

Conversations are central to our relationships and our social systems. As conversationalists, we have rich intuitions about the intricacies of interacting with another person, and the profound value in building up mutual understandings over the course of a conversation. In fact, many important professions rely on having good conversations: consider doctors discussing treatments with patients, faculty advising students on career choices, or therapists counseling individuals through psychological turmoil. How do these conversationalists navigate through complex and challenging interactions to help someone else? By developing ways to systematically address this question, we could unlock great improvements in domains such as public health and education, where access to social support is crucial.

I develop frameworks for analyzing conversations. Through these frameworks, I aim to provide actionable understandings of conversations—understandings that can help conversationalists more effectively navigate through consequential real-world interactions. For instance, a method that identifies what leads to more effective conversations could shape how we train mental health counselors to provide better care for people; a method that highlights particularly difficult aspects of conversations could inform how we support these counselors in the midst of an interaction. My research focuses on designing computational tools that systematically examine large conversational datasets to derive such actionable understandings. These tools have been used to distill insights in domains that are driven by conversations: political discourse [EMNLP 2017],¹ online collaborations [ACL 2018], and crisis counseling [ACL 2019, ACL 2020, CSCW 2020a].

Two key ideas structure my efforts to develop these actionable frameworks. First, conversations are joint activities: what we say constantly shapes and is shaped by the actions of the other people in the interaction. These interactional dynamics are interesting, challenging and meaningful for conversationalists—so the frameworks we develop must place them at the fore. Second, conversations take place in the context of broader projects: running governments, facilitating collaborative work, supporting people in mental distress. To help conversationalists be more effective—and, more fundamentally, to clarify what effectiveness entails—our frameworks must account for these tasks and the roles that conversationalists play within them.

Taken together, these imperatives necessitate a research agenda that couples methodological depth with a broad, interdisciplinary perspective. I aim to chart and realize this agenda. To develop methods that are grounded in broader projects, I have collaborated with domain experts from fields spanning political science, economics, and psychological counseling. In operationalizing my collaborators’ intuitions and curiosities as computational approaches, I have developed novel methods that can systematically analyze conversational dynamics—crucially, ones that are significant to conversationalists, and to the endeavours they facilitate. These collaborations have inevitably surfaced research questions that span across disciplines. As such, my work has pursued new research directions, melding natural language processing, computational social science and causal inference.

Modeling interactional dynamics in conversations

Conversations are joint activities:² they emerge out of the back-and-forth exchanges between multiple people. This essential interactivity undergirds our conversational experiences: at every turn, we make choices about how we intend to engage with or influence other people. For instance, consider a psychological counselor trying to help an individual in a counseling conversation. Through the interaction, the counselor tries to gain an understanding of their situation, foster a sense of empathy and trust, and guide them towards a calmer state.

A key component of my research is developing methods to capture and analyze such inherently conversational phenomena. For instance, when a conversationalist says something, what role do they intend for that utterance to play in the interaction? By systematically addressing this question across a dataset of conversations, we could build better understandings of the choices conversationalists make when they interact.

In this vein, I have developed a versatile computational framework for inferring *conversational intentions* from conversational data. As a point of departure, many existing techniques in natural language processing (NLP) aim to characterize the linguistic content of utterances. However, taken in isolation, the words in an utterance often

¹ Citations in square brackets reference the publications listed in my CV.

² Clark. “Using Language.” 1996.

don't explicitly signal where its speaker intends to take the conversation. As such, these methods fall short of meaningfully capturing interactional properties. The richness of real-life conversational settings present further challenges for conventional NLP paradigms. For instance, in a supervised learning pipeline, a predefined annotation scheme would foreclose on the possibility of discovering the diverse range of intentions that could occur in complex scenarios like counseling. Obtaining labeled data for such a procedure would also present practical hurdles, especially in a specialized or sensitive domain.

To address these challenges, our key intuition is to bootstrap our understanding of an utterance from its *conversational context*—i.e., what precedes and what follows it. We operationalize conversational intentions as *expectations* about what typical predecessors or responses to an utterance will look like. To set these expectations, we examine the predecessors and responses of similar utterances—i.e., those with similar phrasings—in existing conversational data. In this way, we can relate the linguistic form of an utterance to the role we expect it to play in the interaction, and hence the conversational intentions it encapsulates.

To package this intuition as an analytic tool, we start from the distributions of the predecessors and responses corresponding to an utterance, and derive various statistics and vector representations to summarize these distributions. Retracing the steps of our operationalization, these statistics then characterize various aspects of the utterance's conversational intention; I've developed methods to compute some of them. Crucially, these methods are unsupervised: they rely on information intrinsic to the conversation rather than on extrinsic supervision from annotations. As such, we can apply them across a variety of settings while flexibly accounting for the particularities of a domain. Indeed, I have applied this general framework to examine how politicians engage in different types of discourse, to derive predictive signals of eventual conflict between collaborators, and to concretely describe conversational difficulties faced by crisis counselors:

Inferring the rhetorical role of questions [EMNLP 2017]. Questions embody a rich variety of rhetorical functions, especially in socially elaborate settings: consider question periods in the British House of Commons, in which members of parliament take turns posing questions to government ministers. With Arthur Spirling, a political scientist with expertise in the domain, we developed a method to infer the rhetorical intentions of questions asked in these question periods. Following our framework for modeling conversational intentions, we operationalized the rhetorical intention of a question as the types of answers it is expected to receive. If two questions elicited similar answers, we would infer that the questions were likely asked with the same intent: “How can you justify...?”, like “Will you apologize...?” both tend to provoke pointed rebuttals. Via a linear algebra approach, we derived low-dimensional vector representations of questions based on their expected answers, with the property that questions with similar representations are expected to prompt similar responses. Clustering these question vectors then induces a typology of questions by rhetorical role.

We applied this method to examine over 200,000 parliamentary questions, inferring question types spanning information-seeking, self-promotion and criticism, among others. Even without the guidance of any manually applied annotations, these types aligned with known properties of the domain highlighted by our political science collaborator. We also demonstrated the method's analytic utility, applying it to a salient question in scholarship of the domain: how does a legislator's tenure shape their contributions to the discourse? Via a longitudinal analysis of question-asking behaviours over three decades of parliamentary sessions, we found that more senior legislators tended to ask more antagonistic questions than more recently-elected legislators, suggesting that these older members play a more aggressive role in holding the government to account.

Relating intentions to conversational trajectories [ACL 2018]. We used our approach for inferring question types to predict whether a discussion between Wikipedia editors eventually derails into uncivil behaviour—a problem endemic to online settings and crippling to healthy collaborations. Here, our method derived various ways that a discussion comment aims to direct the subsequent interaction, e.g., via remarks for coordinating work or queries about facts in an article. We find that the interactional roles we extracted—represented as vectors—are indeed predictive of conversations going awry. We also identify particular intentions tied to this outcome—bluntly questioning factual validity is related to derailment down the line, while coordinating work signals discussions that stay civil. This application underlines the adaptability of our framework to different domains and analyses.

Examining the interplay of addressing and advancing [ACL 2020]. Beyond prompting subsequent exchanges, utterances can also seek to address what was previously said. Managing these forwards and backwards intentions presents challenges that I came to appreciate while collaborating with Crisis Text Line, a service providing crisis

counseling via text message conversations. I had many valuable opportunities to learn about counselors' experiences and inform my research: I completed the service's counselor training program, took part in some conversations, and had several discussions with staff who trained and supported counselors.

In a counseling conversation, the counselor must ensure the conversation progresses towards a resolution, while making sure to empathetically address what the distressed individual has said. A particular difficulty that the service's staff noticed—and that I found myself struggling with—was striking a balance between these imperatives. Overzealously advancing forwards could rush the conversation and short-circuit the process of establishing empathy; leaning too much on looking backwards and addressing what was already said might stall the interaction without guiding the individual towards ways to cope.

To systematically examine this challenge, we derived a measure, *orientation*, that quantifies how each utterance balanced between these forwards and backwards intentions, and modeled the balance as a comparison: does the utterance more strongly aim at advancing forwards, versus addressing backwards? Following our framework, we measured the strength of these forwards and backwards intentions as the *variation* of observed responses and predecessors—i.e., how spread out these responses (or predecessors) are when embedded in a vector space.³

We measured the orientation of counselor turns across 1.5 million counseling conversations. We showed that the measure interpretably aligns with conversation strategies explicitly taught to counselors—e.g., statements that reflect on what was said are more backwards-oriented, while prompts to problem-solve are more forwards-oriented—even though it is derived without the guidance of pre-determined labels. We also demonstrated that the measure can signal a conversation's progress and effectiveness, perhaps suggesting ways to track progress or to expand the training program to guide counselors in managing conversational balances.

Relating conversational dynamics to broader tasks

Conversations play important roles in consequential endeavours. For instance, crisis counseling conversations supplement a broader agenda to reduce mental health problems. Examining conversations in this wider context surfaces new questions: how might conversationalists change their behaviours over the many conversations they participate in? How can we identify particularly effective conversationalists? Providing actionable answers to these questions requires a multifaceted understanding of conversations and conversational settings. As such, the frameworks I've developed in this direction have integrated ideas across disciplines, spanning NLP, computational social science, and causal inference.

Examining linguistic development across conversations [ACL 2019]. Around a quarter of counselors with Crisis Text Line take over 120 conversations during their service. In such settings, where conversationalists go through such lengthy careers, an understanding of how they might change with experience could be crucial to supporting them throughout their tenures. Examining this trajectory would be particularly informative given the necessity of learning from experience: an initial training curriculum can orient conversationalists towards broadly-specified practices, but cannot cover the varied situations they will inevitably encounter.

We developed an approach to track the development of conversationalists in terms of their language use, applying it in a longitudinal study of over 3,000 crisis counselors. Drawing on conversations with people who trained counselors, and on my own nerve-wracking experience as a new counselor, our hypothesis was that counselors often had a hard time “finding their own voice” beyond the linguistic patterns presented in the training materials, sounding detrimentally robotic as a result. We modeled a counselor's linguistic individuality and adaptability via information-theoretic measures of linguistic similarity, finding that with experience, counselors indeed tended to become more distinctive and flexible in their language. In further analyses, we found lexical trends hinting at potential developmental mechanisms—an increased familiarity with domain-specific concepts, a relaxation towards a more colloquial and perhaps personalized tone, among others.

Quantifying the causal effects of conversational behaviours [CSCW 2020a]. At first blush, the findings revealed through analyzing conversations seem to naturally imply ways of improving them. For instance, I found that conversations in which counselors' choice of language exhibit more positive sentiment tend to get better ratings from the people they talked to in post-conversation surveys—suggesting a promising policy of encouraging

³ One intuition here is to compare leading questions—which point to a specific answer—with open-ended questions—which allow for a range of responses.

counselors to be more positive. However, correlational findings—including those between linguistic patterns and conversational outcomes—do not immediately translate to practical prescriptions. It may be easier to be positive with individuals who are easier to help, and who more readily give good ratings. If the correlation simply reflects such differences in the severity of a situation, then it does not provide any indication of whether positivity would be helpful for individuals suffering through more difficult and draining circumstances.

To distinguish between correlations and actionable insights, we need to meld approaches that analyze conversational patterns with those that address causal questions. Such a perspective, while foreign to past studies of conversations, is pervasive in fields like economics, political science and epidemiology; conversely, these fields do not conventionally deal with conversations. With Sendhil Mullainathan, an economist, we drew on the causal inference literature to formally describe the task of identifying causal effects in conversational settings like the counseling service, and the challenges involved. We identified concrete ways in which the interactive nature of conversations complicates causal inference, and also pointed to methods that, with certain assumptions, could circumvent these difficulties to inform particular types of policies: those that identify and allocate more conversations to effective conversationalists. Applying our arguments to the counseling setting, we empirically showed how correlational approaches could overestimate the relation between a behaviour and an outcome, and how more careful analyses could better estimate the potential effects of a policy.

Future work

I am eager to continue developing frameworks that lead us towards deeper understandings of how conversationalists interact, how they play parts in broader endeavours, and how we can help them.

Modeling conversational trajectories. Many conversational phenomena arise over multiple turns. For instance, fostering trust is instrumental in settings like in crisis counseling, where counselors must build connections to total strangers experiencing turmoil. Such processes could also go off course, as when a question is misinterpreted or deflected. I plan to develop methods that model longer-term conversational trajectories, to better understand how they unfold and how they might be disrupted and recovered. These insights could inform ways to help conversationalists work through conversational troubles during crucial processes like trust-building.

Frameworks for causal inference in conversations. Will doing particular things in a conversation—asking an open-ended question, forgetting someone's name, giving advice—lead to better or worse outcomes? Addressing such causal questions is crucial in informing policies for making conversationalists more effective—training them, giving real-time suggestions during a conversation, among others. I'm especially drawn to the opportunities for technical and theoretical innovation on this front: existing techniques in causal inference are overstretched by characteristics that are essential to conversations, such as the richness of the linguistic behaviours involved and the complex contingencies that emerge over extended back-and-forth interactions.

Towards a more holistic view of conversations. Analytic frameworks that can model conversational behaviours, and that link behaviours and outcomes, do not automatically point us to the behaviours that are worth examining, the outcomes that matter, and the policies that could help. I plan to explore and integrate perspectives on conversations across a wider range of scholarship to address these gaps. Theoretical frameworks and approaches from fields like anthropology⁴ and sociology⁵ could enrich our understanding of conversationalists' experiences. Developing a richer sense of a conversation's impact calls for more holistic studies on its societal context; here, I plan to look to fields like public health and policy for valuable precedents.

The broader importance of conversations continues to be recapitulated in recent events: consider the present importance of contact tracers tasked with prompting people to disclose information about the spread of a disease,⁶ or the increasing recognition of public health risks posed by loneliness, that underline the need for improvements in the provision of social support.⁷ The conversationalists in these endeavours must be selected, trained, and supported, and our ability to help them rests on developing rigorous, actionable ways of illuminating the conversations they take part in. I'm excited to chart a research agenda that moves us towards these understandings.

⁴ Gumperz. "Discourse Strategies." 1982.

⁵ Jefferson. "Talking About Troubles in Conversation." 2015.

⁶ Becker. "This Contact Tracer Is Fighting Two Contagions: The Virus and Fear." The New York Times, 2019.

⁷ Holt-Lunstad et al. "Loneliness and Social Isolation as Risk Factors for Mortality." Perspectives on Psychological Science, 2015.