A Dynamic Dyadic Systems Perspective on Interpersonal Conversation

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Abstract

Conversations between people are where, among other things, stressors are amplified and attenuated, conflicts are entrenched and resolved, and goals are advanced and thwarted. What happens in dyads' back-and-forth exchanges to produce such consequential and varied outcomes? Although numerous theories in communication and in social psychology address this question, empirical tests of these theories often operationalize conversational behavior using either discrete messages or overall features of the conversation. Dynamic systems theories and methods provide opportunities to examine the interdependency, self-stabilization, and self-organization processes that manifest in conversations over time. The dynamic dyadic systems perspective exemplified by the articles in this special issue (a) focuses inquiry on the turn-to-turn, asynchronous exchange of messages between two partners, (b) emphasizes behavioral patterns within and the structural and temporal organization of conversations, and (c) adapts techniques used in analysis of intensive longitudinal data to identify and operationalize those dynamic patterns. As an introduction to the special issue, this paper describes a dynamic dyadic systems perspective on conversation and discusses directions for future research, such as applications to human-computer interaction, family communication patterns, health care interventions, and group deliberation.

A Dynamic Dyadic Systems Perspective on Interpersonal Conversation

The study of interpersonal communication is founded on the notion that people engaged in conversation encode thoughts into symbols, draw inferences from behavior, and experience both personal and relational consequences from their interactions with others (e.g., McLeod & Chaffee, 1973). A wide range of theories and programs of empirical research elaborate how characteristics of the people participating in an interaction, such as their traits and cognitive and emotional states, shape their communication experiences (e.g., attachment style, Kafetsios & Nezlek, 2002; mental health, MacGeorge et al., 2005). An equally robust literature addresses how conversations – whether face-to-face or mediated – contribute to important outcomes (e.g., conflict resolution, Thomson et al., 2018; emotional improvement, Jones & Wirtz, 2006) and shape the impact of pre-existing conditions on those outcomes (e.g., relational well-being, Pietromonaco et al., 2021). As depicted in Figure 1, the underlying theoretical framework that is shared across this body of work assumes that conversations are shaped by the individual and shared qualities partners bring to an interaction episode, and that conversation produces individual and shared outcomes. Although the inputs and outputs summarized in Figure 1 are often clearly specified, the inner workings of conversation are typically less detailed. In this sense, features of conversation are hidden within a black box, which refers to an unelaborated system or process assumed to connect inputs to outputs. Our overall aim is to advance theory and research on interpersonal communication by offering a framework to illuminate the contents and processes inside the black box at the center of Figure 1.

Articulating the inner workings of dyadic conversation makes manifest the nuances that reflect conversational antecedents and shape outcomes (e.g., Howland & Simpson, 2014; Knobloch et al., 2006), thereby enabling more precise tests of theoretical claims. Consider, for

example, prevailing theories about supportive communication (see Jones & Bodie, 2014), which propose that a conversation in which one partner discloses to another about a personal stressor has greater potential to foster emotional improvement when that conversation is constructed of highly supportive and nurturing content. This reasonable theoretical proposition aligns with empirical data that clearly show people prefer discrete highly person-centered messages (High & Dillard, 2012), and they report feeling better after interacting with a confederate trained to enact these discrete messages within a 5-minute conversation (Jones & Wirtz, 2006). Inspection of the messages within supportive conversations, however, shows that most of the speech acts that occur are cursory or mediocre talk at best (i.e., moderately person centered), and it is that kind of talk that leads to emotional improvement (Jones et al., 2018). How can we reconcile these divergent conclusions about supportive conversation? Theoretical progress requires that researchers improve the veracity of conclusions about consequential interpersonal processes by moving beyond the analysis of discrete messages or whole conversations and considering conversational dynamics.

Efforts to elucidate the dynamics of dyadic conversations – that is, the interdependencies and emergent patterns that manifest within the ordering and sequencing of turn-by-turn interchange between dyad members – are prominent in the history of the communication discipline (e.g., Burgoon et al., 1993; Cappella, 1985; Poole et al., 1987); however, this work is not mainstream in the contemporary study of interpersonal communication. The reasons for the relative lack of research on conversation dynamics are straightforward: Conceptualizing conversational dynamics is challenging, and the time, human efforts, and computational tools for obtaining and modeling turn-by-turn data have been neither widely disseminated nor adopted (see also, Hewes, 1979). As Hewes (2016) observed, tools for the sequential analysis of

conversations "have a long history but are seldom used" (p. 1550), and "scholars interested in the science of communication would do well to think sequentially and to apply these methods" (p. 1553). To this end, we offer a dynamic dyadic systems perspective for conceptualizing conversational phenomena that informs strategies for analyzing data derived from conversations.

To begin, we locate our thinking within the broader domain of research on interpersonal communication and dyadic conversation. Then, we explicate dynamic systems concepts and discuss tools for illuminating features of conversations. Along the way, we clarify where examples can be found in the empirical papers collected within this special issue. The focus of these studies include: (a) supportive conversations that unfold face-to-face or via text chat (Rains et al., 2023); (b) conflict interactions of older adult dating couples (Blickman et al., 2023); (c) emotion regulation interactions between parents and adolescents (Theiss et al., 2023); (d) experimental manipulations of peer-to-peer esteem support (Holmstrom et al., 2023); and (e) conversations between female graduate students in STEM fields and their academic mentors (Gandhi et al., 2023). To conclude, we discuss directions for further theoretical and methodological advances using a dynamic dyadic systems perspective.

Studying Dyadic Conversations as Dynamic

The word *dyadic* refers to an entity made up of two units. The word *dynamic* has somewhat more varied meanings. One connotation emphasizes the volume of energy, power, or potential contained within an entity. Another meaning, and the one on which we focus, refers to change in response to internal or external factors. In our view, dyadic conversation is dynamic because each turn is both contingent on what has occurred before and an innovation that shapes future turns. This perspective on conversation hearkens back to Goffman's (1956) characterization of interpersonal interaction as an improvised theatrical performance in which

people enact identities with each other. In sum, then, our approach emphasizes the emergent unfolding that occurs as each person communicates in response to and in collaboration with the other.

Although conversations between two people are inherently dyadic, theory and research on interpersonal communication typically does not embrace the dynamic aspects of dyadic interaction. Many theories and corresponding methods of analysis emphasize either the production of messages by one person in the dyad (e.g., action assembly theory, Greene, 1997; message design logics, O'Keefe, 1991) or the processing of messages by message recipients (e.g., relational framing theory, Dillard et al., 1996; the dual-process model of support; Bodie & Burleson, 2008). In research that considers both members of the dyad, a common approach is to utilize dyadic talk as an experimental intervention (i.e., an exposure that is present or absent) and assess perceived outcomes post-conversation (e.g., Itzchakov & Weinstein, 2021). Other procedures involve generating quantitative ratings of an interaction episode (e.g., Howland & Simpson, 2014; Sillars et al., 2014) or aggregating summaries of specific features of conversational segments (e.g., speaking turns; Overall, 2020; Rains et al., 2019) to examine how the total sum of activities are related to post-conversation outcomes for each partner.

Notably, research concerning the dynamics of conversations was more prominent toward the end of the last century than it has been in the current one. As case in point, the first edition of the *Handbook of Communication Science* featured an explication of interpersonal communication that foregrounded turn-to-turn conversational behavior and the mutual influence processes that connected interlocutors (Cappella, 1987); but that emphasis is absent from the second edition of that handbook, published in 2010. Certainly, pioneers in the study of overtime patterns of convergence or divergence in conversations, along with their collaborators, continue

to occupy an important place in the communication discipline (e.g., Dragojevic & Giles, 2014; Dunbar et al., 2014). Nonetheless, as Courtright (2016, p. 1442) noted:

> …the amount of scholarship on this topic published since the turn of the century is quite meager. As those original scholars fade from the research scene, younger researchers are not taking their place. Simply stated, observational research is demanding, and new scholars may well be intimidated by its difficulty, as well as uncertainty about its publication.

In sum, although research highlighting sequential features of conversation is not wholly absent from the study of interpersonal communication (e.g., Canary et al., 2009; McLaren & Sillars, 2020; Samp, 2013), the analysis of conversational dynamics remains relatively uncommon.

Resurfacing this line of work, we hope to highlight how attention to dyadic dynamics can enhance our understanding of conversations and their impact. In a previous paper (Solomon et al., 2021), we organized our exploration of a dynamic dyadic systems approach around five layers of inquiry that reflected increasingly complex analyses of conversational behavior. The idea was to elaborate progression from describing the set of behaviors enacted during specific kinds of conversations to examining between- and within-dyad differences in the timing and impact of multi-turn segments of dialog. In retrospect, emphasis on five layers of inquiry may have confounded the conceptualization of conversation dynamics with serial deployment of specific analytic tools. As an alternative, this paper prioritizes conceptual issues at the core of theorizing about interpersonal communication from a dynamic dyadic systems perspective. We turn to an explication of those concepts next.

Dynamic Systems Concepts

The changing, interconnected, and complex emergent relations among multiple entities – from cells to people to societies – can often be conceptualized and studied as dynamic systems. Over the past several decades, researchers have fruitfully transported ideas from general systems theory (Bertalanffy, 1968) and mathematics of complex systems (Haken et al., 1985) developed in physical and biological sciences into study of a wide variety of social and psychological processes, including human development (Thelen & Smith, 1994), family dynamics (Cox & Paley, 1997; Minuchin, 1985), social dynamics (Tuma & Hannan, 1984), and communication (Han & Lang, 2020; Watt & vanLear, 1996). A *dynamic system* is a set of interdependent elements or entities that share functions, boundaries, goals, and identity as they change together over time (see Newman & Newman, 2020, Chapter 4). In our case, the dynamic system of interest is a dyad consisting of two individuals that influence and change one another over time during a conversation. Our scientific goal is to describe, explain, predict, and potentially help modify how these conversations unfold over time. To this end, we revisit three fundamental properties of dynamic systems.

State Space

A prerequisite for describing and modeling the dynamics of dyadic conversations is to identify the set of behaviors that are or can be enacted during the conversation – the *state space*. Conceptually, the state space is a comprehensive accounting of the full range of behaviors (e.g., behaviors, emotions, cognitions) that could manifest during a dyadic conversation. Practically, the state space defines the components of the system (i.e., two individuals) and all the many ways the components of the system can behave. In the case of dyadic conversation, the state space is defined by the full array of speech acts each member of the dyad might enact, and the examination of dynamics describes how the dyad moves through the state space.

Research on interpersonal processes has developed numerous coding schemes to describe relevant aspects of the state space associated with different kinds of conversation (see Van Lear & Canary, 2016). In classic research, Rogers and Farace (1975) conceptualized interactions between married partners as a series of statements that expressed a bid for dominance ("one-up" statements), expressed deference to the partners ("one-down" statements), or were neutral with regard to expressions of relational control ("one-across" statements). More elaborated coding schemes for conversational behavior are exemplified by Canary and Seibold (2010) and Sillars (2018), who differentiated a variety of specific tactics or moves that occur within conflict interactions. The studies assembled within this special issue demonstrate a variety of schemes to define the state space for conversations. Blickman et al. (2023), for example, uses a two-dimensional conceptual framework to characterize speaking turns in conflict interactions as direct positive, indirect positive, direct negative, indirect negative, neutral, or off-task. Illustrating an alternative approach, Holmstrom et al. (2023) coded speaking turns into seven categories based on the type of speech act that the turn performed in the context of a supportive conversation. In Gandhi et al.'s (2023) investigation of mentor-mentee conversations, coding focused on independent clauses within speaking turns, which were categorized using Stiles's (1992) verbal response mode taxonomy and then used to identify seven distinct speaking turn profiles. The application of these sorts of coding systems to recorded and transcribed conversations produces the raw data needed for describing and examining conversational dynamics – in other words, how dyads move through that state space.

Self-Organization: Interdependencies, Attractors, and Repellors

As noted previously, a key feature of dynamic systems is that the elements of the system are interdependent. For a dyadic system, this suggests that dyads' movement through the state

space – the trajectory of their conversation – is shaped by the *joint* action of the two members of the dyad. In the aforementioned research on relational control, Rogers and Farace (1975) distinguished between domineeringness, as a quality of individuals manifest in their tendency to express one-up statements, and dominance, which is evident in a two-turn dyadic sequence in which a one-up statement by one individual is followed by a one-down statement by the partner. Empirical evidence also highlights how the form and content of what one person says in a speaking turn is influenced by and influences what the other person says and does. Research on marital conflict communication, for example, has revealed the prominence of sequences in which one partner expresses dissatisfaction or criticism and the other responds by deflecting or avoiding the issue (e.g., Caughlin & Scott, 2010; Sillars et al., 2014). Within this special issue, the study by Gandhi et al. (2023) illustrates how conversational sequences are defined by the behavior of both partners, such that a sequence in which a mentee elaborates on a concern that a mentor acknowledges is distinguished from sequences in which the mentee elaborates on a concern and is met with advice or, alternatively, the mentor's own elaborated disclosure.

A related, general principle characterizing dynamic systems is *self-organization* (or self-assembly), a process in which higher order forms of organization emerge from the recursive local action of interdependent components (Schöner, 2013). For example, Weger and Canary (2010) described how conflict behaviors that are manifest within thought units co-occur in interdependent patterns to form distinct argument sequences – *developing, converging, diverging,* and *rudimentary* – that facilitate or impede dyads' progress toward conflict resolution. In this special issue, Holmstrom et al. (2023) demonstrated that conversations in which people discuss a threat to their self-esteem with a supportive confederate manifest different behaviors – both at the level of overall turns and turn patterns – based on the style of support that the

confederate was trained to perform. Importantly, that study also concluded that confederates were responsive to the support seeker; in other words, their execution of their assigned role was imperfect and varied systematically depending on the conversational behavior of their partner. In dyadic conversation, the general principle is that while each member of a dyad is autonomous, the interdependencies in the system provoke the emergence of organized patterns in behavior.

The self-organization properties of dynamic systems are often described with respect to their *attractors* – specific states or sequences the system often returns to or returns to quickly, and *repellors* – specific states the system rarely occupies or that the system moves away from quickly (Hollenstein, 2013). Extending the previous examples, turn-pairs comprising dominance and demand-withdraw conflict sequences can be interpreted as attractors within controlling or antagonistic marriages, whereas these same sequences may constitute repellors within equitable and congenial relationships. Long-standing evidence that similarity in the micro-momentary features of communication is greater in conversations between partners who are favorably disposed toward each other suggests that accommodation, convergence, or synchrony are attractor states during affiliative interaction (e.g., Burgoon et al., 1987; Cappella & Palmer, 1992). Attractors and repellors are also implied by the results of the studies reported within this special issue. For example, Rains et al. (2023) observed that support seekers in both face-to-face and instant messaging conversations are more likely to change the topic after receiving a low person-centered remark from a support provider, and they are less likely to change the topic if the support provider's speaking turn is moderately person-centered. In Theiss et al.'s (2023) analysis of prominent turn-pairs in interactions between parents and adolescents, a tendency for dismissing and reactive reciprocity was observed in both parent-to-adolescent and adolescent-to-parent sequences in conversations about both unhappy and happy events. Findings such as these

point to potentially consequential attractors that can undermine supportive conversation or derail parent-adolescent interaction.

To summarize, research on interpersonal communication has long emphasized and sought to document the turn-to-turn or multi-turn sequence of moves that regularly occur during dyadic conversation. Although not often labeled as such, this work highlights turn-to-turn interdependencies, attractors, and repellors that characterize types of conversations and may distinguish dyads with different qualities. From a dynamic systems perspective – as illustrated by the articles in this issue – our interest is to discover and describe regularity in these patterns and thereby enable more precise tests of theories that address conversational inputs and outputs.

Phase Shifts: Stability versus Reorganization

Regularities in dyadic conversations suggest that the system prefers a certain topology in the state space. As systems travel along well-trodden paths (attractors) and/or avoid specific areas or locations (repellors) in the state space, they may manifest *self-stabilization* processes that keep the system in a kind of homeostasis (i.e., dynamic stability). The consequences of manifesting a particular set of attractors and repellors may be more or less desirable in the long run, depending on characteristics of the behavioral patterns, the individuals involved, and their shared context. At a general level, the extent of regularity in a system is quantified by examining the total variability in movement within the state space. Dyadic systems that exhibit a lot or little movement across the state space are sometimes characterized as relatively more or less *flexible* or *rigid*. For example, greater flexibility in dyadic emotional expression measured as the extent of variability in parents' and children's emotional expression during problem-solving tasks is associated with better outcomes (i.e., diminished aggressive behavior from the child) following

an intervention (Granic et al., 2007). These kinds of general characterizations provide one way to differentiate types of conversational dynamics and how they are related to inputs and outputs.

More specific patterns of movement within the state space may also indicate presence of specific kinds of self-inhibiting or self-exciting mechanisms. *Self-inhibiting mechanisms* occur when movement away from a stable state results in a pull back towards that equilibrium. In contrast, *self-exciting mechanisms* materialize when the occurrence of one state spurs the increased occurrence of another state. An example of these dynamics is provided by Vuchinich (1987), who analyzed patterns of family conversations to identify the emergence or suppression of conflict episodes. Vuchinich concluded that the performance of an oppositional act on one person's speaking turn becomes a conflict if a family member responds in kind (i.e., with another oppositional turn); on the third turn, the conflict is either resolved, if someone enacts conflict terminating messages, or escalated, if a family member makes another oppositional contribution. In these ways, self-inhibiting and self-exciting *feedback loops* are characterized by opposing or complementary positive and negative associations between dyad members, such as when negative comments made by one person are either counteracted by a partner's positive comments or escalated with reciprocal negativity.

Complementary to their emergent self-stabilization (overall flexibility, self-inhibiting, and self-exciting tendencies), dynamic systems may exhibit *phase shifts* wherein the patterns of organization are disrupted and the system self-organizes into a new and qualitatively different set of dynamics (Cox & Paley, 1997; Minuchin, 1985). For example, Rusbult et al. (1991) argued that conversational turns during a heated conflict discussion that validate and accommodate a partner's complaint can short circuit negative reciprocity cycles and prompt movement into a new phase of conversation. The emergence of different action patterns as a conversation unfolds

may also reflect changes in the dyad's focus as sequential subgoals are achieved. Kellermann and Lim (1990) conceptualized these phasic shifts as the scenes people move through as they enact their schema for conversation, which they called *memory organization packets* (MOPs). To illustrate, they identified a standard MOP for initial interaction that included (a) greeting; (b) orientation to each other through a reference to health, an introduction, or a positive evaluation; (c) disclosures about the present situation or relevant personal facts; (d) disclosure of personal background information; (e) elaboration concerning family or social relations; and (f) eventual discussion of more opinion-laden topics, such as religion, politics, and vices. The scenes within MOPs are intentionally flexible because dyads can move through them more or less quickly as their conversation unfolds. Another example of phasic shifts in conversations comes from Jefferson (1988) who outlined the topography of conversations about a person's stressor (i.e., "troubles talk") that commences with introducing a focus on discussing a source of stress, proceeds to problem description followed by problem solving, and concludes with resolution and ending the conversation or directing attention to a new topic. Of course, not every conversation follows the ideal arc envisioned in these lines of work. As one example, Theiss et al. (2023), in this issue, found that the prevalence of reactive-dismissive conversational sequences toward the end of a parent-adolescent conversation about an unhappy event was negatively associated with emotion regulation and the child's perceptions of parental responsiveness. The general point is that conversations often unfold through a sequence of phases, and differences in how those phase shifts are organized may then be related to differences in the antecedents and outcomes of the conversation.

Altogether, this foray into some of the features of dynamic systems invites inquiry into when and how *interdependence*, *self-stabilization*, and *phase shifts* manifest in dyadic

conversations. We contend that further probing and discovery of the inner workings of conversations – in other words, exploring the black box in Figure 1 – will benefit from more explicit conceptualization and analysis of conversation dynamics provided by dynamic systems concepts.

Tools for Examining Dyadic Conversation

Following the set of dynamic systems concepts outlined above, we point to some of the basic tools encountered in our own engagements with longitudinal data that may be useful starting places for (a) visualizing conversation trajectories in categorical *state space,* (b) identifying *interdependencies, attractors,* and *repellors*, and (c) locating *phase shifts* within the overall structure of a dyadic conversation.

State Space: Visualizing Conversation Trajectories

Analysis of conversational dynamics proceeds from repeated measurement of two persons who are interacting with one another – dyadic time series. These analyses are dependent on the measurement tools invoked in data collection/production – the specific coding scheme invoked to capture salient aspects of each speaking turn defined by the state space. Once the state space is in place, a first objective is often to simply plot and look at the data. Complementary to exciting developments in visualization of digitized conversations (Donath et al., 1999; Kim et al., 2021), we find three visualizations especially useful for exploring and identifying conversation dynamics in the kind of categorical data streams produced through turn-by-turn coding of conversation transcripts and exemplified in this collection of papers: *dyadic time-series plots*, *multiple-dyad sequence plots*, and *state space grids*.

Dyadic time-series plots. Of primary interest in the study of conversation dynamics is how conversations unfold and self-organize over time. Emergent properties of conversations are

often seen in *dyadic time series plots* of the category-coded turn-to-turn behaviors each partner enacts over the course of a conversation. As shown in the two panels in Figure 2[1], the *x*-axes index how the observed sequences of speaking (and non-speaking) turns unfolded over time for each of two dyads (see Gandhi et al., 2023, for additional examples). The *y*-axes distinguish two rows of vertical bars that are color coded to indicate the specific behavior each member of the dyad (in this case a listener and a discloser) enacted during each turn. Alternating bars indicating when each person is speaking (represented with various colors) and not speaking – that is, listening – (represented in gray) specifically highlight interdependence and joint action dynamics. The two plots presented in Figure 2 illustrate how exchange of six different types of speaking turns evolved in two very different supportive conversations (Bodie et al., 2021). In Dyad 126, we see that the Discloser spends the majority of the conversation engaged in elaboration. Interpreted from a dynamic systems perspective, the long sequence of uninterrupted green bars may indicate presence of a single *attractor* state. In contrast, the Listener shows a temporal shift in behavior from mostly acknowledging (red bars) the Discloser's statements to increasingly sharing their own perspective and experience through elaboration turns (green bars). Interpreted from a dynamic systems perspective, the changes in color indicate a *phase shift* from a problem description phase to a problem reappraisal or problem solving phase. In Dyad 190, we see a different conversation dynamic. Here, even though the task was to provide support, the Listener engaged in near-continuous elaboration (green bars) – a pattern indicative of a strong *attractor* state. Meanwhile, the Discloser provided a mix of acknowledgments (red), reflections (purple), and a question (blue) that all fit into a *complementarity* dynamic that kept the dyad in the attractor state without any *phase shift*. Together, the two plots begin to inform rich

[1] Full color versions of the figures are available in the online publication.

descriptions of the different kinds of trajectories that may emerge in the state space defined by six possible types of speaking acts.

Multiple-dyad sequence plots. As noted in Figure 1, differences in individuals' pre-interaction qualities and the shared context in which the conversation occurs may propel differences in how dyads' conversations unfold. Examining these between-dyad differences is often facilitated via construction and interpretation of *multiple-dyad sequence plots*, in which, as shown in Figure 3, each row is a separate conversation. As in Figure 2, the *x*-axis represents the temporal progression of the conversations, and color indicates the type of action each speaker engaged at each speaking turn. This visualization highlights the possibility to empirically examine how a set of conversations differ with respect to the number of turns, prominence of particular kinds of sequences, and possibility to identify different phases of conversation. Particular to this set of support conversations, the shorter sequences will have (probabilistically) traveled through a smaller portion of the state space compared to the longer sequences; the prominence of alternating green-orange and blue-green indicate self-organization around two *complementarity* sequence pairs that serve as *attractors*: elaboration-acknowledgement and question-elaboration; and the general shift over time from relatively more blue turns to more pink turns suggests that at least some of the conversations transitioned from a problem discovery phase characterized by listener questions to a problem reappraisal phase characterized by reflective statements. Here, the collection of multiple dyads' sequences supports description of the range of differences in the conversational dynamics that emerge during a supportive conversation task when viewed with respect to a state space defined by 6 types of speaking acts.

State space grids. Another useful tool for revealing characteristics of conversational dynamics is a *state space grid*. State space grids were developed in the field of developmental

psychology to represent parent-child relationships as entities in which intra-individual changes map onto system-level changes over time (Hollenstein, 2013). Shown in Figure 4, an adaptation specifically designed for dyadic conversation locates the categories defining all possible actions each person can enact on the *x*- and *y*-axes. The sequence of speaking turns enacted by each partner indicate the dyad's location in the state space grid (points) and how the conversation unfolded over time (lines). Like the classic "etch-a-sketch" toy, the person summarized on the *x*-axis controls all the horizontal movements through the state space, and the person summarized on the *y*-axis controls all the vertical movements. Starting from the white circle indicating where the dyad began the conversation, the conversation partners' joint horizontal and vertical action carries them through the state space to the black square indicating where the dyad ended the conversation (with the color of the connecting lines changing as time progresses). In this plot, the locations and overlap of the vertical and horizontal lines provide quick visual access to the organization and temporal emergence of patterns within the dyadic system. For instance, we can see Dyad 126 began their conversation with the discloser elaborating on their problem and the listener acknowledging the discloser's contribution. Dyad 126 ended their conversation when both members of the dyad were contributing elaboration turns. Generally, we can see that although each dyad occupied different areas of the state space, there were fairly well-trodden tracks – *attractors* – in each dyad. In this way, state space grids map the available conversational landscape, highlight specific dynamics that may be serving as attractors (or repellors), and indicate whether and when the conversation may be moving into a different phase or area of the landscape.

Interdependencies, Attractors, and Repellors: Identifying Sequences

Insights into the dynamics of conversations are gained by examining sequences of turn-to-turn behavior. Even the shortest sequences – the linkages between one turn and the next (i.e., lag-1 contingencies) – shed light on interdependence within the system that leads the dyad toward or away from particular kinds of exchanges (i.e., attractors and repellors). Foundational work on interpersonal processes identified and examined these kinds of turn-to-turn dynamics of conversations using a wide variety of quantitative and qualitative analysis tools, including lag-sequential models, time-series models, and formal analysis (e.g., Poole et al., 1987). Pulling from the full set of multivariate methods that have import for the study of conversation, we highlight two tools that may be useful for exploring and identifying interdependencies, attractors, and repellors: *configural frequency analysis* and *sequence analysis*.

Configural frequency analysis. Extending from sequential analysis (Bakeman & Gottman, 1997), *configural frequency analysis* – a method for identifying the (non)independence of categories (Stemmler, 2020) – may be especially useful for identification of (un)likely turn pairs that manifest in dyadic conversation. Similar to the state space grid visualizations, configural frequency analysis proceeds by representing one partner's turn behavior on the rows of a contingency table and the other partner's *subsequent* turn behavior on the columns of the table. The resulting contingency table depicting the frequency that each possible turn pair sequence manifested during conversation summarizes how often dyads visited particular locations in the state space. Statistical comparison of observed and expected frequencies provides for inferences about the specific turn pairs that are especially frequent – attractors – or especially rare – repellors. The method is proving particularly useful in parsing the dynamics of dyadic conversations because it accommodates the relatively large number of behavioral categories often needed to describe a dyadic system's state space. Rather than being constrained

to examination of 2 x 2 contingencies as in sequential analysis, configural frequency analysis affords examination and inferences about the topology of relatively large state spaces. In addition, multi-sample configural frequency analysis also provides formal tests of whether the contingencies (i.e., the attractors and repellors) governing the turn-to-turn dyadic processes differ across groups or experimental conditions (see Rains et al., 2023, for an example; see Stemmler, 2020 for information about including additional dimensions to the contingency table).

For example, configural frequency analysis of the full set of conversations displayed in Figures 2, 3, and 4 afforded identification of the attractor and repellor dynamics that manifested as disclosers and listeners traveled through a conversation state space with 6 x 6 = 36 possible turn-pairs (Bodie et al., 2021). Results indicated that the topology of this state space is dominated by four *attractors* (i.e., turn-pairs that occurred more frequently than by chance): (a) listener elaboration to discloser acknowledgement, (b) listener elaboration to discloser question, (c) listener hedged disclosure to discloser acknowledgement, and (d) discloser question to listener elaboration. That study also identified one *repellor*, evident in the suppressed likelihood of listener elaboration to discloser elaboration turn-pairs. These dynamics – which were apparent across stranger, friend, and dating dyads – underscore how easily supportive conversations can go awry when listeners draw attention to their own experience, rather than focusing on discloser's concerns. Put differently, the attractors and the repellor in these interactions reveal that listeners who use their turn to elaborate on their own perspective encourage minimal discloser responses (i.e., acknowledgements or questions) and discourage disclosers from elaborating on their own experience.

Sequence analysis. As noted earlier, dynamic patterns may manifest across a series of turns beyond the lag-1 turn pair. Self-stabilization processes, including some types of feedback

loops, may require parsing longer, multi-turn sequences of exchange. *Sequence analysis* (MacIndoe & Abbott, 2004), originally developed in biology to study and match molecular sequences in DNA strands and then adapted by sociologists to study sequences in people's engagement in education, family, and work activities across the life course (Gauthier et al., 2013), can also be used to study conversation dynamics. Although there is some hint that the method would be useful for examining entire conversations, we find the method useful for identifying multi-turn sequences of exchange that surface multiple times in and across conversations that we have called *conversational motifs* (Solomon et al., 2022). In brief, to identify conversational motifs, conversation sequences are divided into multi-turn segments/windows of equal duration or length (e.g., 1-minute, 3-minute, or 5-minute segments; 5-turn, 10-turn, 20-turn windows) and with less or more overlap (e.g., adjacent windows with zero overlap to overlapping windows with 1-turn offset). Once the set of sequences is defined, whether as full conversations or the collection of segments created by a moving window, the analysis proceeds by calculating the dissimilarity among sequences and then sorting sequences along a continua via multidimensional scaling or identifying distinguishable groups of sequences via clustering. Conclusions about the number and character of distinct types of sequences that manifest in the conversations are derived from typically used analytic tools that maximize similarity within groups and differences between groups (e.g., silhouette distance, gap statistic; Kassambara, 2017).

In our previous work (Solomon et al., 2022), for example, we identified a set of four 5-turn conversational motifs that captured distinct kinds of self-organizing exchange that manifest in supportive conversations. Two motifs reflected a focus on the discloser's information sharing, while the listener responded primarily with acknowledgement; these motifs were distinguished

by disclosers elaborating on their turns in the *discloser problem description* motif, and disclosers expressing both elaboration and hedged disclosures on their turns in the *discloser problem processing* motif. The other two motifs revealed a focus on the listener's perspective, such that both listeners and disclosers engaged in elaboration and disclosers also expressed acknowledgement in the *listener-focused dialogue* motif, and disclosers also asked questions on their turns in the *listener-focused discloser questioning* motif. As this example illustrates, conversational motifs illuminate substantively distinct segments of interaction. Moreover, once identified, between-dyad differences in presence or prevalence of specific kinds of conversational motifs around which conversations self-organize can be examined in relation to the inputs and outputs highlighted in Figure 1 (e.g., relationship type, duration, demographics, personality traits, cognitive and emotional states).

Phase Shifts: Locating Sequences within Larger Structures of Conversation

The presence and prevalence of two-turn and multi-turn sequences provides some information about the dynamics of conversation. We can also widen the lens to consider the presence and ordering of phase shifts wherein the structure of dyadic interdependencies and joint action transitions to a new set of attractors and repellors. For example, as noted earlier in Figure 2, we see that around turn 45, Dyad 126 shifts from a problem description phase marked by discloser elaboration-listener acknowledgement (a complementarity attractor), to what Jefferson (1988) would likely characterize as the problem solving phase where the listener and discloser engage in mutual elaboration. Similarly, in Figure 4, we see that both dyads started their conversations in the bottom left area of the state space, where disclosers elaborate and listeners acknowledge or question, to the right side of the state space where listener elaboration is

responded to by disclosers in a variety of ways. The analytic task of identifying when the phase shifts occur can be approached in a variety of ways.

As noted by Hewes and Poole (2012), one common approach is to divide the sequence of speaking turns into equal length portions and test for differences in the presence and prevalence of different kinds of behavior across the portions. Those authors drew upon the classic example provided by Bales and Strodtbeck (1951), who divided their coded problem-solving discussions into three segments and then tested for expected differences between segments in acts that indicated three hypothesized phases: orientation, evaluation, and control. Temporal differences in structural regularities of conversation dynamics could also be obtained by comparing state space grids describing each portion (e.g., each third) of the conversation (see Hollenstein, 2013). For example, differences in *entropy*, a metric characterizing extent of movement (i.e., variability or lack of variability in behavior) through the dyadic state space, might be indicative differences among scenes within the MOPs explicated by Kellermann and Lim (1990) or progress toward convergence and problem resolution in conflict negotiations (Weger & Canary, 2010).

A second approach is to leverage theory about the specific kinds of sequences that would be present in one or another of the hypothesized phases and the rules that govern the shift between phases. Holmes and Poole (1991) formalized a *flexible phase mapping* approach wherein speaking turn codes are transformed into phase markers by "crawling" along the time series and algorithmically applying precise rules to rolling windows of data (e.g., the initial boundary of a phase is marked as the first instance of three consecutive codes of a particular type). The resulting maps obtained from each conversation can then be normalized, described, and compared (for a recent example see Sohrab et al., 2022). A conceptually and practically parallel exploratory approach is invoked when using sequence analysis to identify conversational

motifs. Layered windowing of speaking turn pairs and then conversational motifs would, in principle, lead to identification of multi-turn phases of conversation in a completely data-driven way. To our knowledge, this approach has not yet been attempted. However, we have combined this exploratory approach with the splitting approach above. Specifically, after using sequence analysis to identify a typology of supportive conversational motifs, we found that the prevalence of the discloser problem analysis motif decreased across the first, middle, and final thirds of conversations, whereas the prevalence of listener-focused motifs increased across the three thirds of conversations (Solomon et al., 2022).

A third approach is to engage some form of trend analysis (Hewes, 2016) or growth modeling (Grimm et al., 2016). Adapting Hewes's earlier recommendations on modeling time series of continuous variables, we recently explicated dyadic *multinomial logistic growth models* for analysis of categorical conversation data (Brinberg et al., in press). This approach sheds light on how the prevalence of specific turn types changes over the course of conversations. For example, in the analysis of supportive conversations, we found that disclosers' use of elaboration was quite stable over time, whereas listeners' use of acknowledgements decreased over time as their use of elaboration increased. Extension with spline models (Grimm et al., 2016) with known or unknown timing of transition points will provide for explicit testing and/or exploration of theory- or data-derived phase shifts (see Backer et al., 2022). In all three approaches, between-dyad differences in the presence, prevalence, and timing of phase shifts can be examined in relation to the inputs and outputs highlighted in Figure 1.

To summarize, a wide variety of tools are available for examining and testing theoretical propositions about the interdependencies, self-organization, and phase shifts that manifest in conversations, and how individual or dyadic differences – whether antecedents or consequents –

are related to the identified features of conversation. New discoveries will emerge from systematic scrutinizing of the longitudinal bivariate data derived through coding systems that articulate relevant conversation state space; visualizing conversation trajectories; identifying attractors, repellors, and other patterns using configural frequency analysis (and predecessor lag-sequential) and sequence analysis methods; and identifying phase shifts and larger patterns of change using phase maps and trend analysis.

Directions for Future Research

Our objective with this special issue is to support the application of a dynamic dyadic systems perspective for conceptualizing and studying how interpersonal processes unfold in and are influenced by the nuances of conversational behavior. Our strategy for "thinking inside the black box" emphasizes (a) mapping out how conversations unfold in dyadic *state space;* (b) identifying *interdependencies, attractors,* and *repellors* that manifest in multi-turn sequences of exchange; and (c) locating *phase shifts* within the overall structure of a dyadic conversation. Differences in the trajectory maps, sequences, motifs, and phases of organization that best describe conversations can then all be examined in relation to antecedents and consequents of interpersonal processes, allowing researchers to evaluate theories about interpersonal processes with greater precision.

Although our effort to provide concrete language and tools for thinking about conversations as dynamic dyadic systems emphasized strategies for data visualization and analysis, our aims are somewhat loftier. Adoption of a dyadic dynamic systems perspective may provide for more precise formulation and testing of process-oriented theory. As long as the features of turn-to-turn conversational behavior are hidden within the proverbial black box (as illustrated in Figure 1), theories addressing *why* specific kinds of exchange between people are

consequential cannot be adequately tested. Without knowledge of the temporal order of conversational behaviors, we are left only with the frequency of turn types within an interaction. Consequently, we can only draw conclusions about how more or fewer turns of various types correspond with outcomes. This is, at best, an approximate test of theories that link what happens between people during interactions to antecedent conditions and subsequent outcomes.

Looking back at foundational work on interpersonal processes that engaged examination of turn-to-turn sequences, we recognize that the questions we raise and the answers we propose closely resemble those expressed in the past (e.g., Burgoon et al., 1993; Cappella, 1985). Not surprisingly, curiosity about the dynamics of dyadic conversation has a long history in the study of interpersonal communication. We also recognize that the challenges that redirected that curiosity to other pursuits (see Hewes, 1979; 2016) are not vanquished. We are encouraged that advances in computational capacity and greater dissemination of methodological resources will enable researchers to pick up the path charted by scholars at the end of the 20th century. Looking forward, we also note that a dynamic perspective on conversational behavior invites appreciation for temporal fluctuations in cognitions, emotions, and physiological responses that also occur during interpersonal interactions. While recognizing that we have only crossed this threshold, we suggest that a dynamic dyadic perspective can encourage movement beyond descriptive models of conversational antecedents and outcomes to theories that specify – and test – the causal mechanisms presumed to unfold in dyadic interaction.

The studies collected within this special issue point to several specific directions for future research. As demonstrated in the study by Rains et al. (2023), a dynamic dyadic systems perspective is not limited to face-to-face conversations; indeed, it may shed light on substantive differences between in-person interactions and those that are mediated. Looking further down

this path, we wonder if a dynamic dyadic systems perspective might be useful for understanding how human-computer interaction and artificial intelligence interfaces resemble or differ from face-to-face encounters (e.g., Liu, 2021; Meng & Dai, 2021). Theiss and colleagues' (2023) analysis of parent-adolescent dyads raises questions about how a dynamic dyadic systems perspective could test theoretical claims about family communication. For example, studies of family communication patterns that have offered valuable conclusions about how perceptions of family interactions are related to family well-being (e.g., Caughlin, 2003) could be evaluated within a framework that delves into the conversational features that contribute to perceptions of family patterns. The contributions from Holmstrom et al. (2023) and Gandhi et al. (2023) underscore how a dynamic dyadic systems perspective can reveal meaningful nuances in socially significant settings, be those peer-to-peer interventions in identity threatening situations or mentoring marginalized identities through adverse circumstances. These examples suggest other contexts for research on ways in which dyadic interactions are central to health and well-being interventions (e.g., Zhou et al., 2021). Finally, Blickman and colleagues' (2023) study of conflict interactions between older adult romantic partners showcases how considering conversational sequences can reveal new insights about the fabric of disputes. We also see the potential for this approach to scale up to interactions involving more than two people to illuminate the dynamics of contentious and deliberative exchange in a variety of task and social groups (e.g., Bonito & Keyton, 2022). These are just a few examples of directions for future research adopting a dynamic dyadic systems perspective.

Our explication of dynamic dyadic systems highlights a few visualization and analysis tools available for studying interpersonal processes that unfold through conversation. In no way do we intend this to be an exhaustive catalog of options to test empirical questions derived from

a dynamic dyadic systems perspective. Moreover, the methods we presented and those employed by the articles in this special issue do not address all of the dynamic systems concepts discussed in this essay. Rather, we offer these as examples of available tools that can be adapted for the study of the turn-to-turn behavior that comprises interpersonal interaction, and we look forward to future efforts to illuminate dyadic dynamics within conversations. We also see a horizon in which the analysis of speaking turns operationalized as behavioral categories is integrated with continuous data indexing individuals' emotions, cognitions, nonverbal activity, and/or physiological changes. Although one goal in this special issue is to make currently available methods more accessible, we also hope to spark renewed interest in the wide variety of methods that might illuminate the dynamics of dyadic conversation.

One final observation concerns the feasibility and cost of conducting research adopting a dynamic dyadic systems framework. We recognize that researchers may be daunted by the prospect of implementing utterance- or turn-level coding that is the foundation for the approach we have outlined. Having done that work ourselves, we understand the concerns that may arise about the time and effort required to achieve reliable and valid measurement of conversational behavior. We also know that many studies have collected laboratory-based observational data on people engaged in conversation. The expense that goes into building those data sets – the time and research dollars involved in recruiting and scheduling study participants, employing and training research personnel, and managing research protocols for studying dyadic conversations – is considerable. Meanwhile, exciting advances in computation and availability of conversation data from digital platforms (e.g., Reece et al., 2023) promise to accelerate forward progress. As machine-coding advances make the analysis of dyadic conversation easier, we are encouraged by the fact that using archived data sets with transcripts or recordings of dyadic interaction requires

relatively small additional investments of resources to enable more precise tests of theoretical propositions. We hope we have made that option both more compelling and more feasible through the conceptual and analytical framework we have articulated in this essay and the examples collected in this special issue.

Conclusion

Illuminating the black box of interpersonal interaction is essential if we are to adequately test theories that center conversational dynamics. Scientific advance is curtailed when we make assumptions about social interaction as means of intervention, without scrutinizing the features of that mechanism. Moreover, the ability to study the dynamics of interactions adds nuance to understanding how conversation can produce beneficial or harmful outcomes. Beyond standards of care that focus on conversational behavior in the aggregate, the research enabled by a dynamic dyadic systems perspective can clarify how interdependencies, self-organization, and phase shifts contribute to emotion regulation, adaptive changes in attitudes and behavior, and conflict resolution, to name a few. The examples drawing upon a dynamic dyadic systems perspective that are collected in this special issue demonstrate the potential to advance research on a variety of topics, in a range of relationship contexts, and in mediated or face-to-face venues. Our aim in this essay was to elaborate the conceptual foundation for those advances, as well as others we hope will follow from them.

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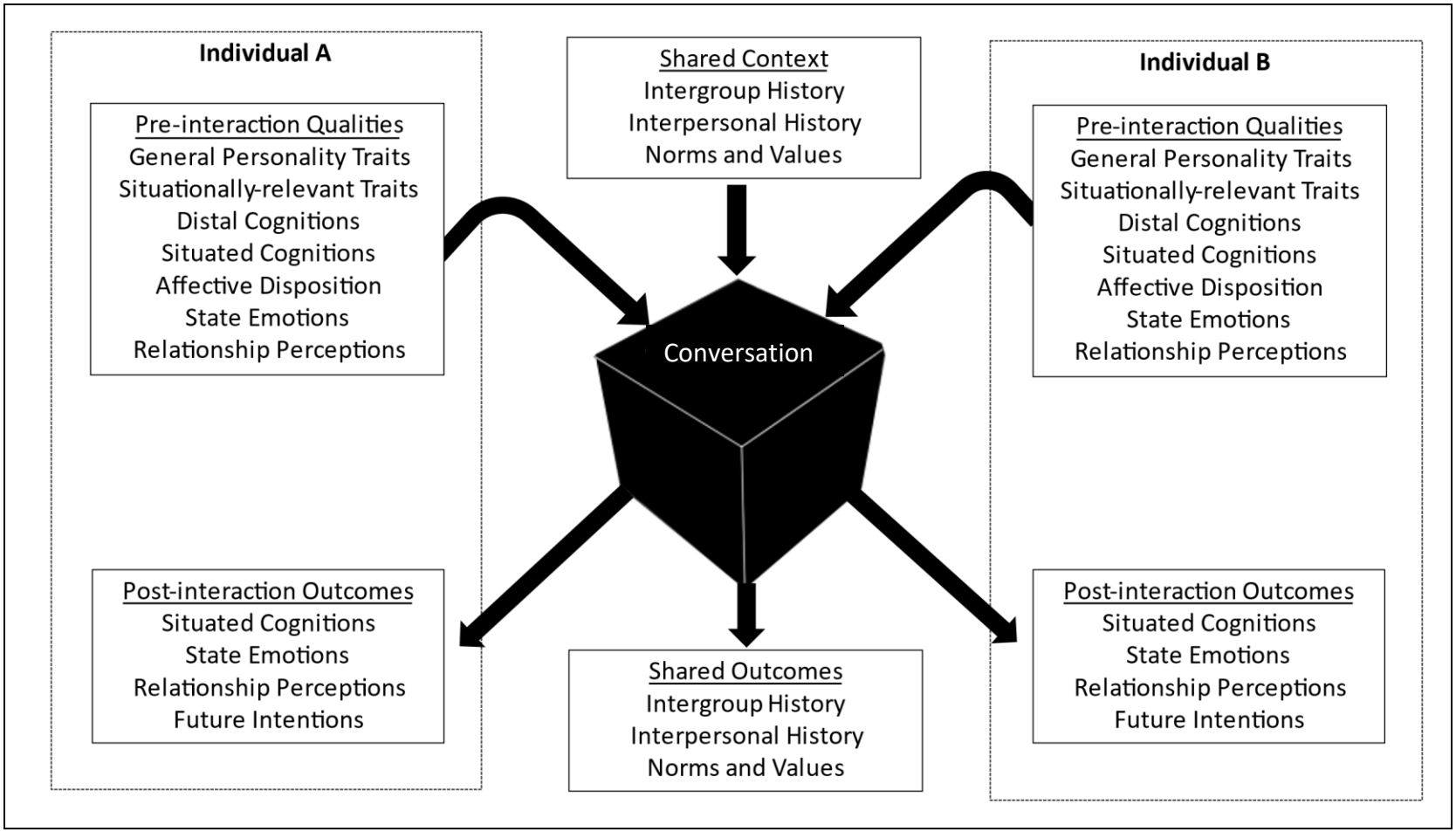

Figure 1. *A general model of dyadic interaction illustrating how individual and shared antecedents affect outcomes as mediated by conversations between partners (e.g., Palomares et al., 2016).*

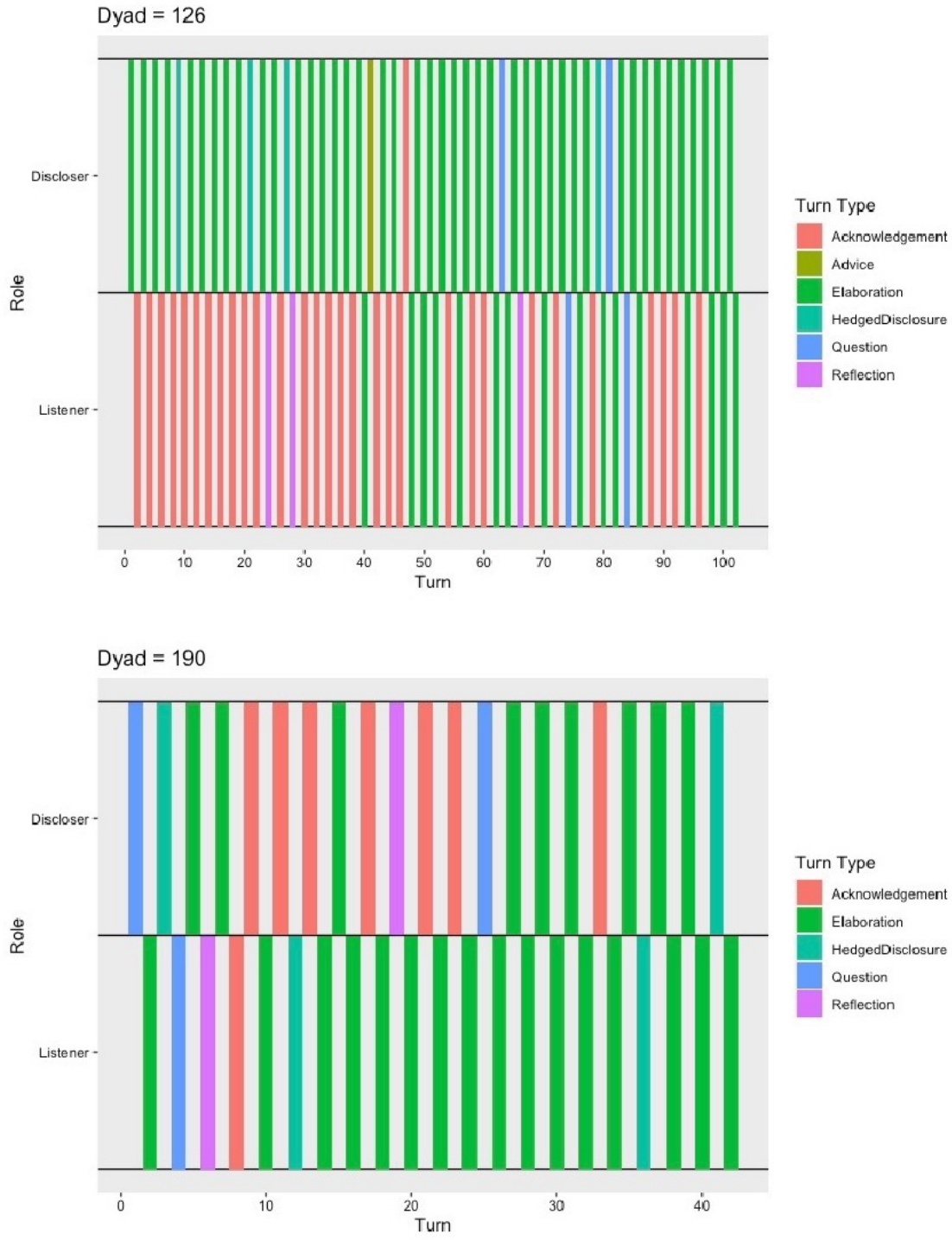

Figure 2. *Two examples of dyadic categorical time series plots of conversations. (Reproduced from Brinberg et al., in press)*

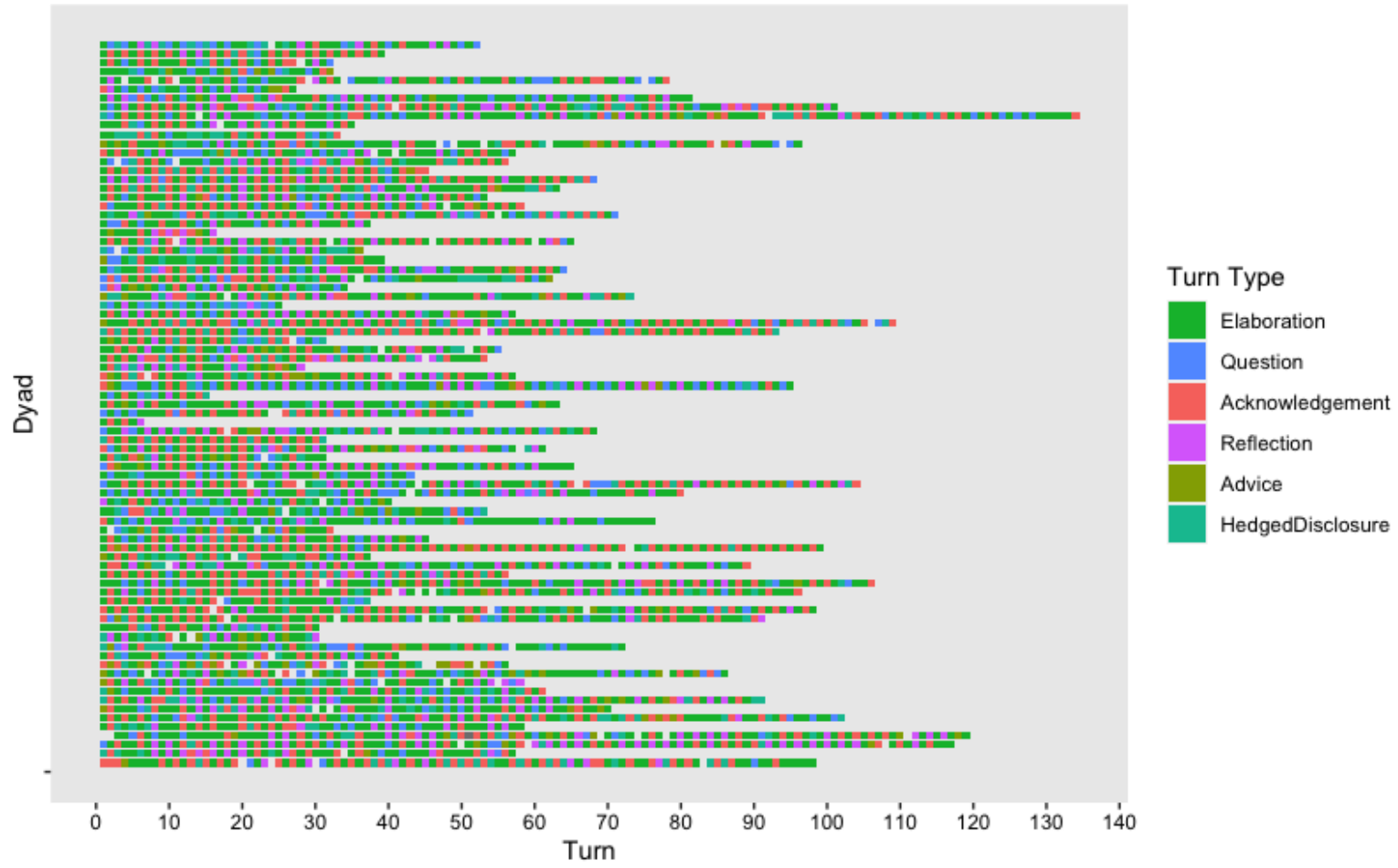

Figure 3. *Conversation sequences plot.*

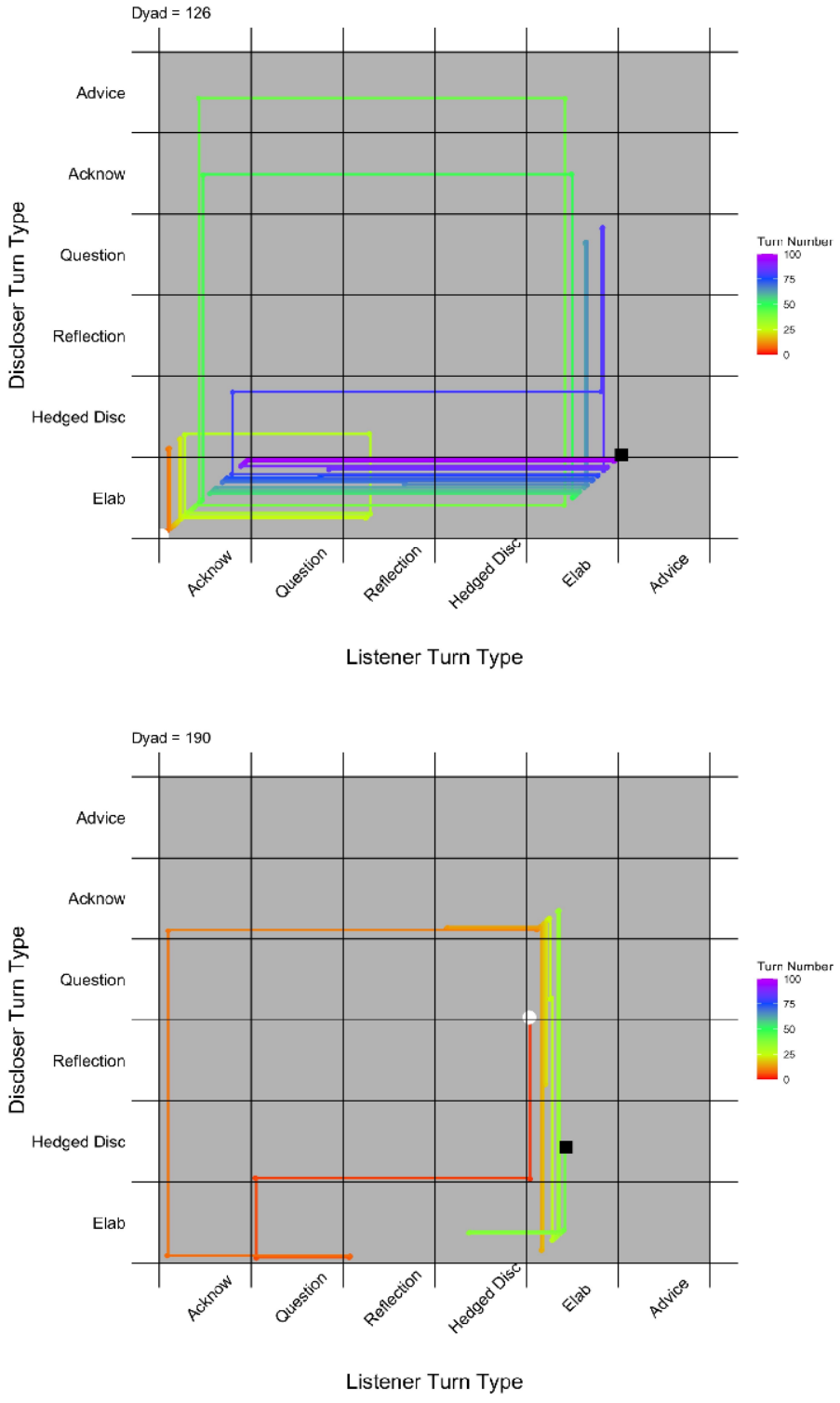

Figure 4. *Two examples of state space grid plots of conversations.*