Client-Designer Negotiation in Data Visualization Projects

Elsie Lee-Robbins, Arran Ridley, Eytan Adar

***Abstract*—Data visualization designers and clients need to communicate effectively with each other to achieve a successful project. Unlike a personal or solo project, working with a client introduces a layer of complexity to the process. Client and designer might have different ideas about what is an acceptable solution that would satisfy the goals and constraints of the project. Thus, the client-designer relationship is an important part of the design process. To better understand the relationship, we conducted an interview study with 12 data visualization designers. We develop a model of a client-designer *project space* consisting of three aspects: surfacing project *goals*, agreeing on *resource allocation*, and creating a successful *design*. For each aspect, designer and client have their own mental model of how they envision the project. Disagreements between these models can be resolved by negotiation that brings them closer to alignment. We identified three main negotiation strategies to navigate the project space: 1) expanding the project space to consider more potential options, 2) constraining the project space to narrow in on the boundaries, and 3) shifting the project space to different options. We discuss client-designer collaboration as a negotiated relationship, with opportunities and challenges for each side. We suggest ways to mitigate challenges to avoid friction from developing into conflict.**

***Index Terms*—Data visualization, Design methodology, Client**

I. Introduction

Data visualization designers often do not work by, or for, themselves. Rather, designers create data visualizations (or data-driven products) for and with many stakeholders. We often consider the most obvious of these roles: designers and the audience using the final product. This ignores an essential, but often overlooked, stakeholder—the client who commissions the data visualization. As a freelancer, the designer's compensation and future work may rely on satisfying this client. A data visualization designer who works internally for a company might have 'in-house' clients (e.g., HR, sales, or other departments). In all cases, designers must communicate effectively to understand the domain problem, the goals, and the needs of the client before designing a solution. However, designers and clients must come to a shared understanding of the goals and, more importantly, agree on the design space of potential solutions.

The challenge for designers is that clients can range from those with a completely clear goal and a prepared, unambiguous brief to those with the vaguest notion of what they need or want. Clients may have an open mind and allow the designer the freedom to explore, or they might have a specific idea of chart types for the solution. This range makes it difficult for the designer to use or adapt standardized design approaches. Even with a specific client, the dynamics of the project can result in changes and disagreements that lead to tension throughout the design process. Clients might withhold data due to privacy issues or prescribe sub-optimal chart types. Designer visions and goals may present their own challenges. For example, they might suggest a new type of chart that the client does not understand. With all of these potential threats to the project, the client and the designer must negotiate to see if boundaries are flexible and, if so, how far they can be moved.

A great deal of data visualization research focuses on the role and process of the designer, but often with very weak (or even non-existent) client constraints and interactions. This ignores the messy reality of non-academic client work, where the goals and specifications originate from a separate stakeholder from the designer. We explore this relationship between client and designer to better understand data visualization practice. Through this, we can better understand the challenges and opportunities of client work, communication between parties, and factors that lead to successful relationships.

In this paper, we discuss negotiation within a client-designer relationship and how it can mitigate challenges and provide opportunities. We define the idea of a *project space* which encapsulates *goals* (what the client and the designer hope to achieve), the *resources* (what will be dedicated to the project) and the *design* (how the visualization is envisioned and constructed). Both the designer and client have a mental model[1] of the project space, meaning they both conceptualize the project with their own goals, resource allocation, and ideas for design. To support our analysis, we used two existing datasets: an ethnographic study of a design agency and an interview study of design professionals. We supplemented this with interviews with 12 data visualization designers to learn more about how they communicate with clients during a project. We find that clients and designers can expand and constrain their mental models of the project space as a way of negotiating boundaries and specifications. Finally, we provide suggestions for client-agency relationships in communication that leave room for design exploration in a strategic way.

II. Related Work

In this paper, we discuss negotiation in the client-designer relationship as they work together during a project. We use the term '*designer*' to represent the person (or group of people)

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[1]As opposed to a mental model of a visualization [1], [2], we consider the mental model of the project as a whole.

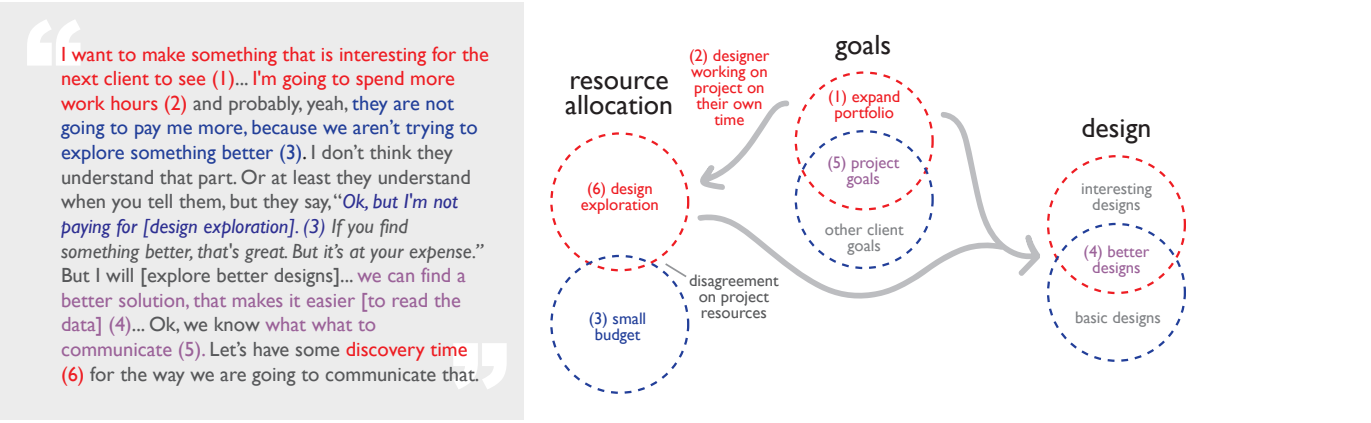

Fig. 1. An example of a client-designer relationship illustrated in the model. The designer's personal goals and desire to spend time on exploring various designs don't match up with the client's priorities of keeping the budget small. In order to achieve his personal goals, the designer works additional, unpaid hours on the project. This also leads to a better design for the project that benefits the client.

creating the data visualization or data-driven solution. The designer could be a single freelancer who works alone or an agency that consists of many different roles and teams that work together on a project. In some cases, the designer role is split. For example, into a data visualization designer and a data visualization engineer; the designer would be responsible for the encoding decisions and the engineer for the technological implementation. For simplicity, we use the singular 'designer' when referring to those within this broad role, but call out specifics as needed. We use the term '*client*' to represent the customer 'commissioning' the designer's services. As with the designer, the client may be a single person or a team representing a company or multiple stakeholders.

There are multiple types of data visualization practitioner positions; the most common two are *employee* (position within an organization or firm) and *freelancer* (or consultant/independent contractor) [3]. We focus on the similarities between these two roles while acknowledging the important differences in these contexts.

We note that there are other project stakeholders that we do not focus on in this paper. For example, the data visualization designer might recruit domain experts to help with tasks (e.g., calculating additional variables or understanding the meta-knowledge of the data). Working with domain experts in long and extensive projects leads to particular considerations for those relationships [4]. Additionally, some projects may have a separate 'project manager' who's role is to facilitate the requirements and schedule of the project. Most importantly, there is the end-user who will be the target audience of the visualization. In some cases, the client and end-user are the same. This would simplify the relationships within the project. The designer could directly talk to the client and ask if it meets their needs. However, when the roles are distinct, we may see communication gaps between the end-user and both client and designer [5]. Ideally, both client and designer will keep the end-user in mind. However, as we discuss, other factors may dominate decision-making and design.

Together, the designer and the client produce a data visualization or data-driven solution to meet their needs. In this paper, we will refer to the final deliverables of the project as '*the data visualization*.' This product may take various forms. This may be a single visualization, several dashboards with multiple visualizations each, or a journalistic story of an article with one or more visualizations.

A. Designing Data Visualizations

Data visualization is a 'wicked problem' [6]. That is, there is not one straightforward solution that will satisfy all needs—there will be trade-offs in design decisions to come to a good solution out of many possible solutions. Models of the design process can help designers create visualizations and help others evaluate these processes. For example, the nested design model provides a structure for validating threats at multiple layers of visualization design: domain problem characterization, data abstraction, visual encoding, and algorithms [7]. Designers can use the nested blocks and guidelines model not only to identify decisions at these levels, but also to connect or justify them between and within levels [8]. These models focus on how to *evaluate* a design. Alternatively, the design activity framework focuses on the *generative* actions that a designer takes: understand, make, ideate, and deploy [9]. These verbs can also encompass evaluation activities in the design process. However, these models attempt to guide good design or processes, but may not account for other stakeholder goals (e.g., project cost, awards, or client retention) or how those goals may come into conflict.

The design process can be messy and iterative rather than straightforward and linear, with pathways to jump back to earlier steps at any point in the process [10]. For designers, there are various processes and situated ways of knowing that they draw on to create data visualizations [11]. Designers may use tools to create visualizations in an unexpected way, much different from their expected use, bringing a new perspective to the practice of creating visualizations [12]. The variability in practice makes it difficult to produce one cohesive model for how data visualization practitioners work [11]. A key goal of our work is to illuminate the connection between design processes in visualization and client-designer interactions. However, in this work we also focus on how differing goals

and resource constraints may ultimately impact design. These aspects (e.g., financial costs) are often different from those experienced in an academic setting (e.g., a visualization design study [10]).

There are many ways in which specific types of client-designer relationships can succeed or fail. For example, for freelancers, working with clients introduces another layer of constraints and challenges. With client work, domain tasks originate from the client. Domain task clarity can range from perfectly crisp, with no ambiguity, to very fuzzy, where tasks are not well known or described [10]. A brief might start out as vague as "We think there is something wrong, but we are not sure what or why, please check" [13]. Having access to the data can help a designer make progress on a visualization project that otherwise has very vague requirements [13]. However, freelancers might not have access to the data due to privacy or confidentiality concerns, or gatekeeping by parties extraneous to the design process [14]. Using 'dummy' data to design can result in a less readable solution, forcing a designer to revise when the real data is integrated [15]. These seemingly disparate issues of vague goals and data access can be considered as parts of the overall client-designer relationship. There is a lack of an overarching framework that can provide an explanation of how these aspects of the data visualization project are considered by both the client and the designer over the course of the project.

Details about technological constraints can also make or break a project's success. A difference in compatibility between the designer's software libraries and the client's can cause a project to fail [16]. Even within a single agency, the design team can be unaware of the technological constraints of the developer team, resulting in extra work to modify the design for technological compatibility [15].

B. Client-Designer Relationships

Client relationships are a factor in many other fields of work, including architecture, advertising, graphic design, and more. Each field has developed guides for working with clients (e.g., [17]–[19]). A key aspect in these is that building a relationship with a client is an integral part of design work. Mutual trust and respect are essential to the relationship [20]. Interpersonal factors of trust and communication are just as important as performance in whether the relationship will succeed or fail [21]. Long-term relationships (over multiple projects or campaigns) are desirable because the designer develops a better understanding of the client's needs and can create better designs [20].

In a client project, there is often a 'design brief,' a document that lays out all of the requirements and deliverables for the project. The brief is one way for the client and the designer to align their expectations and understand the set of requirements [22]. A design brief can act as a 'social object,' serving as a connection point for two people and facilitating a social connection [23]. Artifacts (e.g., requirement lists, meeting notes, mood boards, etc.) can be used for interpersonal cooperation [24]. Often, a designer will work together with a client to create a design brief or other materials as part of the negotiation of the contract agreement. This can be thought of as a 'dialogue' where there is push and pull from both the client and the designer advocating for parts of the design that they want to see in the final solution [18], [25]. For example, in a project with vague client goals, data scientists can use tactics such as working backwards, probing, or recommending as ways to help a client better define their goals [26]. Instead of thinking of the brief as a product, it could be considered a process that sets expectations and builds a relationship between the designer and the client [19]. While a client brief might be useful for data visualization design, most visualization advice focuses on the design itself. Some exceptions describe how to create a brief (e.g., [27]) or offer advice on framing the problem space with clients [28].

One of the key parts of a design brief are the *requirements*—what are the things the solution needs to accomplish? Eliciting the client's requirements can be a challenging task. In fact, a whole field, requirements engineering, focuses on exactly this problem. Requirements engineering has three parts: context analysis (why the system should be created), functional specification (what functions the system should be able to do), and design constraints (how the system should be created) [29]. A specific example of this is the Volere Requirements Specification Template [30]. The template helps software engineers outline functional requirements (i.e., those that are essential) and non-functional requirements (e.g., usability and performance) [30]. However, such a separation may not work well for visualization design. Aesthetics may be a non-functional requirement, but are nonetheless an important and integral part of the design process [31]. In addition, requirements can be specified as goals that may evolve over time [32]. Within a brief, proposed *solutions* from the client are kept separate from requirements, often in a section of suggestions [30]. In communities with longer timelines or larger scale, such as architecture, a brief may evolve over a longer period and progressively increase in detail [25].

Although some briefs encourage clarification of everything at the beginning of the project, other strategies include intentionally embracing ambiguity [33]. In this way, multiple parties can interpret the ambiguities in line with their own goals. This strategy recognizes that objectives, plans, and details may change over the course of the project [33]. Ambiguous objects are favorable because they are both less confrontational and take less effort to create [34]. However, some people still argue that clarity is the best strategy, making the case that broad ambiguity is harmful, but imprecision or intentionally leaving things unspecified is fine [35]. Through our analysis and interviews, we focus on understanding the client-designer relationships specifically in the context of visualization design.

In addition to aesthetic concerns, visualization design is often viewed as a creative endeavor. Thus, the notion of *creativity* is important to a design project. However, clients and designers may have incompatible views on what creativity means, who should be creative, when, and how [36]. Creativity may not be a single creative 'leap' from a problem to a solution, but instead builds a bridge from the design problem and the solution spaces [37]. As such, creative design "is developing and refining together both the formulation of a

problem and ideas for a solution" [38] and is an iterative process to generate new concepts [39].

Originality goals may create another point of tension between design and client. For example, advertising agencies often aim to win creativity awards, which become visible indicators of success. Originality is one of the main factors in winning awards, even more so than strategy or higher-order audience outcomes, such as brand attitudes [40]. Designers may be motivated to create original ideas to appeal to awards. Such ideas may not be essential to the client's needs. In contrast, when catering to a client, designers can compromise their most creative idea if they fear that the client will be too risk-averse to accept it [41]. As in advertising, there are creativity awards in data visualization (e.g., the Information is Beautiful [42], Shorty [43], and Webby [44] awards). Designers may aim to create projects that can be submitted and win these awards. Given that evidence from other fields indicates that these factors impact the designer-client relationship and ultimately affect design, our aim is to understand these effects in visualization design.

C. Negotiation

As with any relationship with different stakeholders, visualization work requires negotiation. From a psychological perspective, parties in negotiation have a cooperative incentive to work together and a competitive incentive to increase personal gain [45]. Negotiations are often about multiple issues (e.g., time frame, budget, scope) and each party may value each differently [45]. These issues may be tangible (e.g., dollar amounts) or intangible, such as feelings of respect or self-image [46]. To facilitate negotiation, intangible issues should be converted into tangible ones whenever possible [46]. For example, a negotiation about creative freedom could be reframed as a number of designs presented or expanding a time frame to allow for more design exploration.

In requirement engineering or creating a client brief, multiple stakeholders might come to the table with varying opinions, goals, and concerns. Creating a specification involves negotiating with the client over the scope, context, and language of the brief [47]. Pros and cons of different options can be surfaced so that stakeholders can use them to communicate about which conditions are acceptable or not [48]. Our focus is in understanding this process in visualization work. Past work on visualization for clients has often highlighted practices that may lead to better visualizations or products (e.g., [7], [10], [26]). These models frequently assume that the practitioner will unconditionally focus on satisfying the client. However, as we show, this is not always the case. Through our work, we seek to better account for the broader set of stakeholder goals, which may be in conflict, and thus require different strategies of negotiation and engagement.

III. Interview Study

The motivation for this study arose from a joint analysis of two previous research projects on client-designer relationships. The first was an ethnographic study of a design agency, observing the design process between designers and clients [49]. The second was an interview study, asking data visualization designers about their communicative intent [50]. Although neither study explicitly aimed at studying client-designer interactions, the topic inevitably came up in both. Through analysis, we identified ways designers and clients work together. Our findings motivated an additional interview study with 12 designers. We briefly describe the three studies.

A. Data

Ethnographic Study (2018-2019): We reexamined data collected as part of an ethnographic study [49]. The data was collected during two visits to a prominent Western European design agency (July 2^{nd}–July 27^{th}, 2018, with a follow-up during June 24^{th}–July 12^{th}, 2019). This data was collected through semi-structured interviews with designers, recording of meetings, and documentation of artifacts related to the design process. The goal of this study was to understand how designers set goals and measured outcome success. The data discussed here was taken from two projects observed at the design agency. The first of these projects (which we refer to as [E1]) was a large-scale, long-term dashboard project for a major multi-national client. The second [E2] was a style guide produced for a charitable organization.

Prior Interview Study (2022): We also reexamined data from a previous interview study [50]. The study consisted of 12 interviews with data visualization designers (which we refer to as [A1-A12]). The semi-structured interview focused on the designers' backgrounds, a visualization they had previously created, and their communicative intent or goals for that visualization. The goal of this study was to explore how data visualization designers' affective intents mapped onto a framework of affective learning objectives. We recruited designers who had posted a visualization on the Data Visualization Society slack channels or Twitter. The designers came from various backgrounds: journalism, graphic design, UX/UI, science, and more. There were diverse arrangements of designers: some working within teams in a company; some working with external clients; and some working as freelancers. The 1-hour long interviews were conducted over Zoom and transcribed for analysis.

Together, we reanalyzed our existing data through the lens of the question: How do data visualization practitioners work with clients to define their collective goals? Specifically, we sought situations where designers described talking with clients about project goals. Through this analysis, we found themes that designers raised of negotiation, trust, and ambiguity. Because the previous ethnographic and interview data were reanalyzed after the fact, we could not say that we had an exhaustive view of client-designer relationships. The initial data reflected broader themes around the design process and communicative goals. Because of these limitations and to explore the phenomenon of negotiation in more detail, we conducted an interview study in which we specifically asked designers about working with clients.

Interview Study (2023): We interviewed 12 data visualiza-

	Job Title	Type of Employment	Location	Years of Experience
D1	Data Visualization Engineer	Internal, Freelancing	N. America	12-15
D2	Graphic Information Web Designer	Freelancing, Design Studio	Europe	3-5
D3	Data Analyst, Independent Consultant	Internal, Freelance	N. America	12-15
D4	President/Founder	Design Studio	N. America	7-9
D5	Data Analytics and Visualization Engineer	Internal, Freelance	N. America	3-5
D6	Data Visualization Engineer	Design Studio	N. America	7-9
D7	Project Analyst	Internal, Freelance	Asia	16+
D8	UX Designer	Freelance	Asia	3-5
D9	Specialist in Data Analytics	Internal	Asia	3-3
D10	Senior Data Analyst	Internal	N. America	3-5
D11	Freelance Information Designer	Freelance, Design Studio	Europe	3-5
D12	Data Visualization Designer	Internal, Freelance	S. America	12-15

TABLE I

DESIGNER PARTICIPANT INFORMATION. WE ASKED PARTICIPANTS, "WHAT IS YOUR BACKGROUND AND EXPERIENCE WITH DATA VISUALIZATION?" AND "WHAT IS YOUR JOB TITLE?" WE CHARACTERIZE A FREELANCER AS AN INDEPENDENT CONSULTANT WITH CLIENTS. DESIGN STUDIO EMPLOYMENT IS WITHIN A DESIGN STUDIO/FIRM WITH EXTERNAL CLIENTS. INTERNAL EMPLOYMENT IS WITHIN A COMPANY, DESIGNING FOR INTERNAL CLIENTS. ADDITIONALLY, A FEW PARTICIPANTS MENTIONED FORMAL EDUCATION IN DATA VISUALIZATION: D2-MA, D6-PHD, D8-BA, AND D11-MA.

tion designers about their experience working with clients.[2] We posted recruitment invitations to the Data Visualization Society and social media (Twitter, LinkedIn, and Mastodon). Due to a large number of interview sign-ups from people who were not actually data visualization designers, we created a screening survey. In this survey, which was given immediately after the consent form, we asked them to "briefly describe a data visualization-centered project that you have worked on in the past year" and to "share a link to your portfolio, personal website, or LinkedIn profile." This screening question allowed us to verify the identity of the person signing up to participate in our study. The designers from this interview will be referred to as [D1-D12].

The interviews were conducted over Zoom by the first and second authors. We followed a semi-structured interview protocol. The set of questions is provided in the Supplemental Materials. From these questions, ad-hoc follow-up questions were asked as needed as clarifying questions or to follow interesting threads of information. The interviews lasted 30 minutes, and participants were compensated with a $15 Amazon gift card. The audio was automatically transcribed. Transcripts were manually reviewed and fixed.

We asked designers about their experience and background in data visualization (summarized in Table I). We categorize the types of jobs into three categories: freelance, design studio, and internal. Freelancing is independent consulting, usually as an individual, commissioned on a project by a client. Design agency employees work within a design studio/firm to create data visualizations for external clients. Internal employment is working for a company and designing for internal or 'in-house' clients (e.g., other departments such as HR or sales). Designers often mentioned working a combination of these jobs either concurrently or as prior employment. During interviews, designers talked about how they have worked with clients throughout their entire career. Therefore, we report their current and previous positions. Of the 12 designers, 8 were freelancers, 4 were in a design studio, and 7 were internal designers. Half of our participants were from North America, 3 were from Asia, 2 were from Europe, and 1 was from South America. The range of years of experience ranged from 3 to 20 years. Although we did not specifically ask, some designers mentioned that they had formal training in data visualization design (1 BA, 2 MA, and 1 PhD).

Interview Analysis. From the original two datasets we identified instances when a designer had discussed working with a client. We created 15 initial codes from this analysis. For example, a participant (from the ethnographic dataset [E]) discussing data access indicated, "it requires constant negotiation between practitioners, the client, and with the API itself as a constraint in the production process," which was coded as *negotiation*.

After we had conducted the focused interview study with 12 data visualization designers, two authors transcribed and qualitatively coded the interviews. The interviews were coded using a combination of the initial set of codes (15), along with inductive coding through new concepts emerging from the data. This phase involved open coding, where additional codes were integrated as new insights were gleaned from the data. In total, the code book contains 24 codes. A second pass of coding was conducted using the expanded code book. This second round of coding ensured consistency in the analysis, allowing for us to make sure the codes were applied to all interviews. In the supplemental materials, we provide the final code book with definitions, example quotes, and counts of codes to protect the privacy of our participants.

Throughout the coding process, we engaged in multiple rounds of discussions, which included deep readings of the interview transcripts. These ongoing conversations facilitated a thorough discussion and iterative development of themes. During our analysis, we compared and contrasted the codes in our code book to existing data visualization design models (e.g., the nested model for visualization design and analysis [7]). Through conversation, we identified themes in our data that went beyond these existing models.

Our interview questions focused less on the data visualization itself and asked about the process of a design brief, creative freedom, ambiguity, and success. Thus, our interview themes covered topics of negotiation, conflict with clients, trust, and the ways in which the designer builds a relationship with their client. In discussing the interviews, we coalesced around the idea of a 'project space' in which both the designer

[2]We attempted to recruit 16 clients involved in data visualization projects, but only one was interested in participating. We discuss these limitations and the client perspective in Section VI.

and the client had mental representations of the project, which would overlap to some degree. We distilled our codes into three main factors of the project space: goals, resource allocation, and design. These themes emerged as central to understanding the dynamics of the client-designer relationship and provided a framework for further analysis and discussion.

IV. Themes

We organized the themes of our interviews into three topics: goals, resource allocation, and design. These reflect situations where client and designer can have mismatched expectations. We highlight the ways in which stakeholders align these through negotiation. We focus on a common tool: client briefs. Briefs reflect an imperfect, but helpful, social object for negotiation and alignment. Because of our data collection strategy, our focus in this work is largely through the designer's view. Thus, our view of clients' perspectives is largely through the designer's interpretation.

Perhaps unsurprisingly, an important aspect of our findings is the wide variety of designers, clients, and projects. One common designer response to many questions we asked was *"it depends."* Clients and projects vary significantly, each requiring different structures, considerations, and ways of interacting. Due to these differences, we **highlight** the main themes, but also recognize that there are nuances. We explore the differences, mitigating factors, and reasons why the design process and communication patterns differ.

Another important point of emphasis was around the topic of creativity. One of our interview questions was: "How do you think about flexibility and creative freedom when working with clients?" As we heard from many designers, 'creative freedom' is an ambiguous concept that they interpret in different ways. Responses included discussions of design space exploration, choosing chart types, aesthetics/artistic freedom, working conditions, and self-expression. In our analysis, we focus on creative freedom in terms of how much the designer controlled the encoding decisions for the visualization solution.

A. Goals

Critically, we found that client and designer have their own individual goals, motivations and specifications for the project. Through examples, we illustrate how client and designer goals overlap and diverge and how friction and conflict can develop.

When starting a project, clients often, but not always, seek a data visualization designer because they have a coherent goal. Generally, designers prefer that clients provide a solid base of information at the beginning of the collaboration. The client may have fully formed specifications and come to the designer with a brief in hand. However, in cases where the client goal is more vague, they may need the designer's help to surface goals. Designers would like to know the specifics of the goal, but these may not always be easy to obtain. One designer [E1] succinctly noted that *"a good client would have a brief, a bad client does not have a brief."* The same designer also noted that, unfortunately, most clients do not have a brief. Another designer [A5] recalled that a client had told her, *"here's the numbers and do whatever [you] want with it,"* starting the project with data but without real goals. If client goals are ambiguous or undefined, designers can elicit information through kick-off meetings and workshops to create design briefs or other materials. These sessions ideally surface all requirements at the beginning of the project. Leaving requirements out (or changing your mind halfway through the design process) could create challenges as a project progresses. In some situations, client goals may be incomplete or insufficiently detailed. Some designers described probing for deeper information. One designer [D5] described asking his clients many questions, each time getting more and more detailed information, remarking *"I don't let them stop at the first answer."*

In some cases, we found that **designers may have personal goals that are distinct from the client's goals**. For example, the designer may have the goal of strengthening the relationship with the current client in order to gain positive testimonials or continued work. For freelancers, the project might serve as an advertisement for potential future clients. One designer [D12] described this as, *"I want to make something that is interesting for the next client to see."* Current or past projects are one way to show expertise and skills to future clients. Thus, the designer might want to design the project to fit both the specifications of the design brief and also be an exciting and appealing project that they would be proud to show off.

In addition to career goals, designers may have personal design preferences. Some designers described wanting to create data visualizations that are beautiful, novel, or fun. A designer [D3] described a personal goal as, *"I want to do something like, a little bit avant garde"*, and as another designer [D9] described, *"I've created something, you know, that [is] so beautiful."* Designers may feel more personal satisfaction from creating novel and aesthetically pleasing visualizations. These goals will influence the design of the visualization, even if the client does not particularly care about these aspects.

The client may have goals that are not held by the designer. Goals could be broadly defined and include things like visualization specifications but can also encompass business goals. For example, one designer described his client's goals as *"Can we accelerate [our] sales process?"*

The **designer's goals and the client's goals will overlap to varying degrees**. A project that has a lot of overlap indicates that they are in agreement and aligned on what would be a successful outcome for both of them. Ideally, the design brief will interest both the designer and the client, though we found that this is only important to some designers. Designers described projects where they were personally interested in the topic, or said that projects should be interesting to both the designer and the client, *"the briefs have to be open somehow, to have an interesting project development both [from] the designer's perspective and the client's perspective"* [D2].

On the other hand, **there may be areas where the client and the designer do not overlap at all**. The designer's desire for a fun and beautiful visualization could clash with the client's expectations or needs. In contexts where data visualization will be used for business analytics or governments, clients (or users) may expect or need a minimalist aesthetic

design and standard chart types. For example, government sector clients expect *"a level of simplicity and cleanliness and familiarity that they want to convey to the public"* [D3]. Another designer [D9] had clients who wanted minimal charts for quick insights, *"the clients are mostly people who belong to upper management and higher management... They're gonna have a look at the report for 30 seconds, make their decision and move on. So it has to be very succinct."* In cases where the designer's personal goals conflict with the client's, the designer tend to prioritize the client's goals.

Through the process of talking to the client, the designer can sometimes negotiate the direction of the project space. Because clients are not data visualization experts, designers can sometimes specify project goals that are more in line with what the client *needs*. One designer [D2] described distilling the client requests *"in terms of what they want, and what they actually need."* This hones in on the essentials of what the client goals are, and focuses the project. The designer could also shape the project goals towards the strengths of their skillset or towards their own personal interests. *"I shape the brief for the client's sake, but also taking into account what I know best and what I can have fun with. So it's a... win win."* This process of negotiating the project goal space can benefit both client and designer.

To summarize, the client and the designer have their own distinct goals and motivations for the project, and these may overlap completely, partially, or not at all. In surfacing these goals, clients may have a clear idea for the brief, or may need help forming a specification. The designer can also negotiate the direction of the project space to influence the brief.

B. Resource Allocation

The resources of a project could encompass the time allocated, deadlines, budget, and data availability and access. All of these factors will influence the scope of the project and how it is executed. As with goals, designers and clients may have different priorities on what they want to dedicate resources to. For example, a designer might want to spend more time exploring the design space or doing user testing, while the client may not see the value in this.

The client may restrict data availability and access. Most of our designers like to start the project by gaining access to the data and learning about metadata. However, sometimes the client is unwilling to share the data for privacy reasons. This situation is likely uncommon in most other types of client-design work. This restriction on data access can cause friction in the design process. One way clients work around this is to provide 'dummy' data, or fabricated data based on actual data. Due to the commercial sensitivity of a project from the design studio [E1], the designers worked with dummy data to populate the prototype on their end, while when the prototype was in use on the client side, it was populated by the actual data. The dashboard project was intended to be a replacement for numerous existing report-making processes in the company and brought together all of the data into a universally used dashboard. As such, the intention of the dashboard was to draw in multiple datasets from data vendors using a custom-built API. Working with dummy data prevented the designer from knowing what the real data looked like. This restriction to the data could influence the design of the visualization. Visual encodings that could work with the dummy data could be less effective or unsuitable for the real data. Even within an internal company, we found examples of clients restricting data. One designer [D5] describes, *"we have a reporting team, and they actually do all of our SQL queries for me. We established a kind of arm's length, so I don't have direct access. It's kind of a bummer."* Restrictions on data access add a level of friction to the design process.

Designers can negotiate with clients to collect data and connect it to goals. While the client often comes to the designer with data in hand, this is not always the case. A few participants mentioned having agency in collecting or finding data: *"very often... I have freedom also in collecting the data"* [D2], and *"maybe we can find another data... or we can ask for it, or we can build it"* [D12]. In addition to collecting data, designers can help clients make connections between their data and goals. As part of their process, one designer [D4] described *"lining up the data to say like, can we even answer this [question] with what we have?"* Some clients might know what their goals are, but may need the designer's help to connect goals to data.

Some designers described **deadlines and budgets as the biggest constraints on the project**. Designers may want to create a visualization that is interesting and that they are proud of. However, this might not be feasible given the resource allocation, particularly if the deadlines and budget are set for the bare minimum product. One designer [D1] reflected that if there was extra time left at the end of the project, he would be able to add features that were not necessarily in the requirements (e.g., accessibility or aspects that would improve the visualization): *"But you finish early on, then you make it more accessible, which, you know, adds some marginal benefit, but benefit nonetheless, you feel better about it. Like, you sleep better at night."* He also described working extra toward personal goals while not increasing the budget. *"Maybe you wanted to experiment with a new chart type, apply a gradient, apply some interesting flourish that the client didn't ask for. And you're not going to charge them for it, then have fun."* Another designer [D12] explained that he had a personal goal to create a visualization that he would want to showcase for future clients. His client did not have a large enough budget for him to explore interesting solutions. Therefore, this designer would work additional hours on the project in his own time to create a solution that is interesting and fun (see Fig. 1). The allocation of resources to a project will constrain or enable a designer to achieve their personal goals.

The client and the designer *negotiate* what the resource allocation should be, dedicating more or less time to things the designer cares about. For example, one of our designers [D8] described a project where the client tried to prescribe a solution and didn't want to allocate time at the beginning for exploration of user needs. The designer negotiated the resource allocation, saying *"we kind of convinced them that, okay... please allow us at least one week of user research."*

This additional time dedicated to understanding the space led to a better outcome for the project.

In summary, a visualization project necessarily requires allocation of resources, such as time, money, and data. Deadlines and budgets are often features of client relationships, and can be negotiated at the beginning of the project to suit both client and designers needs. Data as a resource is more specific to data visualization projects. Thus restrictions on access may introduce friction in the design process.

C. Design

Both client and designer are likely to have a model (possibly changing) of the visualization's design. Here is where the designer has more experience making decisions. However, this does not mean that clients do not try to influence design. For example, our designers noted that clients sometimes prescribe chart types, leading to friction. The general belief is that although the designer usually drives the design aspect of the project, the client should still feel empowered to speak up if a design is not working for them. The dynamics of the relationship between the client and designer rely on mutual trust to find a design that works. However, there are power dynamics at play given the client's financial levers on one side and the designer's expertise on the other.

The client should trust the designer to lead the encoding design decisions. Most of our designers assumed or expected the freedom to choose the encoding techniques. In the designers' view, most clients do not have expertise in data visualization. Therefore, the client should let the designer take the lead on searching for and suggesting visualization encodings. One designer [D5] described not allowing the client to prescribe a specific chart type. He guides the client: *"I won't say we can do whatever you want. I'll say, from what you're describing, it sounds like something like this would be helpful. Is that right?"* Designers often mentioned that trust was a primary factor for whether the client would let the designer lead the encoding decisions. Trust might also be earned over repeated projects with a client. One designer [D1] described this as, *"if I can deliver results on time, or early, consistently enough, then I generally earn their trust...And they let me do what I need to do to help them reach their goals."* This designer explains that the client initially prescribes chart types but eventually realizes it is faster and easier to specify their goals and let him decide on the chart type. Ideally, a client would trust the designer from the beginning, but sometimes this trust develops over time. Trust between the designer and client can mediate creative freedom in the design process. However, a lack of trust could lead some clients to try to control encoding decisions and ask for specific chart types.

Client-prescribed encoding decisions lead to friction within the design process. Designers described an occasional client who would request or demand a specific chart type. Often, this led to friction in the design process. Designers had varying levels of pushback to these types of requests. One designer [D9] said requests would be noted, but his team would ultimately develop the wireframe. He described this as: *"there are cases where the clients have also come up with the wireframe, and we do honor it."* Some designers indicated that they would try to explain to the client why their suggestion was not the optimal solution. One designer [D11] described, *"I always try to make the clients understand why this is not good...fortunately they listen to me 90% of the time."* Another designer [D5] went further and conducted demonstrations to help the client understand the reasoning behind their choice of chart types. When a client said that they needed a pie chart, he described what he might say, *"Why do you want that? What are you looking for? What if I showed you the same data in a pie chart and a bar chart, and I don't know, a line chart. Now tell me, don't forget your question is X, which one of these gives you the answer the fastest?"* This designer is not just telling the client what the data visualization best practices are. He is also letting them experience the difference the chart types can make on user tasks. This demonstration usually leads the client to understand the designer's rationale for encoding decisions, potentially increasing trust in the relationship. Through this negotiation, designers can convince clients that there are better solutions than the chart type they have prescribed. However, these negotiations slow down the design process, requiring more time for the designer to explain their perspective to the client.

Designers noted that **clients should voice concerns over encodings that they have trouble understanding or are not useful to them**. Several indicated that a successful project would be one that the client actually uses, implying that they don't always succeed in this. One designer [D9] described this situation as the *"technological equivalent of a trash bin because nobody is going to use it"*. Another designer [D5] described trying to encourage his clients to speak up when a solution does not fit their needs. He explains,

> *"People can be unwilling to say, 'That isn't meeting my goals.' 'Great, it looks beautiful. Thanks.' And that's when they don't use it. Because they haven't told me, 'I don't know what I'm looking at. I don't know what I'm supposed to click on.' Well, good night, tell me! I will redesign that so that you know what to click on. I'm not designing these things to hang on a museum wall. I'm designing them to be used in every day work. And so sometimes the tension is that there's not enough tension. They're not willing to push back and fight for what's going to make it work for them."*

In a client-designer relationship, the designer will have more expertise about data visualization, but if the client doesn't actually use the final solution, then it's not successful. In more successful interactions, the client negotiates changes and revisions if they think the data visualization solution will not be usable and useful for their needs.

Another theme in our analysis was around **the presentation of multiple options to the client for feedback**. Many designers described presenting the client with several options during their design process, which is a common design practice. Presenting potential designs to the client makes the process easier, as one designer [D5] described, *"you can give feedback*

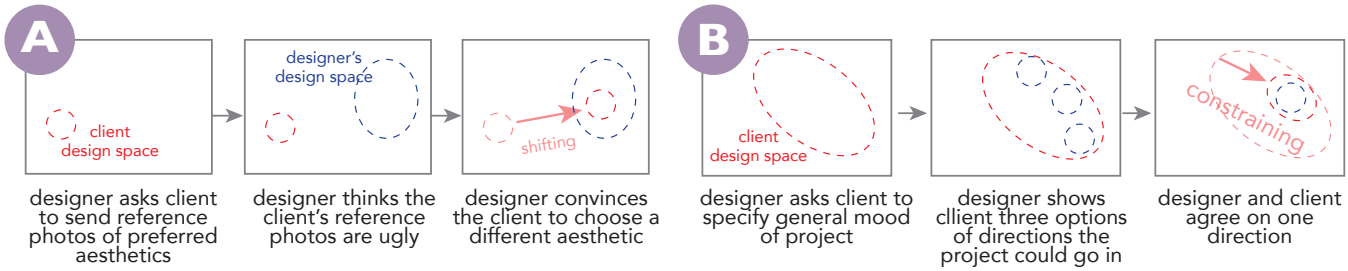

Fig. 2. Two examples of how clients and designer's mental models can change during the design process. (A) The client and designer negotiate the aesthetic design space. (B) The client and designer collaborate to choose an aesthetic.

on a thing more easily than you can build the thing. And so if I come to them, and I say, 'Okay, let's sketch this out together,' they're gonna have no idea what to do." In creating a few options, the designers are driving the process of choosing the chart type and are shaping the direction of the project. One participant [D3] describes this as, *"this is a spectrum of things that we could do to show it, and what I'm really trying to get them to go for is not the most basic, but also probably not the most complicated."* As the designer shows the client a range of options, they can control which options they show and influence the client's choice by how they present them. One designer [D4] describes it as, *"you'll give them different directions of... themes or moods or aesthetics that we could go for. And you kind of give them a set of choices. And you kind of stack the deck to make sure that you like all of the choices."* The designer used the phrase "stack the deck," to mean manipulating the client, but as shaping the direction of the project to be in line with his preferences. Presenting options lets the designer be more in control of all the choices (see Figure 2B).

In summary, designers believe that the design of the visualization should be led by the designer, which requires trust from the client. However, clients must also trust in the relationship to feel empowered to voice concerns about visualizations that might not work for them. The discussion of which design is the best solution may require some negotiation. One way to introduce collaboration between the client and designer was presenting multiple options and soliciting feedback.

D. Negotiation

Within the design process, both the client and the designer need to negotiate goals, resource allocation, and designs. One way to capture these aspects is with a design brief. The design brief is a document that serves to document the details and requirements of the project to create a shared understanding between the client and the designer. Design briefs can act as an imperfect representation of the client's goals, resource allocation, and potentially, design. Thus, design briefs can act as social objects. Clients can come to the project with a fully formed brief. However, some designers described design brief creation as co-creation. One designer [D3] characterized the design brief as *"a living and moving document"*. Through the process of creating the brief, clients and designers negotiate to resolve differences. We note that while common, briefs were not universally used (e.g., [D8] noted that they used *"no formal design brief or anything as such"*).

The use of design briefs varied across our participants and also across projects. Some designers described using very detailed design briefs, like [D11], *"what I'm trying to do at the very beginning is having like a super organized structure"*. Others indicated occasionally using a design brief, adjusting their workflow depending on their client. One designer [D3] described this as, *"I've had projects use very scripted design documents, and I've had projects that use less formal or no documentation. And I'm not sure that ... either way is better or worse. It always seems to me that like, the more time you can spend with your client talking about it, the better."* Design briefs may be too rigid to work across the wide variety of clients and projects. Due to the variability between different projects, some designers feel that a structured design brief is not flexible enough. One designer [D5] mentioned that each project is unique in some way, so the questions that were very helpful to ask in one project would not even apply to another. Another designer [D1] described many questions he would ask in a design brief and said, *"there are plenty of questions to ask. And I do try to calibrate those depending on the client and the audience."* There is no 'one-size-fits-all' solution for briefs. While some designers have a set template, others customize questions based on the client and project, and others forgo a formal document.

Design brief usage may vary on the structure of the designer's relationship with the client (e.g., freelance vs. internal). Freelance designers depend on satisfying the client to be paid for the project. Additionally, freelancers often rely on word-of-mouth recommendations, testimonials, or repeat clients to get more work. Design briefs can be useful to document agreed-upon success criteria to ensure that a project results in payment. For one freelance designer [D2], documentation is *"[a] lifesaver for me in case there are problems or issues along the way."* Documentation may be more critical for freelance designers who have more insecurity and instability in their employment. Designers who work for in-house clients might have different constraints affecting their use of design briefs. One drawback to design briefs is that creating them takes up valuable time that could be allocated to more essential tasks. One designer [D9], working internally within a company, said the working environment did not value

documentation because it was focused on being fast-paced. He described, *"since we are operating in Agile, there is very less documentation,"* and that a design brief would take too much time to create and update throughout the process when things change. Still, even designers that do not use design briefs have some documentation. This same designer [D9] described, *"we do maintain some sort of understanding documents... our understanding is aligned with their understanding."* Designers create other types of documentation to record specifications for their own use and to align expectations with the client. These include writing notes, recording meeting minutes, and email documentation.

In the client-designer relationship, the designer has some control over what information they elicit from the client and how they will use it. Designers often ask clients questions about the colors, fonts, aesthetics, and mood of the project. However, the way that the designer elicits this information can lead to more or less creative freedom later in the design process. Sometimes, a client may need to follow company brand standards and will be constrained by specific aesthetic guidelines. Sometimes, there might be very permissive aesthetic guidelines, giving the designer a wide range of creative freedom. One designer [D11] always asked her clients to send *design* information: reference or inspiration photos and preferred fonts and colors. This designer elicited detailed information about the client's aesthetic preferences. In some cases, this led to friction if they sent her back ugly or outdated styles. She would then need to spend time explaining why their reference photos were less than ideal, negotiating a better aesthetic. However, another designer [D4] only elicits information about higher-level *goals*, such as the audience and the tone of the piece. Then, he provides the client with options for different mood boards and aesthetics. In this way, eliciting only higher-level information gives him more freedom to direct the aesthetic direction of the project later (see Fig. 2).

In summary, a design brief can act as a representation of the shared agreement of the project goals, resources, and potentially design. While a brief is not necessary to have a successful project, the process of creating one can be a useful tool to support negotiation between the client and the designer.

V. A Client-Designer Model

Using our analysis, we theorize a model called a *project space* for client-designer interactions in a data visualization project (see Figure 3). Within this space, there are three interacting aspects: goals, preferences for resource allocation, and design considerations of both the client and the designer. Each aspect reflects the current *state* of the client and designer and the overlap between them. More specifically, each circle in the model represents the client's or designer's mental models and their instantiation: design briefs, prototypes, budgets, contracts, etc. That is, there is the client's project space, the designer's project space, and the overlap between them.

For example, the designer and the client will come to the project with their own initial goals that encapsulate a set of motivations, preferences, and initial specifications. Client and designer goals are likely to overlap, but the degree of this overlap can be highly varied. The project space model captures a specific snapshot in time. As the client and designer's mental models change or move—ideally bringing the parties into increased agreement about the details of the project—the project space will change. In turn, goals will influence the preferences for resource allocation–how much money the client is willing to spend; and how much the designer expects to earn and how they will allocate their time. Both goals and resources will naturally influence the visualization design. As with goals and resources, the way the client and designer perceive the evolving design may be different.

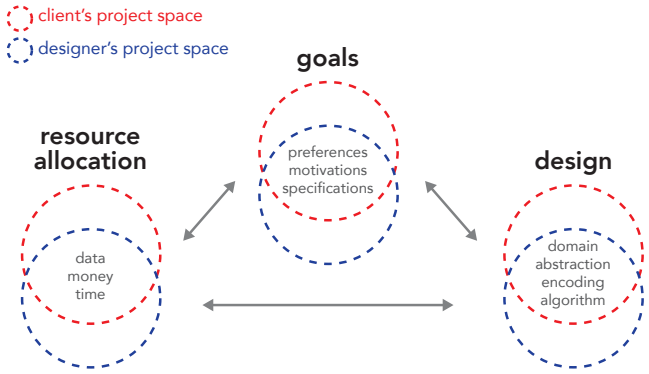

Fig. 3. Data visualization designers have three main parts of the project space for client work. The first component is goals, which is about the motivations, personal goals, and specifications that each person brings to the project. The second component is resource allocation, which is how much time and money is allocated to the project, as well as data availability and access. The third component is design, which encompasses both generative design processes and evaluative design processes. These parts of the project will influence each other.

A. Project Space

Goals. The first aspect of the project space model focuses on the goals of the designer and the client. These goals are potentially overlapping, where both parties have a similar vision of what they want to achieve from the project. The client's specifications will encompass the requirements for the data visualization–as far as they understand them at the start of the project. However, goals may also include adherence to constraints, which may influence encodings. The client's motivations might be more broadly about business goals, increasing sales, making processes more efficient, or being a data-driven business. The designer will come to the project with their own goals. They may be interested in maximizing profits, adding a great new piece to their portfolio to advertise their skills to new clients, furthering their relationship with their current client, or winning data visualization awards. The initial set of goals in the project space may be ill-defined with each part helping the other to make this aspect suitably concrete. For example, based on their experience, the designer could help the client distill a vague list of project goals into clear and concise specifications. Insofar as they will motivate decisions, aspects like aesthetic preferences form part of the client and design goals.

Resource Allocation. The second aspect of the model focuses on the preferences and constraints for resource allocation for the project. Both the client and the designer have resources they can allocate to the project. This aspect encompasses the most common resources in client projects, such as budget and time, but also resources that are more specific to data visualization, such as data availability and data access. While these are clearly constrained (e.g., an upper bound on budget or minimum costs to build a project), both designer and client may have additional preferences on allocation that are determined by their goals and preferences. Similarly to the first aspect of the model, the designer's and client's resource allocation preferences may overlap, where they both agree on resource distribution. However, the designer could value spending time on parts of the project that the client does not care about, such as design space exploration or user evaluation. Where the client and designer's spaces do not overlap, there may be room for negotiation. For example, the designer may need more time or money than the client originally wants. If the client cannot expand the timeline or budget, there could be a negotiation about the scope of the project.

Design. The final aspect of the model is the visualization design. The designer has data visualization expertise and usually drives progress in this aspect. However, the client is also involved in this process, sometimes weighing in on different options, giving their feedback for what works for them, or prescribing chart types. As with the first two aspects, there is also room for negotiation to bring the client and designer into alignment on what they both agree is an acceptable solution. The allocation of resources directly influences the design and development process, as the client and the designer decide how much time and effort to devote to generating and evaluating the visualization. While 'resources' serve as a key lever for controlling design, the initial designer and client goals (e.g., specifications or aesthetic preferences) can also directly influence the visualization's design and prioritize or rank design concerns (e.g., the domain tasks).

The three aspects of the project space will naturally affect each other. For example, the designer and client's goals will influence the resource allocation and design for the project. The goal of making a beautiful or interesting visualization will drive the design decisions for the visualization. A designer or client's goal for creative freedom would influence their preference for resource allocation. We found that creative freedom varies by project and client. Some data visualization professionals are known for doing creative pieces, and clients want to work with them because they are looking for novel and original designs. Others create more standard visualizations, such as dashboards or applications, that do not require visually novel solutions. For designers that want more creative freedom, this might manifest in resource allocation that allows the designer more time to explore the design space of options. Conversely, the project resource allocation could constrain the designer's goals. A project with tight deadlines and small budgets could lead to final designs that are not as creative as the designer might want. The goals and constraints of the project can balance the range of creative freedom for the design. Surfacing goals at the beginning of the project can help set boundaries for what the designer might have creative freedom over (or not). For example, if the audience for the visualization is people with low data literacy, the designer will be restricted from designing complicated and novel charts.

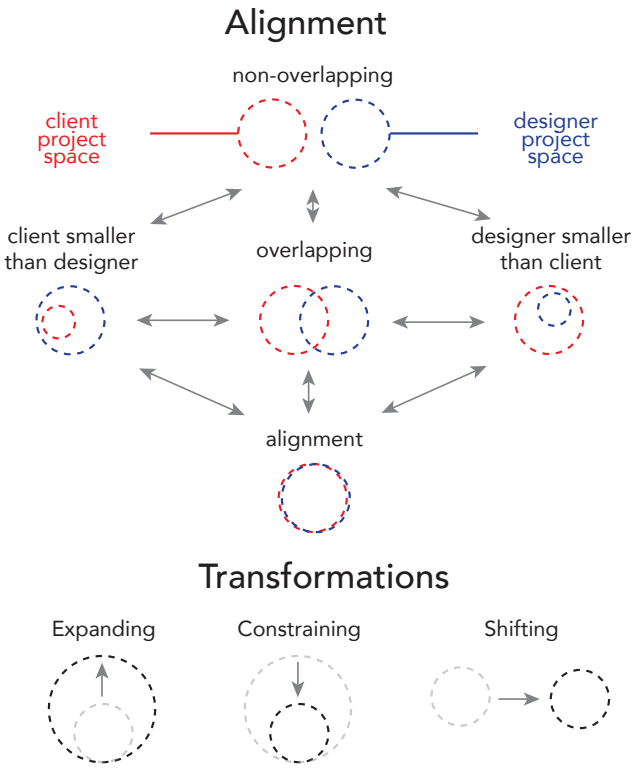

Fig. 4. A diagram of how the alignment of the clients' project space and the designers' project space could change from one state to another. One potential situation is that the clients' project space and the designer's project space do not overlap at all. An ideal situation is when the client and designer are in perfect alignment and agreement about the project space. In the middle, there are varying levels of overlapping and differently sized project spaces. Project spaces have three main transformations to transform from one alignment to another: expanding, constraining, and shifting.

B. Alignment of Project Spaces

Non-overlapping project spaces: One of the less ideal scenarios is that the client's project space does not overlap with the designer's at all. The potential features the designer envisions (e.g., designs, goals, or resources) differ from those the client has in mind. In this situation, the two parties cannot come to an agreement that both find acceptable. When the designer and the client are in this situation, the result is frustration or negotiation. An example of this disagreement could be that the client requests a specific chart type that the designer believes is not in line with data visualization best practices. Putting their name on a suboptimal design could jeopardize the image of their professional brand and threaten to alienate future clients. However, the designer may feel pressured to implement this solution if their income depends on pleasing the customer and finishing the project (e.g. if they are in a freelance position). Another example of a nonoverlapping project space could be that the designer has

suggested a data visualization solution that the client does not understand how to read or use. While the client may have a certain amount of power through financial levers, they may nevertheless feel pressured to accept the solution or not feel comfortable voicing disagreement.

Overlapping project spaces: A closer alignment would be if the designer and the client's project space overlaps. In this scenario, there is some agreement about an acceptable project space. However, both may consider additional potential options as viable or desirable that the other does not. This overlapping scenario can still lead to a successful project as long as the final solution ends up in the overlapping area of the project space.

Designer's project space is much smaller: Sometimes, aspects of the designer's project space will be much smaller than the client's. In this scenario, the client would have a broader range of potential features they would consider. One example could be that the designer has already narrowed in on (what they believe is) an optimal solution. Ideally, through communication, the designer could convince the client that the project space should be narrowed to where they suggest. In practice, this could look like a meeting between the client and the designer where the designer presents several options. At the beginning of the meeting, the client's project space may be wide if they do not have a clear idea of which direction the project should go. At the same time, the designer has already chosen a few potential directions, narrowing down the project space into a smaller subset. As the designer presents the options to the client, the goal is not just to narrow the project space to the few options presented, but to pick one of them to pursue. By the end of this meeting, the designer's project space will hopefully be constrained to an even smaller space as the client gives input on which option might be the best. Ideally, by this point, the project spaces will be aligned.

Client's project space is much smaller: In some cases, aspects of the client's project space may be smaller than the designer's. This is similar to the previous scenario, except the range of possible acceptable features is larger for the designer. The budget is one clear example where the client's desired allocation is far smaller than the designer's. Another example is if the client has pre-existing opinions about what the chart type should be (e.g., if they believe only a pie chart would be acceptable). This may lead to the client prescribing a visual encoding solution. The designer may have a much larger set of possible options if they consider other chart types as potential solutions (potentially even better than the one the client prescribed). Additionally, the client might not be aware of uncommon chart types that could be solutions to their problem. Since the designer has more experience and knowledge about visualizations, the designer might have a larger repertoire of chart types that they may be considering.

Aligned project spaces: Ideally, the designer and the client will reach a state where they align on the project space. Perfect alignment is often impossible to achieve—the design could always be more refined, the budget could have been bigger or smaller, evaluation could have taken more or less time, etc.—but sufficient alignment can nonetheless lead to a good outcome. An indication of good alignment is that at the end of a project both the client and the designer agree on the final design. This is not to say that aspects of the project space need to be precise or refined. In fact, alignment could occur if the client has little or no restrictions and is happy to accept the designer's chosen solution.

Designers and clients communicate and negotiate with each other to transition between these different states. The shape, size, and overlap of a project space can change over the course of the project. **Expanding** is to expand the boundaries of the aspects of the project space to include more potential solutions. An example would be the designer showing the client new chart types they were previously unaware of. Then, the client's project space expands to include more potential solutions. **Constraining** narrows the project space by ruling out possible features. An example of this would be the process by which the designer and the client start with a few options, and they narrow down the options to choose one direction to go in. **Shifting** would be adjusting the bounds of the project space to move away from one feature and toward a different feature. An example would be the designer convincing the client that their prescribed chart type (e.g., pie chart) might not be the best and that a different chart type (e.g., bar chart) is a better solution. The client shifts their mental model of the possible solution from pie chart to bar chart.

C. Negotiation

Throughout our interviews, we saw that designers and clients negotiated a shared understanding of the project space through discussions, design briefs, and design processes. As an additional stakeholder in the project, the client brings opinions, expectations, and works with the designer to surface project goals. Threats to the project may arise when the client and the designer have disagreements about the project space, resulting in non-overlapping alignments. We describe ways that clients and designers navigate these situations and negotiate to reach a better alignment state.

There were many quotes in our data that described negotiation, but we will focus on one as an example, as illustrated in Fig. 5. This designer's [D5] ideal process is transforming the project goals that the client has described into a data visualization solution that follows best practices. However, the designer also described a scenario of *negotiation*, where the client prescribes a specific chart type that is not in line with data visualization best practices. The designer negotiates with the client to lead them to understand why a bar chart or line chart would be better. In this way, the designer is trying to *shift* the client's design space to overlap with his. This discussion will ideally lead to more alignment in their project spaces, and lead to a final solution that is acceptable to both parties.

Communication between designers and clients serves to narrow the boundaries of the solution. At the very beginning of the project, the project space is wide open. As the client and designer discuss the needs of the project and generate specifications, they align expectations of boundaries of where the solution needs to fall. The client and designer's mental models of the project spaces shift over time during the process of the data visualization project, as the requirements may start

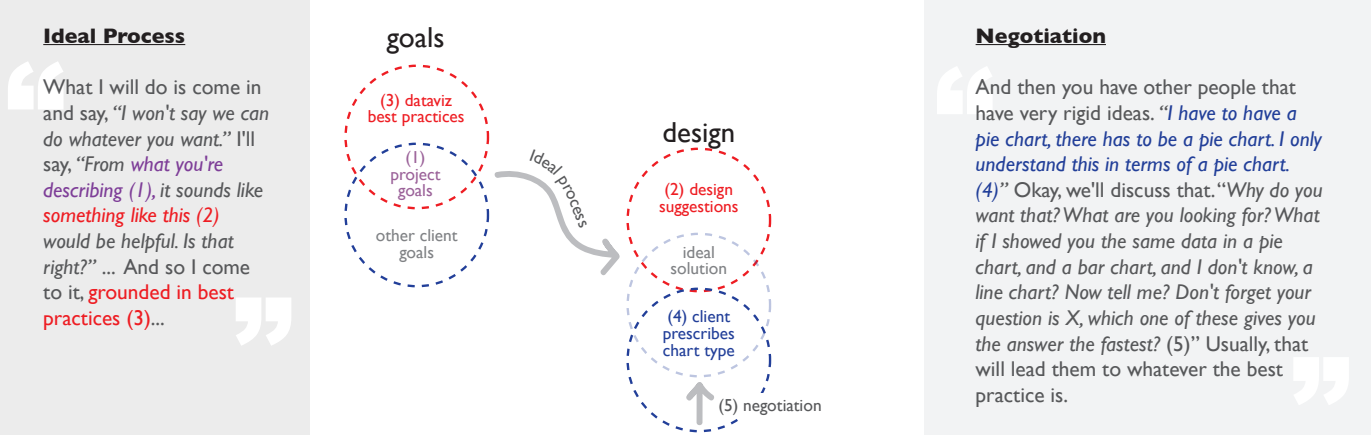

Fig. 5. An example of a client-designer [D5] relationship illustrated in the model.

vague (and project spaces potentially far apart), but eventually, the project culminates into a final design (and hopefully one that lands within both parties' project spaces of acceptable solutions). A design brief can be one way to elicit information, document decisions, and gain shared understanding. When there is a disagreement about some part of the project (non-overlapping project spaces), negotiation can help bring the client and designer closer together and find common ground.

VI. Discussion

Briefly, we contrast data visualization design work with similar design fields. In addition, we provide suggestions for how practitioners can leverage this work to improve client relationships in their own projects. Finally, we discuss limitations of the current study and opportunities for future work.

A. Data Visualization Compared to Other Design Work

In this paper, we focus on how data visualization designers work with clients. In Section II, we discuss ways designers work with clients in other fields, such as graphic design, advertising, and architecture. In many ways, working with clients is similar in these fields, although the design process may differ. Data visualization design introduces additional constraints that are not in other fields. For example, a graphic designer and a data visualization designer might both have the same goal of making the product aesthetically pleasing. For a data visualization designer, the visualization design must also work with the shape and form of the data. This constraint is especially apparent when clients restrict access from the data or provide 'dummy' data [15].

Visualization design is in many ways more free of constraints than other fields (e.g., an architect's physical constraints or lawyer's legal constraints) but may be more constrained than others (e.g., advertising and graphic design). Data visualization design is a 'wicked problem'—there will be design decisions made as tradeoffs to find an acceptable solution [6]. Some fields may not have 'wickedness' as deeply embedded in their work. For example, a software engineering project might have a list of feature requirements. However, these projects may not need to make certain tradeoffs—beyond what time allows—all features can be added. Visualization design is more complicated as an indeterminate problem without set bounds or clear solutions, and often requires creative iteration. Therefore, while there are some similarities to requirement engineering, the element of the shape, trends, and limitations in the data necessarily introduces another layer of constraints beyond what a client might set out for goals. Not all visualization problems are 'wicked.' However, room for exploration and creativity might be more essential for visualization design compared to software engineering.

Other communities have acknowledged the separation of project aspects. For example, in legal interactions with clients one can separate 'negotiation of reality' (the goals) versus 'negotiation of responsibility' (who does what/when) [51]. Our model attempts to more clearly isolate the key features of a negotiated visualization project (e.g., to explicitly include a broader theme of resources that goes beyond personnel).

B. Implications for Designers

We suggest a few lessons for data visualization designers to consider. Our taxonomy may provide a shared framework for discussion or negotiation. Additionally, insights from our research can help designers who work in collaboration with others, whether that be a freelancer-client relationship, researcher-domain expert, or designer on a team of multiple collaborators. These recommendations are based on successful approaches observed in our analysis. However, we acknowledge the differing needs and requirements between clients and projects.

First, the designer should negotiate the visual encoding if the client is overly prescriptive. Clients who insist on specific chart types could be requesting a sub-optimal final product. The designer should feel empowered to negotiate more freedom to choose or at least explore more design options. Allowing the designer to use their expertise to recommend and explore more options will be more likely to lead to a better solution. Additionally, the designer is creating a product that will have their name on it, and will reflect the quality of the work that they do. If the designer produces a low-quality product that will be seen by potential future clients, then their reputation

may be compromised. Allowing the designer to have control over the visual encoding is beneficial to both the client and the designer. In the context of architects, Franck et al. analogize this relationship as being a 'good enough mother' to the client. That is, being sufficiently present and responsive to the client but separate enough to enable creativity [25].

Second, the designer should try to get specificity in client goals. Clients may have vague goals and give the designer a lot of freedom in design. Although this might be advantageous in some ways, the designer should still make sure that the design works for the client. Having a solid understanding of the client goals will reduce the likelihood that the team reaches the end of the project and the product does not work for the client.

Finally, a strategic approach could be for the designer to control what information they elicit from the client. The designer can gain important information about the goals of the project while still leaving themselves freedom to figure out the best solution. For example, the designer could ask the client about their goals for mood and tone, rather than examples of preferred aesthetics. This strategy is beneficial for the project because the designer may have more expertise in design and can suggest good aesthetic options depending on the tone of the project. This approach is advantageous for the designer, as it can prevent the client requesting an 'ugly' or outdated aesthetic that the designer does not agree with. This tactic balances the control between the client and the designer; it allows the client to specify the desired mood and tone, while allowing the designer to make design decisions about what aesthetics might best achieve those (see Figure 2).

In negotiation, both parties try to convince each other to accept their offers or demands. Negotiators will be more effective if they are able to convince the other that they have a right to make an demand or deliver rewards (or punishments) [46]. To this end, our work may give credibility to designers to negotiate terms of a client brief. As creative professionals, designers have a legitimate power to request creative freedom and this increases the likelihood that the end result of the project will be beneficial to the client. As opposed to a 'zero-sum' outcome, negotiation can lead to a win-win situation for all parties. Importantly, the ambiguity around 'creative freedom' often necessitates the designer and client to build a shared understanding of the term.

C. Limitations and Future Directions

In this study, we found that the projects, clients, and designers had a lot of variation between them. One limitation, given our sample size, is that we are unable to discern differences between certain combinations (e.g., projects with high versus low requirements for artistic freedom). Additional interviews would allow us to better isolate differences.

Our interview study focuses on talking to designers, not clients. Thus, our view of the client's views were through the perspective of the designers. Data from the ethnographic study included sessions of designers talking to clients, but follow-up interviews were only with the designers. To try to learn more about the interactions from the client's perspective, we attempted to recruit clients. We reached out to 16 potential clients, two responded to our email, and only one agreed to participate in an interview. This resulted in a low response rate of 6%. This low response rate is likely because we were cold-emailing clients—often guessing who at the organization may have been in charge of the data visualization project—or emailing a generic email. We intentionally chose not to try to recruit the clients of the designers we talked to. Although this may have been a more successful method, we did not want to negatively influence the relationships between the clients and the designers. Questions about how the client's goals and designer's goals differed might have highlighted situations where the designer pursued their own goals at the expense of the client's.

Although we were only able to talk to one client, he corroborated the themes of the designers. At the beginning of the project, he indicated that he had no clear idea of his goals. Additionally, this client shared that he restricted data availability and access and would not allow the designer full access to the dataset due to privacy reasons. Instead, he shared dummy data, which was fabricated data based on real data. This resulted in some friction and conflict during the design process. The client recognized competing interests between him and the designer, saying *"I was trying to avoid sending more than was essentially needed for the, like getting the first draft kind of thing, and [the designer] was kind of trying to get as much as she possibly could from the data, so that she could use that as part of the process for designing the visualizations."* Furthermore, basing the design on the dummy data led to issues once they plugged the real data into the design they had created. Design adjustments were necessary to deal with differences between fabricated and real data. In this specific case, the client valued creative freedom, and specifically noted that he *"didn't want to impose too many constraints."* This provides more evidence that leaving encoding decisions out of the design brief may be in the client's best interest as well. While we heard from many designers that freedom around visual encodings was preferred, this supports the theme the client should trust the designer to lead the encoding design decisions. Future work should explore new methods of finding and contacting clients in order to learn more about the client-designer negotiation from the clients' perspective.

Another limitation of our study is what designers are willing to say or admit during these interviews. Designers may avoid revealing if they were deliberately creating visualizations that were not in the best interest of the client. They may also be less likely to describe their own failures in the process. Since these interviews were done over video or in person, there may be some reluctance to speak freely about their intents and behaviors. One specific unaddressed theme was that of power. Differences in negotiating power were implied, but not directly addressed in our data. However, these are worth considering in that client-expert relationships demonstrate 'dominating' and 'dominated' relationships (e.g., corporate clients may be dominant over the legal counsel [51]). Future work might use an anonymous survey to capture these aspects.

In our designer recruitment methods, we sent out recruitment messages on social media and the Data Visualization Slack. This might have biased our sample to recruit people

who are more likely to be engaged on social media and Slack channels. In the future, another recruitment method, such as reaching out to a list of design firms. Additionally, using the term 'clients' might have biased us to recruit more freelancers. However, in-house designers might have similar relationships with the people they work with and not have the same terminology. A screener survey asking designers about how they work with different stakeholders could potentially connect us to more in-house designers. Therefore, we cannot say our findings are necessarily generalizable to all designers in all types of professional relationships with clients.

While we use the singular form 'designer' and 'client' in this work for simplicity, we did talk to designers who worked in larger groups. For example, we observed that in a design firm designers negotiate both internally and externally to align their shared project spaces, through discussions on goals, and resource allocation. The designers internally negotiate their shared designer project space which is subsequently negotiated to align with the client project space. As such, while our model is abstracted to flatten the role of designer and client, we believe it is scalable to represent multiple stakeholders.

Additionally, the insights from this work could be impactful for the visualization research community as well. In an analogous researcher-domain expert relationship, academics might aim for visualization solutions that prioritize novelty similar to how a designer might aim for creativity to win awards. Such relationships often manifest in visualization design studies [10]. The researchers have a personal and professional goal to publish a paper, which necessarily requires some amount of novelty. However, novelty would be an additional goal outside of the project goals—it is not necessary for the domain expert as an acceptable solution. This may not necessarily be a conflict, but could require negotiation around design solutions that fit both the researcher's and domain experts needs.

Furthermore, visualization researchers can use our model to analyze interactions between clients and designers. The client-designer model is a theoretical contribution to the literature. The social relationship between the client and the designer can affect the success of a project. Therefore, it is important to study what friction points may exist and how to best negotiate the different aspects of the projects. Future studies could use our model to analyze interactions in the client-designer relationship to provide more insight into the data visualization process.

We developed this model based on interviews with data visualization designers, but we have not evaluated its use within a design process. In some ways, it is not meant to be used as a practice resource. For example, because projects are varied and not all projects even take advantage of a design brief, this is not intended to be a model that a designer brings to a client. Rather, it is a theoretical representation of aspects within the client-designer relationship.

VII. Conclusion

Data visualization design with a client, external or in-house, involves unique aspects of the design process that a designer would not experience on a solo project. In addition to considering typical constraints such as design and technical requirements, designers also have to deal with interpersonal relationships and effective communication. The client will bring to the project their own goals, preferences, and opinions about what success would mean for the project. Besides wanting to satisfy the client's goals, the designer also brings their own personal goals, such as receiving positive testimonials, improving their portfolio, or creating a fun visualization. In cases where the client and the designer have disagreements on what the project should be, this can cause friction and lead to sub-optimal solutions. Our work analyzes and theorizes the ways in which the client and the designer conceptualize *project spaces*. We introduce a model that captures both client and designer views. Although the process of negotiating the project space is messy and challenging, we identify ways in which effective communication can lead to a successful project and to continuing relationships between the client and the designer.

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