or Identify Feedback Providers

Research on performance assessment in the workplace has shown that supervisors who are about to provide negative feedback are more reluctant to critique [46]. Similarly, peer assessors in the classroom are less likely to give critical feedback, in part because negative feedback requires more elaboration [23]. Anonymity offers one way to increase feedback criticality [14]. For example, anonymity on Facebook confession boards has encouraged users to discuss socially taboo topics [5]. Nevertheless, the relationship between anonymity and criticality is complex. Reicher, Spears and Postmes [62] argue that the effects of anonymity are moderated by prevailing group norms; being anonymous can predispose a person to adopting a salient group norm, whatever that may be. For these reasons, the identifiability of feedback providers is an important dimension to consider when designing an OFE system.

While most of the recent work on OFE involves anonymous feedback providers on Amazon Mechanical Turk [74,77,79], one study tested the effectiveness of gathering communal feedback in a design classroom [36]. Feedback providers who were told they would be anonymous provided more specific praise and criticism [36]. Another study suggests that designers react more positively toward feedback from anonymous sources [59]. However, in many systems, such as *Notism* [97], feedback providers must display their name and email in order to comment on a design. In other systems, feedback providers are not told they will be anonymous, but the nature of the feedback (i.e., clicking on a design on *Verify* [83]) makes their identity negligible. Hence, there is an opportunity for researchers to explore how preserving the anonymity of providers affects the content of online feedback.

While anonymizing feedback providers can lead to more specific critique, we do not know if this imposes new constraints on OFE. Hence, researchers should investigate if anonymizing feedback providers reduces the capability of

designers to interpret critique. In addition, researchers could study the effects of allowing feedback providers to choose how they are identified to designers. For example, instead of requiring a name to submit feedback, systems could allow providers to use pseudonyms. These directions could help us to understand the complex relationship between anonymity and providing critical feedback.

Creating Norms and Opportunities to Give Feedback

Situational and motivational factors can influence whether an individual provides feedback. In the workplace, supervisors are more likely pay attention to a subordinate's task performance if 1) the performance is particularly salient and 2) the norms of the organization favor giving feedback [46]. When communication between supervisors and subordinates is valued, they are more likely to use informal and formal feedback systems [46]. Even on sites of voluntary collaboration, such as *Wikipedia*, incentive structures help sustain contributions in a similar way that gaining credibility motivates scientists to continue conducting research [25]. Kraut and Resnick find that individuals are more likely to contribute to online communities if they feel socially obliged to or believe they can make a meaningful contribution [42]. Moreover, Crowston and Fagnot argue that for users to contribute, projects in need of help must be visible to them [16]. In short, creating opportunities and incentives to contribute feedback is an important consideration in OFE.

Currently, some OFE systems use reputation schemes to sustain contributions. Designers on *DeviantArt* [89] become "Senior Members" for contributing to the community, while designers on *Pixalo* [99] receive reputation points for creating posts. Other research has found that strategies, such as rewarding points to the first three commenters, attract a limited number of contributions [75]. Nevertheless, Forte and Bruckman [25] recommend against stratifying users based on reputation points, instead suggesting that online communities allow natural leaders to emerge. Researchers should compare the effects of these reward schemes on the rates of contribution to OFE. Aside from understanding how to incentivize feedback providers, OFE system developers should consider how these systems create opportunities for giving feedback. While some systems automatically match feedback providers to designers who need feedback (e.g., *FiveSecondTest* [98]), others give feedback providers the freedom to choose the designers they want to help (e.g., *Pixalo* [99] and *Dribbble* [94]). Researchers should investigate how systems will balance the amount of discussion around more and less popular work.

Adapting Feedback to Designers' Work

Learning scientists propose that feedback can address the task itself, the way a task is done, the way an individual monitors his or her performance, or the self [33,66]. For example, task-oriented feedback could specify characteristics of the design that are incoherent. In contrast, feedback targeting self-regulation highlights ways the designer can assess their own work (e.g., "check that there is a clear hierarchy of design elements on the page"). Self-directed feedback addresses a quality of the designer (e.g., "you're doing a good job!"). When feedback is targeted at self-regulation, it can increase an individual's self-efficacy for seeking feedback later on [33]. In contrast, self-directed feedback can lower task persistence [11]. Moreover, when designers are prompted to make conceptual rather than superficial changes to their design, they produce higher quality revisions [77]. In short, adapting feedback to meet a designer's needs is important in an OFE system as feedback can influence a designer's self-efficacy and quality of work.

Structuring Critique

One way feedback can be adapted to meet designers' needs is to structure the critique process. Crowdsourcing researchers use structure to regulate the quality of online crowd work (e.g., [7,37,40,41,73]). In OFE literature, researchers find that crowdworkers lack the expertise needed to critique well [49,75]; however, with rubrics and guiding questions, these crowds produce more elaborate, specific, and useful feedback [49,76,77]. While this suggests that online feedback providers need to be guided through the critique process, we still lack an understanding of how to generate rubrics for various design tasks.

Existing OFE systems either provide pre-determined rubrics or allow designers to determine how they want their work to be judged. *Concept Feedback* [100] in Figure 3 supports feedback providers by asking them to rate designs on criteria such as design, usability and strategy. On other sites, such as *Feedback Army* [82], *Loop 11* [81], and *Five Second Test* [98], designers guide the critique by directly providing tasks and questions to feedback providers. Again, OFE systems have yet to provide rubrics that scale to different design tasks, whether that is creating a website for a small business or a weather forecast application. This is

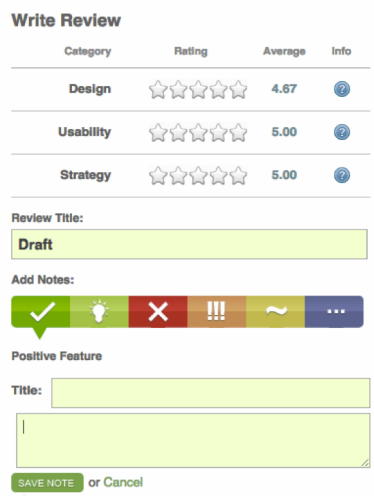

Figure 3. A *Concept Feedback* screenshot illustrates support for feedback providers, who can leave numerical ratings.

an important consideration given that the criteria for success of a particular design are often apparent only after receiving feedback [22]. As a result, researchers should address how OFE systems can intelligently generate critique rubrics for different categories of designs and at different stages of the process.

Encouraging Task-Specific Feedback

Effective feedback draws attention to the task and away from the self [33,66], and addresses the strategies an individual uses to monitor their progress [33]. The way feedback is framed, such as a numerical rating or a written comment on a critique interface, can influence the types of feedback generated. For instance, feedback prompts without numeric rating scales lead providers to focus on the development of the learner and produce higher quality comments [30]. Some OFE systems provide self- rather than task-oriented feedback. On *WEBook* [87], feedback providers give "compliments" or badges that remain on the writer's profile. On *ABCtales* [88], feedback providers can "follow" writers they admire to receive updates on their posts. Researchers should aim at systematically investigating the effects of these different modes – ratings, project-specific comments, and self-targeted cues – on the content of feedback.

In the majority of systems reviewed (e.g., *HelpMeViz* [101], *Conjure.io* [102]), feedback providers provide only one form of feedback - written critique. However, there may be benefits to providing more than one mode of feedback. Learning scientists find that cognitive overload can occur when information is presented in a single modality [66]. Some systems use alternative modes of feedback; feedback providers on *MURAL* [85] and *Notable* [103] comment and annotate directly onto designs. Designers using *Voyant* found it helpful to read first impressions of their designs [76]. Researchers should focus on clarifying the effectiveness of different modes of feedback to designers.

Making Sense of and Integrating Feedback into Revisions

Although OFE allows designers to reach many feedback providers quickly, making sense of such rich data can be time-consuming [22]. Furthermore, how one makes sense of feedback may influence the outcome of a design; despite receiving feedback, some designers make more significant improvements than others [60,77]. Moreover, critique often requires a great deal of structure to interpret [12] and its framing can affect how it is received [59]. Studies show that how individuals interpret feedback can influence their conception of a problem and its solution [8,9]. Therefore, understanding how designers make sense of feedback is crucial for supporting a successful feedback exchange.

Supporting Dialogue with Feedback Providers

In order for individuals to improve their performance, they must understand the standards by which they are being assessed; however, these standards often contain hidden and vague criteria [8,9]. For example, when students are told a paragraph contains "not enough analysis," they may interpret it as needing more depth, originality, or relevance. In the same way, researchers recommend designers interpret and view feedback as indicators of a problem, rather than as solutions in themselves [12]. However, OFE lacks some of the richness of information that comes from other design evaluation methods, such as contextual inquiry [22]. Designers want to clarify concepts with crowds, but may not always have the ability to do so [22].

One technique researchers use to increase the richness of inquiry is laddering, or asking questions to explore underlying motivations [63]. Some systems allow designers to respond directly to comments (e.g., *Please Critique Me* [104], *Lomography* [105]), while others, such as *Verify* [83] do not. While not all systems may be able to support dialogue, system developers must be aware of the implications this may have on a designer's ability to interpret feedback. Moving forward, researchers should study alternative ways to facilitate laddering, such as work flows that simulate laddering without the need for synchronous communication.

Reviewing Past Design Iterations and Feedback

Through continuous reflection, designers amend their goals [20,45] and alternate between thinking and implementing solutions [15]. Viewing past prototypes may help designers reflect on their progress [26]; moreover, viewing prototypes in parallel encourages designers to compare feedback and search for divergent solutions [21]. Likewise, several OFE systems allow designers to view previous versions within the same project (e.g., *Red Pen* [95] and *Notism* [97]). Nonetheless, others limit designers to viewing design iterations separate from one another (e.g., *UserTesting* [80]). This presents an opportunity for HCI researchers to further study how reflection on previous design iterations can be supported within the same visual space.

In addition to considering how designers will interpret feedback, system developers should account for how designers prioritize different pieces of feedback. Practitioners recommend that designers prioritize feedback according to their frequency, relevance to goals, immediacy, and source of the critique [12]. In line with these recommendations, users on *PhotoSIG* reported they would take a critique more seriously if they saw others agreed with the critique [76]. On top of that, cues about one's expertise and effort can affect the perceived quality of the feedback [74]. Designers may also find it helpful to explore these cues in depth [76].

Existing systems approach prioritization in different ways. Some provide cues about the quality of comments through voting mechanisms (e.g., *MURAL* [85], *Concept Feedback* [100]) while others allow designers to filter feedback based on topic (e.g., *Notism* [97]). On *FiveSecondTest* [98], feedback providers are asked simple questions after viewing a design for five seconds; their answers are aggregated into a word cloud. In contrast, *Concept*

Feedback [100] asks feedback providers to prioritize comments by categorizing them into groups, such as "Positive Feature" or "Minor Problem." In short, more research is needed to understand successful sense making behaviors and the effectiveness of prioritization cues.

Choosing When to Deliver Feedback to the Designer

Another factor that can affect how designers reflect on their designs is timing. Even though OFE is timely [22,39], designers report wanting critiques within minutes, rather than hours [75]. However, delayed feedback can be beneficial for knowledge transfer between tasks, such as learning new rules to categorize different sets of shapes [66]. Although research on the impact of timing remains inconclusive, learning scientists currently suggest that immediate feedback may enhance learner motivation, particularly for developing procedural skills such as mathematics [33,66]. While more research is needed to understand the impact of timing of feedback on reflection, system developers should be mindful of the effect timing could have on the feedback exchange.

DISCUSSION

Much of the prior HCI research on OFE focuses on mechanisms to improve crowd performance, but falls short in guiding an end-to-end, iterative feedback cycle. In this paper, we argue that the success of OFE is also influenced by broader socio-psychological factors.

Tradeoffs Provide Opportunities for Research

We found several opportunities for research on OFE. In many cases, these research questions presented themselves as tradeoffs. For instance, OFE systems could encourage designers to share early designs, but feedback providers might need to see a degree of polish to engage in critique. Researchers could explore the effects of delaying feedback; should systems side with designers who prefer rapid feedback or delay OFE to encourage reflection? Although delayed feedback can be beneficial for knowledge transfer [33,66], one study of a computer-supported peer feedback system showed that grades improved with immediate feedback [43]. Hence, researchers should clarify circumstances in which immediate feedback leads to better learning outcomes. Although one may view these tradeoffs as problematic, we argue they are opportunities for innovation and research of future OFE systems.

Application of Design Considerations

At first glance, it can be difficult to determine which of the considerations in the feedback exchange warrant more attention or investigation. Our conceptual framework invites researchers and system developers to interrogate each of the considerations and reflect on how it affects subsequent activities. For example, identifying a feedback provider may impact how a designer receives and reflects upon critique later on. Further, the ability to reflect on OFE may influence the likelihood a designer will seek feedback on their next iteration. Like all socio-technical systems, OFE systems must account for more than the crowd, the designer, or the technology, but also the interactions that take place between and within them [70].

Applicability of Results

Due to the broad nature of this review, one might wonder how our insights relate to other contexts, such as "social search" [24,57]. Although both involve asking questions to individuals [10], they differ in two critical ways. First, the focus of the communication in social search is a topic of shared knowledge, such as computer programming, while in OFE it is a designer's unique project. Thus, OFE systems must additionally support designers in presenting their designs. Second, the quality of social search responses depend on their long-term relevancy [32], while OFE is considered high quality if the information leads to design improvements. This suggests that other psychological processes may impact the usefulness of OFE.

Limitations

We recognize that the scope of this review is necessarily limited. For example, we could have described other approaches for making sense of feedback or explored the effect of emotion on receptivity toward feedback. However, we have strived to explore issues that are most pertinent to the design of effective OFE systems given the field's current understanding. Although we have not formally validated our framework with user studies, our contribution synthesizes literature across different domains to guide the design of these systems. More empirical research is needed to quantify the impact of each of these activities on an end-to-end design process (e.g., the amount of time that is lost when designers struggle to seek feedback online). Broadly, this framework attempts to expand the set of issues practitioners and HCI researchers see in OFE.

CONCLUSION

As the demand for authentic, affordable, and timely design feedback increases, we need a better understanding of how to develop end-to-end online feedback exchange (OFE) systems that support both designers and feedback providers. By integrating research on learning, design, organizational behavior, and HCI, and reviewing 25 practitioner systems, we illuminate five activities that affect the design and use of OFE platforms. Besides the content of feedback, factors such as dialogue and the identifiability of feedback providers can influence the usefulness of online critique. These design considerations can conflict with one another in a OFE system. Hence, HCI researchers can benefit by exploring these tradeoffs, while system developers can use this framework to evaluate their OFE systems and improve the way we support design work at scale.

ACKNOWLEDGEMENTS

This work was supported in part by the National Science Foundation under awards 1122206, 1122320, 1462693, 1530818, and 1530837. We also thank members of the Delta Lab at Northwestern University and the Design Lab at UCSD for their helpful feedback.

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