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Perspective

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Seeing things the same way: perspectives and lessons learned from research-design collaborations

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ABSTRACT

Information visualizations are increasingly being developed by informatics researchers to communicate health information to lay audiences. For high-quality results, it is advisable to collaborate with creative professionals such as graphic designers, illustrators, or user interface/user experience designers. However, such collaborations are often a novel experience for both parties, each of which may be unfamiliar with the needs and processes of the other. We have coalesced our experiences from both the research and design perspectives to offer practical guidance in hopes of promoting the success of future collaborations. We offer suggestions for determining design needs, communicating with design professionals, and carrying out the design process. We assert that successful collaborations are predicated on careful and intentional planning at the outset of a project, a thorough understanding of each party's scope expertise, clear communication, and ample time for the design process to unfold.

Key words: information visualization, health communication, participatory design

INTRODUCTION

Information visualizations are a growing method to communicate health information to lay audiences in health informatics.[1] Informatics researchers are using *participatory design* methods to develop informative, comprehensible visualizations with and for target audience members and are frequently encouraged to include visualizations (e.g., graphical abstracts) to accompany research articles to reach wider audiences.[2–4] To achieve high quality designs, collaboration with a creative professional such as a *graphic designer*, *illustrator*, or *user interface* (*UI*)/*user experience* (*UX*) *designer* is recommended (for brevity, we will use "designer" for this heterogeneous group).[5] Collaboration leverages each party's complementary strengths. The researcher's role is to extract meaning from the data whereas the designer applies aesthetic principles to yield a refined visual product aligned with the target audience's needs. However, the knowledge and skills required for successful collaboration with designers are not a standard part of informaticians' training and many designers may be unfamiliar with the unique needs of researchers as these may differ somewhat from those of their typical clientele.

In this perspective article, we summarize our insights and expertise as researchers and designers who found common ground to complete design-related research and provide lessons learned through our collaborations.[6] Given the readership of this journal, our perspective is primarily that of the researcher planning to hire a professional designer to develop visual representations of health-related research (e.g., information visualizations, graphical abstracts) with or without the use of participatory design methods. With that being said, we hope it will also be useful to design professionals, students, and informaticians in non-research roles.

We, the authors, comprise researchers and designers (graphic designers, illustrators, UI/UX designers) who have closely collaborated on several design projects with diverse,

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lay populations across multiple cultures and languages (English, Spanish, Hmong). Our expertise draws from principles of information design[7,8] and participatory design methods, which is a subset of human-centered design that involves close collaboration with target audiences.[9–11] The information visualizations we have collaboratively designed are intended for various clinical populations with conditions including dementia, asthma, pain, COVID-19, stroke, hypertension, hospital-associated infections, and HIV.[12–24] For this perspective, we reflected on our collaborations using guided questions. We then synthesized our thoughts, experiences, tips, and advice into this guide.

DETERMINING DESIGN NEEDS

Choosing a designer

Designers need as much detail as possible to determine the scope, feasibility, and timeline of the proposed project. Researchers can specify their objectives, desired features, and outcome of their project when approaching a designer using a *design brief* and the specific *copy* (if available) to be used in the visualization. These terms and others are defined in Table 1. Designers from our team mention that some design features that help with determining whether to accept a project include: the type of output desired (e.g., infographic, graphical abstract), the requested format of delivery (e.g., mobile application, webpage, printed), and the "shelf-life" of the output, meaning whether the project is a one-time design, if it will be iterated upon along the course of the study, or if it will be tailored for different groups.

Researchers need to have a clear understanding of what the designer does and does not do (e.g., writing scientific content, programming), and designers need to know what skills (e.g., software proficiency) are needed to complete the project. It is also important to consider the designer's workflow and how many estimated products will come out of the design process (e.g., number of starting images, iterations, pages, and final images in the product), which can help to facilitate budget estimates. Rough sketches indicating style and formatting can also be helpful upfront. It may be valuable for the researcher to engage the designer early in the research process, including grant proposal development, to set realistic budgets and time commitments.

Compatibility

Researchers and designers highly value compatibility in communication style/availability, design style, and any factors that connect designers to the needs of the target audience. Designers in our team mention wanting to empathize with or connect to the target audience and the researchers' goals, which is echoed in design thinking literature as the first step toward creating effective designs.[26,27] Researchers can help designers with this by providing background and context about their research projects and participants. Researchers mention that, depending on the target audience and study, compatibility can also require a cultural match, a language match, and/or comfort around working with sensitive topics or stigmatized groups.

Communication

Researchers need flexibility with communication to facilitate the design process, so having both in-person and virtual options is the most helpful. The frequency of communication and projected turnaround time that the designer can commit to for each iteration can affect the project timeline. Many researchers and designers emphasize the value of having in-person discussions and workshop time, especially at the start of a project, but we have successfully collaborated completely virtually in the past due to the COVID-19 pandemic.[24] Both designers and researchers value having a virtual option for subsequent meetings because they present additional possibilities for collaboration and convenience, especially when sketches or reference images can be shown via screen sharing, an overhead camera, or a live-sketching application. Phone calls and email are also useful, but we have noticed that email correspondence usually requires an additional conversation to

Table 1. Glossary of key terms

Term	Definition
Participatory design	A method that involves working with target audience members to create and iteratively refine a creative product, which can include information visualizations.
Design brief	A comprehensive document that summarizes the key information involved in a design project including: project goals/background, target audience, key stakeholders, context, specifications of the desired design and its use/outcome, available technology and resources, timeline, budget, and deliverables.
Stimulus/stimuli	Any material presented to target audience members to prompt feedback at any stage of the design process, including prototypes, graphical elements, or final layouts.
Graphic designer	A design professional who creates layouts by assembling elements including text, color, and images that are used in electronic or printed media.
Illustrator	A design professional who creates images through a variety of mediums which can include drawing, painting, and using digital media.
User interface (UI) designer	A UI designer focuses on tailoring the aesthetic and functional elements of an interface such as the buttons, text, colors, and interactions.
User experience (UX) designer	A UX designer focuses on the overall usability and feeling when users interact with the product or service.
Design saturation	Design saturation is met when target audience members are no longer suggesting new and substantive changes to the design and express satisfaction with the stimuli. The research team achieves a point of diminishing returns that no longer contributes to accomplishing the established objectives.
Reference image	An image that can be used to give a sense of the content or visual style desired, or that shows other similar examples to the desired end product. Reference images can be products of an environmental scan of the main topic.
Visual learning objective	A specification of the communicative intent of a visualization based on Bloom's taxonomy.[25]
Copy	The verbatim text that will be included in the product.

clarify feedback. Instead of email, some designers preferred communicating through a team collaboration platform, especially if files will be exchanged frequently, so all correspondence is in one place.

Hiring considerations

Depending on the policies of the researcher's institution, multiple steps may be required to work with a designer. This can include scope of work documents, setting up a vendor account, drafting service provider/legal agreements, and requesting work orders, among others. To facilitate writing a scope of work document, we provide a template in Supplementary File S1, with the caveat that format may vary by institution. If the work includes software development and thus liability insurance is required, that may affect the designer's cost estimate.

Designers may need to provide more documentation based on the project's needs. For example, if the designer will be interacting with human subjects in participatory design sessions, researchers should factor in time for human subjects training and Institutional Review Board approvals, which may extend the deadline by days to months.

Designers also suggest transparency around retaining image rights or copyright, and if the researcher will pay cancellation fees if the project does not move forward. It is therefore important for researchers to plan for how images will be distributed (which, in some cases, may be determined by the researcher's institution) and discuss this ahead of time; designers need to know what can or cannot be used in portfolios and whether an embargo period applies.

THE DESIGN PROCESS

Getting started

Designers need to be oriented to the project; therefore, we find it useful to start with a design brief that can include key areas such as *visual learning objectives*,[25] relevant context of viewing, budgeting, timeline, and *reference images*. Consequences and contingency plans are also useful to include. We provide an example template of a design brief in Supplementary File S2. The design brief can be refined or edited for clarity as the project comes together but should not be altered so much that the scope of work expands. If the output requires a deeper understanding of a clinical topic that is unfamiliar to the designer (e.g., in-depth understanding of medical concepts such as relevant laboratory analyses for HIV management), some researchers suggest providing a brief presentation, relevant grant materials, and/or prior publications to augment understanding. If needed, researchers may also consider providing designers with physical items or reference images to help with anatomical and medical device illustrations. For example, one designer was provided a urinary catheter to use as a model to accurately illustrate the components of the device that are essential to its use (e.g., drainage tab) and better understand how it can be positioned.[24] For harmonious collaboration, researchers also may need orientation to the designer's creative process, planned workflow, terminology, and possibly the basics of the software used for design.

Prototyping

Designers point out that their processes may be unfamiliar to some researchers, making communication about expectations for the prototyping phase particularly important. For instance, it is common practice in the human–computer interaction field to start with low-fidelity prototyping (e.g., early-stage sketch of design concepts that reflect the target audience's design preferences)[28,29] and utilize design probes (e.g., prompts or activities to engage the target audience in providing feedback and insight into a design)[30,31] during human-centered design sessions. The researchers who conducted participatory design studies concur—participants find it easier to react to *stimuli* rather than ideating from scratch, therefore, starting with multiple options for target audiences is highly recommended. Researchers can work with designers to develop multiple stimuli for initial design sessions that are aligned with their objectives and will provide target audience members with a starting point for feedback. When developing starting options for prototype images, researchers and designers find it helpful to use reference images to communicate style and content preferences (example in Figure 1). Reference images can come numerous sources (both scientific or for lay audiences) and can be produced by both parties.

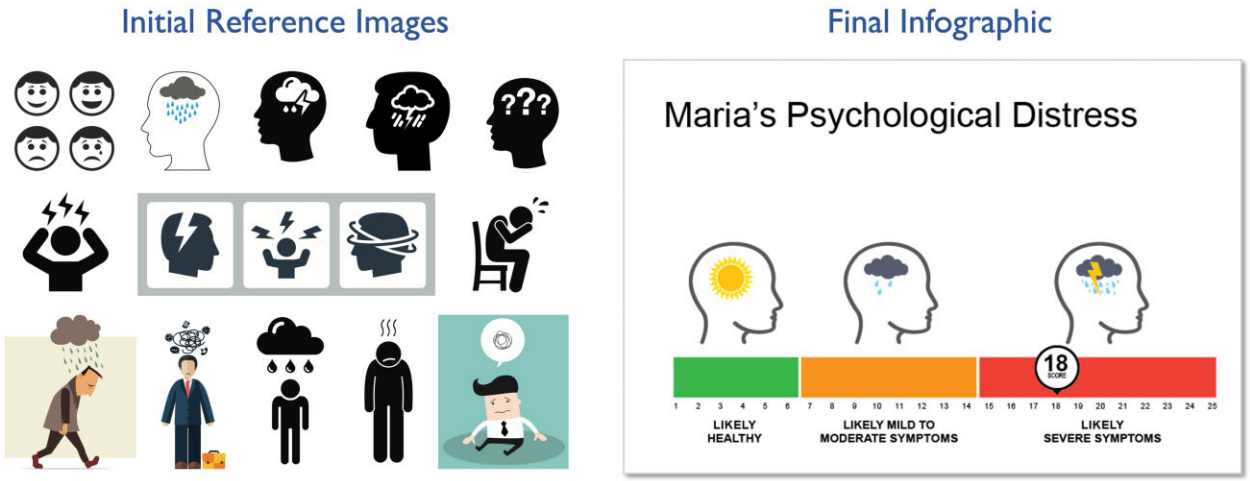

Figure 1. A figure displaying the original reference images compiled from purchased clip art that were presented to the designer (left) and the resulting final infographic (right) after iterations of participatory design sessions with target audience members. Adapted from Reference[18].

Tracking iterations and changes

For a scientifically rigorous design process, researchers may need more documentation than typical design clients. Therefore, it is important to have a clear plan to document iterations and tracking changes. Methods to record iterations can include use of file sharing and storage platforms (e.g., Dropbox, Adobe Creative Cloud), creating a standardized form to describe changes made to each iteration (e.g., Airtable), and establishing sequential naming conventions for images. Some of our designers prefer to use more integrated platforms (e.g., Figma) where comments can be made directly on the working file. Alongside tracking and documenting iterations, saving as much information as possible throughout the design process, including scans of sketches, field notes, and recordings of meetings and interviews, provides a repository of data that can be used to inform future design decisions and facilitate transparent research dissemination.

Collaboration

Researchers have also found that the more exploratory the project is, the more the working relationship with designers will develop over time. To facilitate this, workflow adjustments can include delegation of decision-making power, communication frequency/format, and time allotted for iterations. Researchers and designers find that a successful collaboration is one that draws on the expertise of all team members without needing to frequently override or defer decisions.

Designers need clear communication and rationale from researchers to effectively incorporate suggestions into visualizations, especially if the designer is not present during design sessions with participants. In those cases, the designers agree that the researcher is not always the expert—they are the "messenger of the target audience's needs," and it is important to lean on the designer's expertise to solve design problems. In one researcher's experience, instead of suggesting style changes to the text based on their observations, they "diagnosed" the problem (i.e., participants not paying attention to text) and requested the designer to suggest solutions which were incorporated throughout the resource.[21]

CHALLENGES DURING THE DESIGN PROCESSS

Our collaborations have been fruitful, but not without their challenges. Every one of us has, at some point, caused a "bottleneck" and delayed the design process due to competing demands on our time. These competing demands can become so great that the designer has to leave before completing the project, as has occurred twice in our experience. Although unexpected personnel changes are sometimes unavoidable, clear expectations about project prioritization and commitment to its completion can help and even be included as a contractual obligation, if mutually agreeable.

Another challenge we have experienced is conflict of opinion about specific design decisions. In this case, it is preferable to establish a decisional hierarchy a priori. In one project, the research protocol stipulated that if contradictory opinions arose, the target audience's preferences would receive priority, followed by those obtained by expert participants (in this case, clinicians).[21] It is ultimately the researcher's responsibility to ensure their participants' feedback is reflected in the final designs, even if it means respectfully overriding the designer's advice.

Lastly, "scope creep" can occur when a project outgrows the originally agreed-upon scope of work.[32] Poor specification or underestimation of the original objective is one potential cause. Although possible in any project, scope creep is likelier to affect novice researchers and exploratory projects. In these cases, a designer may need to re-assert their boundaries. The researcher can then either revert to more modest goals or request renegotiation and revise the scope of work, adjusting compensation accordingly. For example, in one study, the designer based their project fee on their estimate that about 100 h of work would be needed to create the 8–10 one-page infographics requested by the researcher. It became clear in the design process that the complexity of one of the planned infographics necessitated interactivity and so was deferred to a subsequent grant for which another designer created an app[33] based on preliminary work from the original study.[17] Another solution for projects in which the scope is nebulous is simply to contract with the designer on an hourly basis. Customary hourly rates will vary by market; online salary estimators can help researchers start making ballpark budget estimates.

Ultimately, we have surmounted challenges by addressing them in much the same way as any other workplace challenge—with communication, flexibility, and a collaborative mindset.

AFTER THE DESIGN PROCESS

Once the visualizations are finalized, the team will want to collect and store any files or documentation from the design process. The researcher may need multiple versions of the finalized designs for implementation and dissemination (e.g., different file sizes, formats, language variations). If the researcher is not able to create these versions themselves, they will need to either request the needed file exports in advance or come to an agreement about the designer's availability and compensation for ad hoc requests. Lastly, for visualizations that will be interactive or tailored, the team will need to create a style guide to specify requirements for subsequent software programming.[15,34]

CONCLUSION

In this perspective article, we present insight from our experiences as designers and researchers who have developed information visualizations. Some key takeaways include that successful researcher/designer collaborations occur when there is careful and intentional planning at the outset of a design project, and that clear communication and understanding of one another's roles is essential. We encourage researchers to learn about the full scope of the designer's and the target audience's expertise and find ways to apply that expertise throughout the design process. We emphasize that flexibility is important, particularly because we often underestimated the amount of time needed to complete tasks, and that every collaboration will evolve over time, especially with more exploratory projects. By the end of our design process, we had all gained a new appreciation for the complexity involved in the other's discipline. With the understanding that our insight is not intended to be exhaustive, we

hope to have provided a foundation for collaborating with designers in future design research.

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AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows. Study conception and design: AA, SM. All authors contributed to the data collection, analysis and interpretation of results, draft manuscript preparation, and critical review and approval of the final version of the manuscript.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Journal of the American Medical Informatics Association* online.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

The data underlying this article are available in the article and in its online supplementary material.

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