Negotiation Offers and the Search for Agreement

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Keywords
negotiation, tactics.

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Abstract

A key component of negotiation dynamics is the search for mutually beneficial agreements, and offer exchange is a key element of that process. Rooted in the tradition of information processing psychology, we develop a theoretical model that conceives of negotiation as the collaborative search of a complex *offer space*. Negotiators simplify and coordinate search via information contained in *offer exchanges*, isolating subregions of the offer space for potential solutions. We suggest that early search is more exploratory and primarily influenced by the *value* of offers; later search is more focused on refinement and is influenced by the *content* of offers. In that, search by value is substantially more difficult than search by content, and parties seek value through communicating about content. Important information about the negotiators' perspectives is revealed in comprehensive offers, and critical insight into this search process can be gained by examining the pattern of comprehensive offers.

The dynamic nature of negotiation, in which two or more parties attempt to find solutions that satisfy their conflicting interests (Lax & Sebenius, 1986; Raiffa, 1982; Walton & McKersie, 1965), is an area that is just beginning to be understood. In route to an agreement, negotiators are known to communicate their preferences and priorities via direct and indirect information exchange (e.g., Thompson, 1991; Weingart, Hyder, & Prietula, 1996). In this article, we explore the role of offers in the negotiation dynamic. As offers communicate preferences and priorities, an analysis of offers and

We thank Jeanne Brett, Don Moore, Sally Blount, Elizabeth Mannix, Kevin Rockmann, Howard Raiffa, and Francesca Gino for comments on versions of this manuscript. This project was partially funded by the Dean's Research Fund, Tepper School of Business. An earlier version of this article was presented at the Academy of Management Meetings, Honolulu, Hawaii, August, 2005.

their progression provides a rich source of information and insight into how negotiators jointly search for mutually beneficial agreements. In this article, we provide a theoretical model of offers and offer progression, within which such analyses can be situated.

Offers represent the instantiation of knowledge and insight gained during a negotiation. As such, examining offers in multi-issue negotiations is important because offers uniquely emerge from the communicative milieu as a *critical indicator* of the negotiators' conceptualization of, and search for, a potentially viable agreement. Consequently, *offers* provide significant signals that allow negotiators to update and improve their understanding of the set of viable alternatives and the *pattern of offers* reveals how this understanding unfolds over time. While important in this way, little has been explicated about the role of offers in negotiations that involve multiple issues where Pareto optimal solutions are possible. In contrast, much more is known about how negotiators use offers in single issue negotiations, such as concession patterns and rates in bilateral monopoly type tasks (e.g., Siegel & Fouraker, 1960). Thus, we propose a descriptive, problem solving-based model of how two negotiators (within a dyad) use offers to coordinate search for mutually acceptable agreements in scorable multi-issue negotiations with integrative potential.

We focus solely on the exchange of offers in a negotiation, recognizing that these offers occur within a context of rich communication. When treated this way, offers afford a trace of the negotiation process. The exchange of offers and counter-offers are seen as critical communication acts that reflect coordinated action by individuals working toward their goals (Baker, 1995; Clark, 1996). As such, our model is driven by parsimony—that is, we are trying to describe the negotiation process in a reduced form that will be representationally efficient with respect to the phenomena of interest, and can account for a significant amount of behavioral variance. Game theory is a good example of a reduced form approach that characterizes complex processes and interdependencies as simplified games to capture key aspects of behavior in comparatively structured (i.e., isomorphic) situations in the ''real world''. Correspondingly, we are representing offer patterns in a simplified form that captures critical information about the negotiation process. Our approach is based on the premise that significant information about negotiators' preferences, priorities, and aspirations is revealed in their offers, especially in their comprehensive offers. Furthermore, we assert that sufficient information about the negotiation process is revealed in the sequential patterns of offers so that both measurements and analyses based on those measurements can be made in service of behavioral understanding.

To begin, we cannot examine the progression of offers without a full understanding of the structure of the situation within which offers occur. Recall Simon's (1969) allegory of the ant, in which the apparent complexity of the ant's behavior (i.e., its path traversed over a beach) was largely determined by the characteristics of the ant's environment (i.e., irregularities in the beach) rather than the complexity of the ant's decision processes. Similarly, the progression of offers in a negotiation is as much about the task terrain that needs to be traversed as the strategies of the negotiator. In this model, we specify how salient and specific characteristics of a negotiation *task* influence individual choice (c.f., Gigerenzer, 2008; Newell & Simon, 1972) and suggest how these task characteristics influence joint problem solving.

We suggest that the negotiation task affords two important types of characteristics to which a negotiator attends when considering solutions (as offers): value characteristics and content characteristics. *Value* characteristics are the preferences and priorities held by the negotiators in terms of the issues and option levels of the task, often expressed as utilities. Value characteristics define the worth of an issue level, a partial offer, or an offer to a negotiator. Value characteristics help discern if one offer is ''worth more'' than another offer, or if a counter-offer is ''better than'' a current offer. In a sense, value characteristics, taken together, define the *value structure* of the task and *specify how value is determined in the task.*

Content characteristics, on the other hand, define how the particular negotiation task is depicted (literally) in terms of issues and options (*sans* value) presented to (or perhaps even constructed by) the negotiators. Content characteristics of a negotiation task would include (a) how many issues, (b) how many issue levels, and (c) how issues and option levels are specified (e.g., ''1 day'' or ''Max 3 errors''). Content characteristics, taken together, define the *content structure* of the task and specify *how offers are configured in the task.* Thus, content specifies what an offer ''looks like'' in terms of the options under discussion (as a description commonly held by both negotiators), while value determines what an offer ''is worth'' to each negotiator. Table 1 depicts the content and utility structure of a simple negotiation task.

We limit our examination of the negotiation task to a *scorable* negotiation task (i.e., negotiations where the utility to each negotiator is predefined). Scorable negotiations allow us to track the value and content of offers to both parties. Although stylized, these types of negotiation tasks have been used in many laboratory-based studies (e.g., Pruitt & Lewis, 1975; Bazerman, Magliozzi, & Neale, 1985; Giacomantonio, De Dreu, & Mannetti, 2010; Thompson, 1990; also see Tripp & Sondak, 1992) and serve as a reasonable starting context for explicating our model. Thus, our particular negotiation task

Table 1
Content Options for Each Issue and Their Associated Values (Utilities Endogenous to Each Negotiator Role; From Weingart et al., 1990)

SPEED				EDITING				APPEARANCE			
Content		*Value*		Content		*Value*		Content		*Value*	
Option	Done_by	*Buyer*	*Seller*	Option	Max_errors	*Buyer*	*Seller*	Option	Printer	*Buyer*	*Seller*
1	1 day	3,000	−200	1	None	1,800	−600	1	Typeset	600	−1,000
2	2 days	2,500	−100	2	Max 1	1,500	−300	2	Laser	500	−500
3	3 days	2,000	0	3	Max 2	1,200	0	3	Letter quality	400	0
4	4 days	1,500	100	4	Max 3	900	300	4	IBM selectric	300	500
5	5 days	1,000	200	5	Max 4	600	600	5	Spinwriter	200	1,000
6	6 days	500	300	6	Max 5	300	900	6	Ink jet	100	1,500
7	7 days	0	400	7	Max 6	0	1,200	7	Near letter quality	0	2,000
8	8 days	−500	500	8	Max 7	−300	1,500	8	Dot matrix	−100	2,500
9	9 days	−1,000	600	9	Max 8	−600	1,800	9	Smith-Corona	−200	3,000

for this study has well-defined (and well-structured) value characteristics and well-defined (and well-structured) content characteristics. This allows us to control for these aspects of the task environment and observe the nature of the responses composed by our negotiators as the variables of interest, as we would watch Simon's ant negotiate a beach. If we can begin to explicate the systematic behavior of our negotiators in their effort in these well-structured environments, then we can likely progress toward interpreting their behavior in less-structured negotiation environments, as the underlying processes are likely not that dissimilar (Simon, 1973). Rather, and again, the apparent differences may be attributed to the differences in the environments, and not substantial variation in the processes brought to bear in negotiating those environments.

Theoretical Model

We see negotiation as a joint problem solving task, where two individuals need to collaborate to discover a solution (as neither individual generally has full information) that is mutually beneficial (Carroll, Bazerman, & Maury, 1988; Prietula & Weingart, 1994). We employ the robust standard model of information processing psychology as it provides the theoretical foundation for defining problem solving as search through a problem space (or set) of possible alternatives (e.g., Klahr & Kotovsky, 1989; Newell & Simon, 1972; Simon, 1978; Simon & Kaplan, 1989). According to information processing psychology, problems are characterized by individuals creating problem spaces—dynamic internal (cognitive) representations of the particular task (the problem environment as presented to the problem solver)—which include goals to be achieved, a representation of potential states of the task, the allowable actions that are presumed to be possible (as problem solving steps), information available, and perhaps other elements of the task environment as perceived relevant to (or imposed by) the problem solver (Dunbar, 1998; Newell & Simon,1972). In the context of negotiation, a negotiator's representation of the task necessarily includes the issues, the issue options available and their associated value, the goals and constraints for the negotiation (e.g., ''maximize your own negotiated outcome,'' ''solutions must include agreements on all issues''), as well as the other negotiator and his/her actions.

Problem *solving* is seen as an active search process for potential solutions within that internal representation (Hayes, 1989; Newell & Simon, 1972). Negotiators search for potential solutions using a variety of mechanisms, including offer exchange. Furthermore, when problem spaces get sufficiently large or complex such that a problem solver is unable to search (consider) all of the alternatives, methods must be engaged to reduce the search effort, as humans are indeed boundedly rational, but still function to address the task at hand (Gigerenzer, 2008; Gigerenzer & Selton, 2001; Groner, Groner, & Bischof, 1983; Simon, 1956, 1982).

Our model focuses on the underlying search space that is suggested in the context of communication, called the *offer space*, which is jointly searched by the negotiators. Even in a simple three-issue negotiation task for example, the total number of possible solutions that could be proposed can be quite large—much larger than the number of offers

actually made during a negotiation (see Mumpower, 1991). Given the apparent *complexity* of the task (as defined by the number of potential solutions in the offer space and the alternative ways of configuring these solutions), this presents three fundamental questions addressed by our model:

(**1**) How do negotiators jointly search a large offer space for potential offers?
(**2**) How do negotiators select the offers they propose within that search?
(**3**) How do these offers converge toward an agreement?

Answers to these questions would improve our understanding of negotiation in at least two ways. First, answers would provide additional insight into the negotiation process, complementing extant knowledge regarding integrative and distributive tactical behavior. Aside from early work on heuristic trial and error/systematic concession making (Kelley & Schenitzki, 1972; Pruitt, 1981; Siegel & Fouraker, 1960), few have considered the role of the content of the offers in the multi-issue negotiation process amongst human negotiators (see Putnam & Holmer, 1992 for a qualitative analysis of issue development). Research on the negotiation process using tasks with integrative potential has largely focused on the use of integrative and distributive tactical behavior—such as information exchange, types of offers, argumentation, and threats—in terms of their frequency, sequences, and phases (Weingart & Olekalns, 2004). That research identifies offers as being either single or multi-issue and considers how often and when they, and other tactical behavior, occur. Results reflect the ways negotiators tactically respond to one another during the course of the negotiation (e.g., are offers reciprocated?) and whether negotiations pass through predictable phases (e.g., when do offers occur?). For the most part, within this work there is an (often tacit) assumption that negotiators interpret potential offers and counter-offers in terms of their value to the negotiator.

Our model complements this work by examining the *content* of offers (as defined by the configuration of option levels of the constituent issues), as well as the *value* of offers (as defined by the total value of the offer to the negotiator), and how negotiators alter the offer content (changes in the option levels of the issues), as well as how the value of offers vary over time, in response to prior offers in their search for mutually acceptable agreements. The content and value of offers provide information about the potential solutions negotiators are currently considering and how information is incorporated into subsequent offers during search. We suggest that negotiators engage in two basic search methods when making offers and counter-offers, and the nature of each differs according to the primary task characteristics influencing the process: value or content. In addition, these two search methods appear to serve different functions. We will demonstrate that negotiators initially engage in a speculative, broad form of search in which they attempt to more precisely define, refine, and align their understanding to establish a ''common ground'' to search in the negotiation terrain (Clark & Marshall, 1981; Pickering & Garrod, 2004). Establishing common ground is necessary for reaching agreement—it is within this ''common ground'' that mutually acceptable solutions reside. This initial search, called *value-based exploration*, is influenced by the value characteristics of the task, where offers asserted reflect more of a focus on negotiator's own value structure than the content options specified in any

offer on the table. Offers are considered primarily in terms of their "better value" to the negotiator. Nevertheless, this eventually leads to a specific discussion and an (perhaps tenuous) agreement on a subset of the issues. Second, the issue subset agreed upon *anchors and constrains* the set of subsequent offers that are considered, resulting in a distinctly more coordinated and restricted search activity. This subsequent search, called *content-based refinement*, is influenced by the content characteristics of the task, where offers asserted in that search reflect more of a focus on the specific content options extant in offers (partial or comprehensive) on the table. Offers are considered primarily in terms of their "better fit" (i.e., matching specific issue options) with current offers on the table. When the two negotiators initially agree on even one issue, which frequently occurs, the size of the search space is substantially reduced, coordinated examination of smaller regions can effectively ensue, and potential agreements are more likely.

The study is organized as follows. We first characterize the offer space (i.e., the set of all possible offers) in terms of a frequently used, stylized negotiation research task (three issues with integrative potential). We incorporate a typical two-dimensional plot to illustrate the space (x, y dimensions represent total offer values to each negotiator), but add a specific cartographic improvement in the form of a feaux third dimension that captures the number of offers yielding the same total value to each negotiator. Next, we consider offer exchange patterns, differentiating between partial (containing a subset of issues under consideration) and comprehensive offers and the type and amount of information they convey. We then discuss the role of partial offers in terms of exploration and comprehensive offers in terms of offer refinement, distinguishing between value-based and content-based search. We narrow our discussion to considering how the exchange of comprehensive offers is used by negotiators to refine the joint search and reach a final agreement. We conclude by reflecting on several possible patterns of comprehensive offer search and considering extensions and elaborations of our model.

We assert specific theoretical propositions suggested by the model. Some of these are foundational propositions that formalize widely shared beliefs about how negotiators employ offers; others provide prediction and explanation in terms of the concepts of our model. We use illustrative data to demonstrate how we code and interpret these concepts. In the concluding section, we build on these concepts and show how they may serve as heuristics for offer generation as well as the foundation for description and analysis of negotiation dynamics. Prior to our discussions, we offer a summary of the key terms of our model in Tables 2 and 3.

Characterizing the Offer Space

We characterize the offer (i.e., solution) space for a typical negotiation task of the type used in many laboratory studies—a three-issue (nine option levels per issue), role-playing task conducted between two individuals negotiating typing services (previously described in Weingart, Thompson, Bazerman, & Carroll, 1990). This characterization will provide the foundation for our model development, and we will use the data from

Table 2
Static Components of Model

Component name	Component definition
OFFER DESCRIPTIONS	
Comprehensive Offer	An assertion (package) specifying the preferred options to a negotiator across *all* issues
Offer (search) space	Set of all potential Comprehensive Offers definable within the negotiation task
Offer Value	Total *value* of an Offer to a single negotiator as defined by the sum of the value for each option specified across all issues
Offer Content	The specific option of each issue comprising an Offer
SIMILARITY METRICS	
Content Equivalence	Two offers that share the *same option choice* on an issue are said to have Content Equivalence on that issue
Value Equivalence	Offers that differ in content (issue options), but have the *same total value to a negotiator* (not considering the value to the other negotiator) are said to have Value Equivalence
Indifference Set	A set of offers in the Offer Space that have the same total value to a negotiator, but are differently configured in terms of content options
Common Indifference Set	A set of offers that are configured differently, but have a set value for negotiator 1 and a set value for negotiator 2
DISTANCE METRICS	
Content Distance	The number of incremental changes in option levels that one Offer differs from another Offer
Value Distance	The numerical difference between individual Offer Values

this study to demonstrate the application of our model.[1] Whereas our model can be applied to more complex negotiations, we restrict our discussion to this simpler negotiation problem for ease of presentation and construct development. For this problem, there are 729 possible (and discrete) three-issue (i.e., comprehensive) offers, as each of the three issues has nine possible choices of options (Table 3 shows the specific value schedules for each negotiator). When agreements valued lower than the negotiator's status quo (worth 0 points) are removed from the set for both parties, the remaining set includes 521 possible solutions. This set comprises the bargaining zone or zone of possible agreement (Raiffa, 1982).

[1]To demonstrate the constructs, we employ dyadic negotiation data (n = 8 dyads) from a previously published study (Weingart et al., 1990) that used the negotiation task summarized in Table 1, a common type of task used in negotiation studies. It is important to note that we did not use the data to test our model, but rather to illustrate how we might understand our constructs using real data. We randomly chose 8 dyads from the existing data set and recoded the transcripts identifying where offers were made and the content of those offers. Data from all eight transcripts are used to demonstrate aggregate measures of offer patterns. Specific examples from selected transcripts were used to demonstrate different patterns of offers. Thus, the sequences of offers described below were not randomly chosen, but were chosen because they provided a clear illustration of the concept being proposed.

Table 3
Dynamic Components of Model

Component name	Component definition
Offer Exchange	When an Offer made by one negotiator is followed by an Offer from the other negotiator (comprehensive or partial)
Exploration Phase	A phase of negotiation defined by primarily value-based exploration exchanges, usually occurring early in the negotiation (but may be re-engaged if necessary)
Value-based Exploration	*Value-based Exploration* is evidenced when consecutive or immediately prior offers from the other negotiator are not content equivalent; that is, they do not share any issues that have the same option proposed
Refinement Phase	A phase of negotiation defined by primarily content-based refinement exchanges, occurring after an Exploration Phase
Content-based Refinement	A coordinated search evidenced by an Offer Exchange where the two Offers have Content Equivalence on at least one issue
Refinement Set	The inclusive set of potential comprehensive offers (agreements) in the offer space that remain viable (i.e., do not violate any asserted content option) after a comprehensive offer has been made by each of the negotiators
Content Proximity Bias	Refinement sets (as common ground components) tend to evolve by relatively small changes in *content proximity* (issue options) that serve to maintain the continuity of joint attention and to reduce disturbance to the current state of the common ground

Our model can be generalized to scorable negotiation tasks that include more than three issues and nonmonotonic point schemes (i.e., the difference in points across options within an issue and for a given negotiator does not need to be uniform). However, we do assume that the options within an issue are rank ordered such that they are either increasing or decreasing in utility for a given negotiator.

As we have noted, there are two types of task characteristics that directly influence the nature of offers: value characteristics and content characteristics. The ''content'' of an offer is comprised of the specific options selected for each issue. For example, referring to Table 1, a Seller may make a comprehensive offer that includes three options describing the *content* of the offer: Speed option 2 (done by 2 days), Editing option 6 (maximum of five errors), and Appearance option 9 (use a Smith-Corona printer). The ''value'' of an offer is the sum of the utilities of the options for each negotiator. In our example, the value of the offer to the Seller is 3,800 (Speed option 2 = −100, Editing option 6 = 900, Appearance option 9 = 3,000). As indicated in Table 1, for any given offer content there are two associated values, one to each negotiator (based on the negotiator's own utility scheme). In that the content of an offer is visible to and always the same for both parties, we always talk about the content of an offer at the dyad level. In contrast, the associated *values* to each party can be different and are endogenously held by (and known to) the individual. Therefore, it is appropriate to discuss the value of an offer at the individual level.

We use notation throughout our discussion that identifies which party made the offer, where it occurred in the sequence of the interaction, and the content structure of the offer. Thus, if the offer described above was denoted as S5[2,6,9], it would identify the seller's fifth offer, composed of Speed option 2, Editing option 6, Appearance option 9. This notation provides a general representation of the structure of an offer and allows for comparisons across offers.

When *comparing* offers, we also rely on content and value. For each we define when components of offers are the same (equivalence) and if not, how far they are apart (distance). *Content equivalence* is based on whether two offers have any issues that share the same option level. Comparing with the prior Seller example, imagine that the Buyer follows with this comprehensive offer: done by 2 days (Speed option 2 = 2,500), maximum four errors (Editing option 5 = 300), and use a dot matrix printer (Appearance option 8 = −100)—that is, B6[2,5,8]. The Seller and Buyer agree on the same option for one issue, the Speed (option 2), so we say that these two offers are *content equivalent* on the Speed issue, but not on the other two issues. Note that when two offers are content equivalent across all issues, they are describing two offers that are exactly the same.

But how "far apart" are these two offers in terms of their content alternatives? We define the *content distance* between two offers by counting the number of issue option levels it would take to transform an offer from one negotiator into the subsequent offer from the other negotiator (see Hamming, 1980). Thus, an offer with more changes is deemed "farther" away than another offer that has fewer changes in the offer options. Looking at our example offers, and referring to Table 3, we see that they differ on *one* option level for Editing (Seller wants option 6, Buyer wants option 5) and *one* option level for Appearance (Seller wants option 9, Buyer wants option 8), so by simply adding these up, we get a content distance of *two* between these offers—that is, the two offers differ in their content selections by only two option levels.

Comparing values is a bit more straightforward. *Value equivalence* is when two offers have exactly the same total value to an *individual* negotiator, derived from summing over the utilities for each issue option of the offer. Consequently, S5 and B6 are not value equivalent as the Seller's offer, S5[2,6,9], is valued at 3,800 to the Seller while the Buyer's offer, B6[2,5,8], is valued at 2,700 to the Seller. *Value distance* is simply the numerical (e.g., points, dollars, utility) difference between individual offer values, so the value distance between the two example offers is 1,100 for the Seller. Note that when the value distance equals zero, offers are value equivalent.

Negotiation offer spaces are often displayed in terms of value as a two-dimensional "joint-sum plot" where all possible comprehensive offers are mapped into the respective values to each negotiator (Sebenius, 1992). From these plots, measures of performance, such as joint outcome, Pareto efficiency, and an integrativeness quotient, have been discussed (e.g., Clyman, 1995; Tripp & Sondak, 1992). This representation facilitates the visual interpretation of value distance. This type of joint-sum plot for our example is shown in Figure 1. In our plot, we only show values that are greater than zero, assuming that negotiators would not accept a total package that they value as a loss.

For this (and most) negotiation tasks, there can be several comprehensive offers that differ in content, but provide the same value to an individual negotiator. In Figure 1,

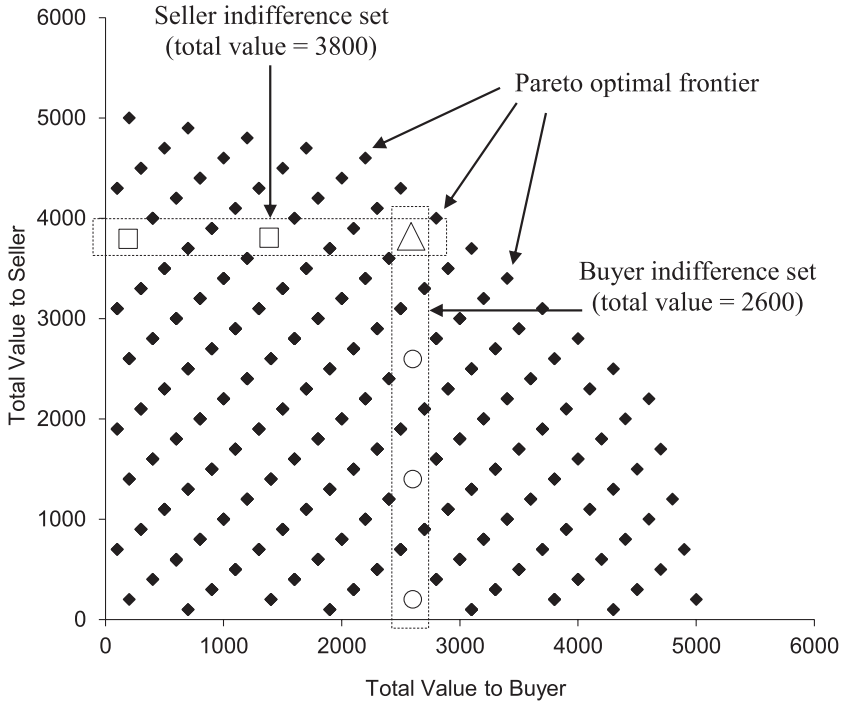

Figure 1. Typical Joint sum plot of discrete three-issue offer space.

the Seller's horizontal rectangle shows the set of comprehensive offers that all yield a value of 3,800 to the Seller (but whose value varies widely from the perspective of the Buyer); the Buyer's vertical rectangle shows the set of offers that all yield a value of 2,600 to the Buyer (but whose value varies widely for the Seller). We refer to these groups of comprehensive offers as *indifference sets* for a negotiator—that is, a negotiator should be indifferent to any offer in the set, as all of the offers in that set are value equivalent to that negotiator (a condition that does not necessarily hold for the other negotiator). Researchers examining choice amongst equivalent package offers have indeed recognized value equivalence (Bazerman, 1990; Brehmer & Hammond, 1977; Kimmel, Pruitt, Magenau, Konargoldband, & Carnevale, 1980).

From the plot we see that there is an intersection of these indifference sets that reveals a *potential* agreement (the triangle). The trick, of course, is for the two negotiators to discover such an intersection because a solution, by definition, requires both parties to agree on the offer. Figure 1 suggests that negotiators only need to consider three or four alternatives from their indifference sets to discover the intersection. However, even in this simple negotiation task, this is not as easy as it may seem, as the offer-space described by a joint-sum plot of Figure 1 is actually even more complex than it appears.

Figure 1 depicts 165 comprehensive solutions, but that represents only 31.6% of the entire set of offers in the offer space. Where are the remaining 356 offers? Because each point plotted in Figure 1 represents an offer value, but not the content configurations of options that can yield that value, distinct offers are ''stacked'' at many of the offer values. In fact, for 84.2% of the points plotted in Figure 1, there is more than one comprehensive offer that can be configured to generate that exact same value to each negotiator. As such, Figure 1 represents not simply a point-plot of offers, but *a plot of indifference sets* for the value of each comprehensive offer in the space. Given that almost every point plotted represents multiple configurations of offers that are shared by both negotiators, we call these points *common indifference sets*. A common indifference set captures the set of solutions that are all worth some value A to negotiator 1 and some value B to negotiator 2, where A generally does not (but can) equal B.[2] For example, if one negotiator, Bill, suggests an offer worth 1,000 points to himself, and the other negotiator, Sarah, counters with an offer of say 1,200 points to herself, the values of these two offers may intersect in the offer space. At that intersection, there may be several alternative offers that provide 1,000 points to Bill and 1,200 points to Sarah. As such, different offer content choices can generate equivalent offer value. This is shown in Figure 2.

From an omniscient observer's perspective, this produces a ''third-dimension'' to the joint-sum plot that indicates the number of differently configured (in terms of content options), but equally valued solutions for a particular joint-sum point (for Figure 2 the size of the common indifference sets ranges from 1 to 5). Consequently, this yields a more complex landscape of offers than is typically depicted in negotiation research and further suggests the necessity for (and existence of) negotiator mechanisms to systematically reduce the complexity of search of that landscape. In our running example depicted in Figure 1, the set of differently configured offers for the Seller to consider that generate a value of 3,800 is actually eight, while the Buyer is faced with fifteen differently configured offers valued at 2,600. These are depicted by the overlaid squares, circles, and triangle from Figure 1. This is an important, but rarely identified, feature of an offer space.

From an individual negotiator's perspective, value equivalence affords a flexibility of indifference to proposed offers that differ in content. However, negotiators are (generally) neither privy to nor capable of calculating the entirety of this landscape as humans are inherently boundedly rational (Gigerenzer & Selton, 2001; Groner et al., 1983; Simon, 1956, 1982). Therefore, they must *reduce the complexity of the search* of this space both to address their individual preferences and to accommodate the requisite joint goal of reaching an agreement. Thus, we assert a familiar, but fundamental, proposition that underlies our scaffold of arguments.

***Proposition 1*:** Negotiators will reduce the complexity of the search by considering only a subset of potential offers.

[2]The common indifference sets will represent the same value to both negotiators if they reside on the set of offers bisecting the joint-sum plot from the origin on a 45° angle to the Pareto optimal frontier.

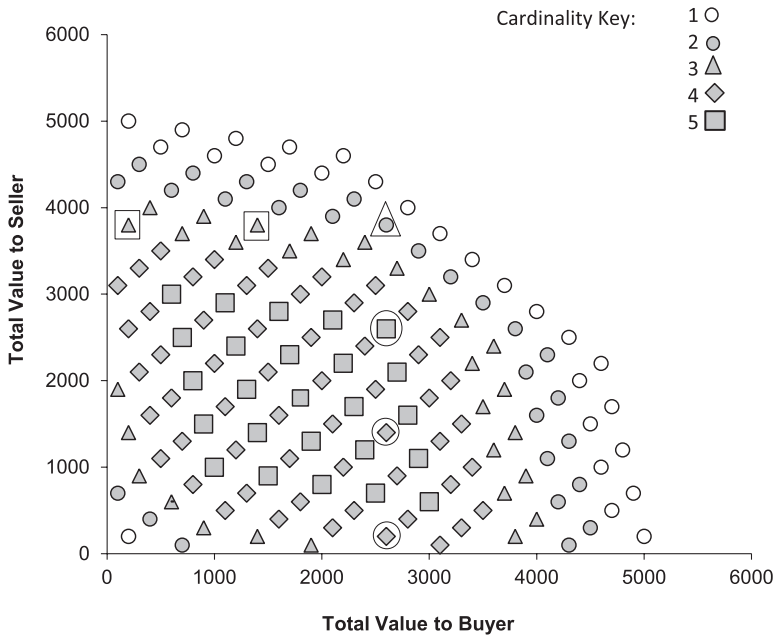

Figure 2. Joint sum density plot of discrete three-issue offer space (all solutions) showing cardinalities of common indifference sets.

The question at hand is *how* that reduction occurs in negotiation search. Our model presents two different and fundamental methods of reducing the search for potential offers: attention paid to constraints imposed by *value* and to constraints imposed by *content*. For the former, regions of the offer space that are similar in *value* are searched (and proposed) as offers. For the latter, regions of the offer space that are similar in terms of *content* (i.e., issue options) are searched (and proposed) as offers. To describe evidence of how search is actually conducted and constrained, we must first define the form and significance of examining patterns of offer exchanges.

Considering Offer Exchange Patterns

Offer patterns have been studied in distributive negotiations where two parties are attempting to reach agreement on a single issue. In this literature, offers are framed in terms of the concessions they represent and analyzed in terms of the amount and timing of the concessions (Allen, Donohue, & Stewart, 1990; Komorita & Brenner, 1968; Smith, Pruitt, & Carnevale, 1982). More relevant to our model is the examination of offers in multi-issue negotiations that are characterized by integrative potential (such that both parties can increase their outcomes simultaneously). In that literature, offer patterns have been studied in terms of ''systematic concessions'' (Kelley & Schenitzki, 1972; Siegel & Fouraker, 1960) or ''heuristic trial and error'' (Pruitt, 1981) and

discussed in terms of the dance of packages and joint construction of a compromise contract (Raiffa, Richardson, & Metcalfe, 2002). While informing our model by providing insight into the way offers might be constructed, these streams of research have not provided sufficient insight into the detailed processes accounting for joint offer patterns.

Offer/counter-offer pairs are the primary units of analysis for our model. We adopted this approach based on three theoretical positions. First, taking turns in discourse is fundamental to conversations (Sacks, Schegloff, & Jefferson, 1974; Schegloff & Sacks, 1973). In negotiation, offers afford an important focus of conversational turn-taking. Second, the offer/counter-offer sequence is consistent with the ''presentation-acceptance'' model of discourse contribution in that people integrate others' communications into their own (Clark & Schaefer, 1989). In terms of negotiation, this means that offers (partial or comprehensive) embody substantial components of prior information exchanges. Third, language (in the context of problem solving and game playing) reflects not only the existence of joint action, but embodies the mechanisms to coordinate that action (e.g., Clark, 1996; Schelling, 1960). For a negotiation to be successful, both negotiators need to agree on a solution. Furthermore, joint action serves to define and refine elements of the common ground, and the offer/counter-offer pairs reflect key changes in that common ground state (the content of a proposed solution).

Via such a discourse, negotiators exchange information in their attempts to reach agreement. They provide information about their preferences and priorities, argue their positions, and exchange offers (Olekalns, Smith, & Walsh, 1996; Putnam & Wilson, 1989; Weingart et al., 1990, 1996). Offers, however, are unique in that they are proposals made to the other party that reflect an acceptable solution to the proposing negotiator and embody information obtained prior exchanges. Offers provide information to the other party about one's own desires, and the progression of offers over time provides information about one's willingness to concede (Komorita & Brenner, 1968; Kwon & Weingart, 2004). In that sense, offers are ''information rich'' as they embody aspects of the history of prior information exchanges in a form that reveals the underlying consequences of those exchanges directly as value.

Offers can be partial (specifying content options for a subset of the issues) or comprehensive (specifying content options for all of the issues). While single issue offers reflect desires on a given issue, multi-issue offers combine preferences on issues such that the issues can be packaged together or traded off across the parties. Crafting a multi-issue offer is not a simple task—previously considered single-issue offers must be jointly associated to form multi-issue offers, at times requiring the negotiator to abandon a goal for a single issue as a means of obtaining a higher outcome overall (Hyder, Prietula, & Weingart, 2000). Multi-issue offers thus can provide information about how a negotiator values the issues relative to one another. Consequently, more information is contained in multi-issue offers and in offer sequences, so perhaps the most important communication is indeed the exchange of multi-issue offers and counter-offers (Tutzauer, 1992). As research on negotiation processes has demonstrated the temporal interdependencies of negotiator strategic behavior (Olekalns et al., 1996; Putnam & Jones, 1982; Weingart, Prietula, Hyder, & Genovese, 1999), we suggest that the exchange

of offers provides information about how negotiators value issues and embodies information gained from prior exchanges. As the information salient to a *negotiator* is contained in an offer, the information salient to a *negotiation* is contained in the sequential patterns of those offers.

***Proposition 2*:** Offers incorporate information regarding the value of prior offers and the content of prior offers.

The value of an offer is easy to discern in scorable games, and certainly reflects (to a substantial extent) the utility of the issue options proposed. But as we have seen, there can be several alternative offer content configurations that yield that same value, so we turn to examining the influence of prior content choices evidenced in offers. To determine this, we map the sequence of offers by content and can look to the Weingart et al. (1990) data to illustrate. In the mapping, we note how the offers relate in terms of their content equivalence—noting if they share any issue options. An example is shown in Figure 3, which specifies all offers (partial and comprehensive) made in a sample negotiation, and the order in which they were made. The center column depicts all comprehensive offers from either the Buyer (B) or the Seller (S). The left column depicts all partial offers made by the Buyer; the right column depicts all of the partial offers made by the Seller. The arrows indicate for a given offer, the most recent prior offer, from both the Buyer and the Seller, where at least one of the issue options are in agreement—that is, the *arrows define content equivalence* among offers. Issue options are always in the same sequence in the parentheses (Speed option, Editing option, Appearance option). Ultimate agreements are indicated by an asterisk (*).

Characterizing Search in the Offer Space

When viewing the exchange patterns of offers and counter-offers that emerge from actual dyadic negotiations, the resulting paths are often irregular, seemingly random when graphed over the offer space (e.g., joint sum plots); other times they exhibit quite systematic movements toward an agreement (Raiffa et al., 2002; Weingart & Prietula, 1998). Raiffa et al. (2002) describe a negotiation process called ''joint construction of a compromise contract'', which begins with discussions of and temporary agreements on single issues, proceeds to trade-offs, and ends with closing of the contract.[3] We further specify (and explain) Raiffa's process in terms of our model. Specifically, a negotiation begins by engaging an *exploratory* phase wherein negotiators rely on partial offers (i.e., offers that specify acceptable values on a subset of issues) to ''probe'' each other in a search for potential regions of agreement. Subsequently, negotiators shift to the other phase comprised of fewer partial offers and more comprehensive offers. Within this *refinement* phase, we expect to see distinct evidence of issue option integration across offers and more of an effort to compose offers that may lead to an agreement.

[3]Raiffa (1982) also describes this process; however, we could find no empirical studies examining how negotiators pass through these phases of offer exchange.

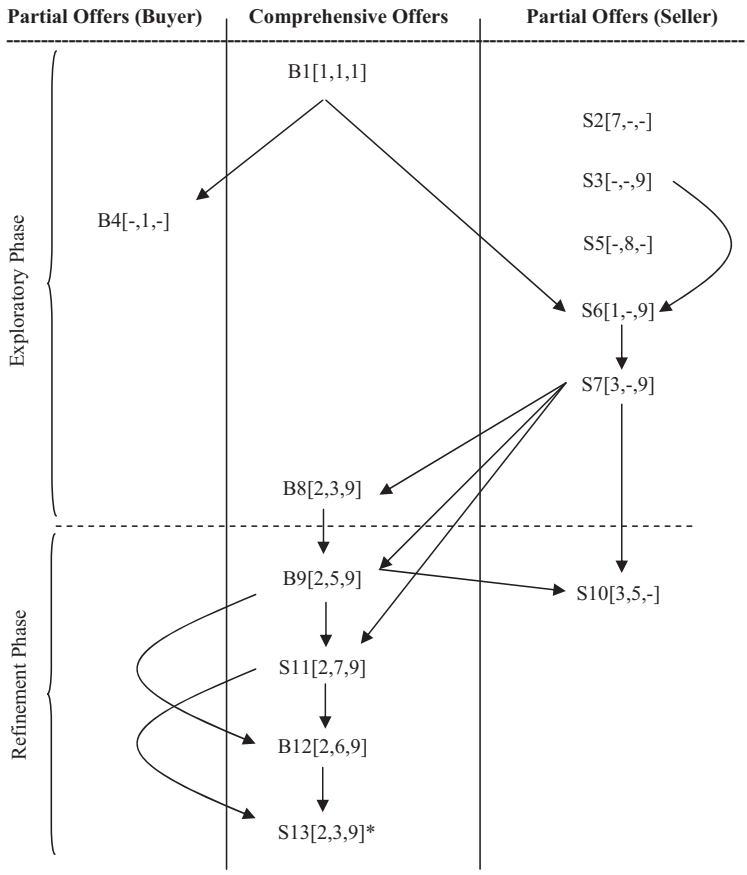

Figure 3. Map of Offer Sequence in Dyad 1. B, Buyer; S, Seller; B*i*, S*i* indicate the order in which these offers were made. Numbers in the brackets indicate the *content of the offers*; that is, which option choice was proposed for each issue as B*i*[Speed issue, Editing issue, Appearance issue] Dashes [–] indicate no option was proposed for that issue (i.e., a partial offer). Example: B1[1,1,1] = Buyer makes the first (and comprehensive) offer of Speed (level 1), Editing (level 1), Appearance (level 1). S2[7,–,–] = Seller makes the second (but partial) offer of Speed (level 1). Arrows indicate *content equivalence* for issues as sequence unfolds (from both parties' offers). Example: B9[2,4,9] has content equivalence with B8 [Speed = 2 and Appearance = 9] as well as S7 [Appearance = 9].

We argue that the apparent complexities and regularities of the offer traces, as well as the two types of phases, are explained in terms of value-based search or content-based search. We propose that there are significant tendencies for *value* to guide the search for "where" acceptable regions of the offer space are located and *content* to guide the more refined and focused effort towards "which" components of those regions might be acceptable for the composition of agreements. Furthermore, these tendencies will be evidenced in the offers and their patterns, and the signature patterns

proposed by the theoretical model for value-based and content-based influences are distinctly different.

Value-based exploration is a self-centered, individualistic search process sensitive to the value structure of the task. It is driven by assessments of value to oneself and drives a broad search for an acceptable agreement that is not anchored by the content of prior offers, but constrained by value aspirations and bottom lines of the individual negotiator. Because negotiators are aware of their own value but not their opponents', value-based exploration offers are less likely to systematically address the value of the other party.[4] In addition, when engaged in value-based exploration they are less likely to incorporate issue options from the other party, resulting in a less coordinated search across the two parties. If negotiators are purely engaged in value-based search, then there is no reason for the content (issue options) of their offers to overlap. Hence, we define value-based exploration in terms of the (lack of) overlap of issue options in offers.

> *Value-based Exploration* is evidenced when consecutive or immediately prior offers from the other negotiator are not content equivalent; that is, they do not share any issues that have the same option proposed.

To illustrate value-based exploration, we refer to Figure 3. Here, the Buyer (B) initiates the negotiation with a comprehensive offer valued as optimal from an individualistic perspective, B1[1,1,1] (Speed option 1, Editing option 1, Appearance option 1), generating a personal value of 5,400. In the first five offers of the negotiation, there is no content equivalence between the offers made by the negotiators. We infer that this type of search in the offer space reflects no commitment to refinement of the common ground, but is dominated by a concern for value.

The other pattern, *content-based refinement*, demands more coordination but potentially defines a smaller region of the offer space to which joint attention is paid, resulting in a more focused search. Content-based refinement is sensitive to the content structure of the task. It begins when the two parties start to converge on what constitutes a possible solution in terms of issue options. In content refinement, negotiators construct their offers by building directly off of the other party's prior offers' content. In this way, negotiators are integrating information from the other party into their own representation of the problem resulting in convergence on some common ground that

[4]Value-based exploration has been considered in early negotiation research on systematic concession making. Systematic concession making is a model of negotiation process whereby negotiators open with packaged offers (including all the issues) that provide maximum benefit to themselves and then examine packages at the next level of reduced value (to themselves) before conceding more (Siegel & Fouraker, 1960). With each concession, negotiators lower their aspirations, expanding their set of acceptable agreements. When these two sets intersect, they will reach agreement. The systematic concessions model "assumes nothing about the bargainers' ability to identify or distinguish between the various contracts" (Kelley & Schenitzki, 1972: 323); negotiators are modeled as employing own value-based rather than content-based search. When using systematic concession making, negotiators do not need any information about the other party to formulate their package offers and do not incorporate information received from the other party even if it is available.

can be exploited. Thus, we define content-based refinement in terms of the issue options that offers have in common.

> *Content-based Refinement* is evidenced when consecutive or immediately prior offers (across parties) are content equivalent; that is, they share at least one issue that has the same option proposed.

For example, consider in Figure 3 the comprehensive offer B8[2,3,9]. For each offer, we look for *content equivalence with the most recent offers* from the Buyer and Seller, if they exist. The most recent prior offer by the Buyer is B4, but there are no issues that are content equivalent. The most recent prior offer to B8 from the Seller is the partial offer S7[3,–,9], and there is content equivalence with the Appearance issue (option 9, use a Smith-Corona typewriter)—so an arrow is inserted mapping S7 → B8.

Each dyad in our sample was analyzed to exemplify negotiation offer patterns. The *Refinement* phase was defined as beginning when the first two comprehensive offers were made in a row (across parties). The *Exploratory* phase was defined as all offers preceding those two comprehensive offers, embodied by value-based exploratory search. Two sequential comprehensive offers demonstrate response-in-kind by the other party and signals that both parties are focusing on offer composition rather than offer exploration. The results are shown in Table 4 under the two columns labeled Exploratory phase and Refinement phase.

The data show the demarcation between the two phases based on comprehensive offers. The Exploratory phase includes a lower percent of comprehensive offers (M = 7.4%) than the Refinement phase (M = 87.8%). As the phase-shift from Exploratory to Refinement was defined as two sequential comprehensive offers (across parties), it is generally unlikely (but not impossible) for one or the other party to engage in comprehensive offers while

Table 4
Influence of Comprehensive Offers During Refinement Phase

	Exploratory phase		Refinement phase		
Dyad	No. of Offers	Comprehensive %	No. of Offers	Comprehensive %	Content Equivalence in comprehensive offers %
1	8	25.0	5	80.0	100.0
2	18	0.0	15	100	100.0
3*	8	0.0	11	54.5	83.3
4	2	0.0	5	80.0	100.0
5	11	9.0	20	85.0	93.3
6*	2	0.0	4	100	100.0
7.1†	4	0.0	2	100.0	100.0
7.2*	9	33.3	11	90.9	100.0
8*	2	0.0	8	100	100.0
Average	7.1	7.4	9.0	87.8	97.4

Notes. *Dyads that achieved Pareto optimal solutions.
†Dyad 7 had an Exploratory phase followed by a Refinement phase (7.1) then reoriented the search by reengaging a second Exploratory phase again followed by a Refinement phase (see text).

the other does not. This is equivalent to one party searching by value, and the other party attempting to shift the search to content. However, once a comprehensive offer was made, the negotiators often shifted from partial, exploratory offers to refining, comprehensive offers. We do not claim that negotiation necessarily proceeds sequentially through these two and ceases; rather, we see negotiation as possibly oscillating through these phases as required to accommodate the aspirations of each negotiator under the constraint of a mutual agreement.[5] We do claim that these phases are distinct and serve different purposes, so are likely to be found in most negotiation contexts.

During the Refinement phase (which usually contains the eventual agreement), comprehensive offers are made much more frequently than in the Exploration phase. Consequently, we analyze the comprehensive offers in the Refinement phase to assess the content equivalence and determine the level of relatedness (and therefore implied influence) of those offers. This is shown in the Content Equivalence column in Table 4. As can be seen in the table, once the refinement phase began, most of the offers were comprehensive offers ($M = 87.8\%$), and almost all of the comprehensive offers were composed from issue options existing in previously proposed comprehensive offers ($M = 97.4\%$). We assert three specific propositions regarding our definitions of phases and search underlying those phases.

***Proposition 3*:** In general, negotiation will tend to evolve by phases evidenced by offers: one is Exploratory embodied by value-based exploratory search; another is Refinement embodied by content-based refinement search.

***Proposition 4*:** Exploratory search is value-based, dominated by partial offers, influenced more by individual value and less by asserted content of offers.

***Proposition 5*:** Refinement search is content-based, dominated by comprehensive offers, influenced more by asserted content of offers than by individual value.

How Negotiation Progresses: Refinement Sets of Comprehensive Offers

The explanation of why the Refinement phase generates focus and agreements is found in the role of content equivalence, as content equivalence narrows the search space dramatically. When negotiators' offers reflect similar issue options they are narrowing the search space, which will further constrain subsequent offer progression. By (even tentatively) agreeing on one issue option, negotiators' attention shifts away from the ''solved'' component of the agreement (that particular issue), and towards the ''unsolved'' component(s) of the agreement, on the average *reducing* the size of the offer space to be searched by 90% in our sample task. We can identify the reduced region of search by focusing on the range of options in the offer space that still remain open between sequential offers (i.e., the set of potential agreements illustrated in Figure 2). This defines a restricted region of

[5]In fact, there are situations where a subsequent phase-shift back to an Exploratory phase occurs that appears to function to ''reorient'' the negotiation in the offer space, but followed by another Refinement phase. The demarcation of such a shift would simply be two sequential comprehensive offers (across parties) that have *no* content equivalence. This is the case for Dyad 7 (Table 3).

the offer space that is now the focus of joint attention. This, of course, facilitates achieving a joint-agreement, but the extent to which it accommodates any maximization of individual or joint gains depends on where (in the offer space) this region resides. Given that the refinement phase is dominated by comprehensive offers, our analysis focuses on the relation between comprehensive offers and content equivalence.

We refer to these restricted regions of the offer space as *refinement sets*—the set of possible agreements (i.e., comprehensive offers) that remain viable after one or more issue options have been (perhaps tentatively) agreed upon (i.e., are content equivalent). Refinement sets are not explicitly defined by negotiators and negotiators are probably not even directly aware of them; however, they do reflect an alignment of the common ground between the two negotiators in terms of the offer space and they do (indirectly) influence subsequent behavior by their restricted set of solution options. Refinement sets reveal the set of solution possibilities given a joint agreement on less than all of the issues under negotiation.

> A *refinement set* is the inclusive set of potential comprehensive offers (agreements) in the offer space that remain viable (i.e., do not violate any asserted content option) after a comprehensive offer has been made by each of the negotiators.

Returning to our example from Figure 3, we focus on exchanges between negotiators involving comprehensive offers that are content equivalent—that is, they have at least one issue option in common. Consider the Buyer's comprehensive offer B9, followed (but not immediately) by the Seller's comprehensive offer S11. The content of the Buyer's offer B9[2,5,9] specifies 2 days, Max 4 errors, and Smith-Corona). The content of the Seller's offer S11[2,7,9] specifies a different Editing option (option 7, Max 6 errors), but are content equivalent on the other two issues. Thus, the refinement set for these paired offers are the following three *potential* agreements:

	Speed	Editing	Appearance
1.	Option 2	*Option 5*	Option 9 [the Buyer's offer]
2.	Option 2	*Option 6*	Option 9
3.	Option 2	*Option 7*	Option 9 [the Seller's offer]

The Buyer then offered B12[2,6,9], which was in fact an offer included in the refinement set (Speed option 2; Editing option 6; Appearance option 9). In response, the Seller countered with an offer that differed in Editing (option 3), redefining the refinement set to be these four potential agreements:

	Speed	Editing	Appearance
1.	Option 2	*Option 6*	Option 9 [the Buyer's offer]
2.	Option 2	*Option 5*	Option 9
3.	Option 2	*Option 4*	Option 9
4.	Option 2	*Option 3*	Option 9 [the Seller's offer & agreement]

Table 5
Basic Properties of Refinement Sets for the Illustrative Data

Dyad	Average size	Average size as % of offer space*	Percent redundancy†	Percent of offer space searched‡
1	3.2	0.6	68.0	1.5
2	13.0	2.4	30.9	5.5
3	4.0	0.7	0.0	1.5
4	4.5	0.8	67.5	2.4
5	4.6	0.8	15.3	2.1
6	14.8	2.8	25.0	4.6
7	12.0	2.3	57.1	7.4
8	3.3	0.6	40.0	2.4
Average	7.4	1.4	37.9	3.4

Notes. *This is the percent of offer space covered by the average size of the refinement set, based on the adjusted 521 possible solutions within the zone of possible agreement for this problem.
†Percent redundancy is over all pairs of sequentially defined refinement sets of that negotiation.
‡Percent of offer space covered over the entire negotiation by number of unique offers generated over all refinement sets, based on the adjusted 521 possible solutions within the zone of possible agreement for this problem.

A refinement set is the consequence of a dynamic process engaged by both negotiators. Therefore, refinement sets evolve as the negotiation ensues. A refinement set contains more than one possible solution (else, it would be an agreed-upon solution), so it is informative to determine how many solutions comprise any particular set, as that size tells us how large of a space the negotiators must subsequently jointly consider. Table 5 presents the analysis of our illustrative data. The columns shows the average number of potential agreements in the refinement sets for the dyad and this number interpreted as a percentage of the entire offer space.

On average, refinement sets were small (under eight potential agreements), capturing only 1.4% of the offer space. For each negotiation, it is insightful to examine redundancy of offers in the refinement sets—the percentage of offers that remained the same in two adjacent refinement sets. The assessment of redundancy provides a measure of discontinuity in the evolution of refinement sets—that is, the more redundancy, the less discontinuity in the regions jointly searched. Redundancy suggests that search is progressing ''smoothly'' as refinement sets are transitioning in an overlapping manner. For example, Dyad 4 searched relatively smoothly through the solution set with (on average) 67.5% redundancy in refinement sets across contiguous offers (see Table 5). If we examine all refinement sets in a negotiation, we can generate an estimate of the offers space *jointly* searched in the negotiation (adjusting for redundancy). As can be seen in the last column of Table 5, even when all refinement sets are taken into account, on the average only 3.4% of the offer space is jointly searched.

***Proposition 6*:** Offer refinement search will tend to move smoothly across the offer space with few discontinuities and will reflect substantial overlap with, proximity to, previously defined regions.

How the Search Narrows: Content-based Heuristic and Bias

Reduction in the offer space under consideration might occur as a means of simplifying the task and should reflect integration of knowledge gained through discussion of preferences and priorities and prior offers made. This is similar to, and consistent with, the concept of ''minimization of collaborative effort'' from collaborative models of discourse (Clark & Wilkes-Gibbs, 1986). That is, if we presume that each negotiator is boundedly rational and seeks methods that will simplify the individual demands of the task, it is logical to assume that together they will employ methods that will jointly accommodate their cognitive restrictions and generally search (relatively) small fractions of the offer space. As we suspect, negotiators do not systematically examine large portions of the offer space. Much of the productive work that leads to agreements is accommodated by reducing the focus of substantive negotiation effort within the context of refinement sets.

***Proposition 7*:** A refinement set is the primary mechanism by which negotiators coordinate to reduce the search effort within an offer space.

Because of negotiators' cognitive limitations, it is not surprising that refinement sets are expected to be substantially smaller than typical offer spaces seen in this type of research. But how is this reduction realized? We suggest that one common mechanism is actually a by-product of a simple heuristic influenced more by the content of offers rather than their value. We previously defined *content distance* and *value distance* (see Table 1). We now apply these to the comprehensive offers and to refinement sets made within a negotiation, to infer the possible mechanism that explains the source of these offers.

In Figure 3, consider the comprehensive offer by the Buyer, B12[2,6,9], with Speed option 2, Editing option 6, and Appearance option 9. The Seller responds with S13[2,3,9], with Editing option 3, and Speed and Appearance options both are content equivalent to the Buyer's previous offer. The value to the Seller for that offer is 2,900 (see Table 1), but what is interesting is the *indifference set* for that value. If the Seller desires 2,900, there are 10 different content options that generate that value. The content distance from the Buyer's B12 offer is indicated.

	Speed	Editing	Appearance	Distance
1.	Option 7	Option 3	Option 8	9
2.	Option 6	Option 5	Option 7	7
3.	Option 5	Option 7	Option 6	7
4.	Option 5	Option 2	Option 9	7
5.	Option 4	Option 9	Option 5	9
6.	Option 4	Option 4	Option 8	5
7.	Option 3	Option 6	Option 7	3
8.	Option 2	Option 8	Option 6	5
9.	*Option 2*	*Option 3*	*Option 9*	*3*
10.	Option 1	Option 5	Option 8	3

Table 6
Content Distances Between Comprehensive Offers (and Indifference Sets)

	Ave content distance (between offers)*		Ave content distance (offer & indifference set)		
Dyad	Other negotiator's	Same negotiator's	Other negotiator's	Same negotiator's	Average size of indifference set†
1	2.3	1.6	5.6	5.6	12.5
2	6.0	6.0	7.4	6.5	8.0
3	3.0	1.9	6.0	7.5	21.0
4	2.5	2.3	5.6	5.5	11.1
5	2.0	6.0	5.7	7.3	10.0
6	4.5	4.1	6.9	5.7	9.3
7	5.4	4.9	8.1	6.5	9.0
8	2.0	1.8	6.3	5.7	8.3
Ave	3.4	4.2	6.3	6.2	11.1

Notes. *Smaller numbers indicate that the offers were closer (i.e., more similar) in terms of their content structure (i.e., issues and option levels).
†For the offers made between negotiators (Other Negotiator's).

The Seller's actual offer, S13[2,3,9], is the ninth in the list, noted in italics. There are two observations here. First, the Seller's offer minimizes the content distance from the Buyer's offer (one of three), but more importantly it is the only one that holds content equivalence to that offer—it is part of the refinement set. Thus, the odds that such an offer was selected randomly from this set are quite low (11%), as what might occur when searching solely by value (i.e., all offers are assumed equally likely) and not influenced by content.[6] Content distances for comprehensive offers were computed from the illustrative data, averaged within dyads, and the results are shown in Table 6. The second column shows the average content distance between a comprehensive offer made by one negotiator and the next comprehensive offer made by the other negotiator (Other Negotiator's), while the third column shows the average distance between two offers made sequentially by the same negotiator (Same Negotiator's). For example, in Dyad 1 when one negotiator made an offer, the other negotiator's response differed on the average by 2.3 options from that offer, but any two offers made by the same negotiator differed by only 1.6 options (suggesting that negotiators in that dyad had a tendency to rely on their own prior offer than on the other party when constructing the next offer).

Recall that for most offers, there is a set of offers (different content choices) that yield the same value to the negotiator—the indifference set. We calculated the average content distance between every comprehensive offer and every *possible* offer in its indifference set. In Table 6, the fourth column shows (when compared to the second column) that the

[6]In fact, we can compute the average odds of selecting the single, content-equivalent offer from the average indifference set sizes defined in the last column of Table 6. The lowest is 4.9% for Dyad 3 and the highest is 14.2% for Dyad 2.

average distance of an offer made is closer to the other negotiator's prior offer ($M = 3.4$ options, second column) than to the average distance of the offers that actually generate the same value for the negotiator via the indifference set ($M = 6.3$ options, fourth column). Similar results hold for the negotiator's own subsequent choices (distance from prior choice, $M = 4.2$ options, third column; distance from mean of indifference set of same value, $M = 6.2$ options, fifth column). As can be seen in the last column, when a negotiator responds to an offer made by the other negotiator, that offer is selected from an indifference set that has on the average 11.1 different possible choices of the same value. However, the offer selected from that set is more likely to "look like" (i.e., have closer content proximity with) the offer from the other party (closer to that than even their own prior offer). This illustrates what we call the *content similarity heuristic*.

***Proposition 8*:** *Content Similarity Heuristic*. Negotiators will respond to comprehensive offers with those that *tend to be similar* (in terms of content options selected) to immediately preceding offers (their own *or* the other party's).

The content similarity heuristic has consequences during refinement search. As at least one of the issues are in agreement between the negotiators during refinement (by definition), the use of this heuristic facilitates the specification of a common ground of search (specified by the agreed-upon issue and the remaining possible offers) and, ultimately, to the final agreement. We can demonstrate the influence of refinement sets on final agreements by analyzing their content distances. The average distance from the initial refinement set to the final agreement was 2.1 options and only 1.2 options to the penultimate refinement set.

What this illustrates is not only the influence of content structure on negotiation offers, but also the proximity maintained between offers and refinement sets that occur in a refinement phase of negotiation. As noted, we speculate that it is *cognitively* easier for negotiators to consider variations in content then assess the value of the options, than consider variations in value, and then attempt to craft the requisite agreement contents that can render that value. We also suggest that it is *collaboratively* easier for negotiators to consider variations in content, as offers and counter-offers are communicated in terms of their obvious content characteristics (e.g., tomorrow, max 3 errors, letter quality), making the content (and content options) more cognitively accessible to negotiators and the subsequent interpretation into value straightforward. We suggest that together these result in a *content proximity bias* that facilitates the coordination of the negotiation search activity. It is an anchoring and adjustment mechanism (Tversky & Kahneman, 1974), where the anchor is the refinement set and the adjustment is governed by the content proximity to extant issue options in that set. Consequently, knowing this bias could allow us to better predict the outcome regions that are likely to contain the agreed-upon solution.

***Proposition 9*:** *Content proximity bias*. Refinement sets (as common ground components) tend to evolve by relatively small changes in *content proximity* (issue options) that serve to maintain the continuity of joint attention and to reduce disturbance to the current state of the common ground.

Reflecting on Patterns of Comprehensive Offer Search

In this section, we ''step back'' and note four general (and possibly primary) patterns of search in negotiation dynamics (as revealed by the traces of offers) that can be explained in terms of comprehensive offers and refinement sets. One pattern type embodies *exploration*, and three others reflect *refinement*.

There are patterns that exhibit apparent randomness of offers. Often seen initially in negotiation, these early offers seem to be ''all over the place'' as in Raiffa et al.'s (2002, p. 274) ''dance of packages'', where negotiators exchange packaged offers early in a negotiation, each based on their own value goals, resulting in what appears to be a random sequence of comprehensive (or packaged) offers. However, even later in a negotiation an apparently random offer may be made and the dance can begin anew. In our model, the signature for the dance are sequences of offers that lack content similarity—offers that have no issue options in common with those made by the other negotiator. Our model suggests that such offers occur when an active refinement set is not acceptable (or not yet defined) as a region in the offer space that could support joint search, and assertions of offers are driven by concerns (perhaps as signals) of individualistic value alone. The consequence of this type of pattern is usually not an agreement, but rather a specification of a *new* refinement set that accommodates the joint interest of the parties. Negotiators are *searching* for a new neighborhood, as agreement formulations are more likely to be coordinated by content than value.

The next three patterns involve refinement sets. First, search can exhibit a pattern of *low* (*or zero*) *movement* toward the frontier and usually only *proximal activity* within the offer space. This is the case when comprehensive offers made between negotiators are generated from current or past offer refinement sets, or current or past refinement sets are modified via reconstituted offers. Thus, existing (although not necessarily articulated) alternatives are revisited. The refinement sets essentially parallel the Pareto frontier because the negotiators were distributing value on one issue while defining their refinement sets by agreeing (anchoring) on another. As such the negotiators were *remaining* in their neighborhood.

Second, search can exhibit a *systematic extension* into nearby regions of the offer space not covered by the existing refinement set, but are proximate to the refinement set, as asserted by Proposition 6. The emergence of offers and refinement sets are tightly intertwined such that comprehensive offers are often influenced by the most recent offers and active refinement sets. This results in a systematic and constrained pattern of extension into the offer space. Negotiators are collaboratively *reforming* their existing neighborhood.

Finally, there can be a *discontinuous shift to a new offer refinement set* via exploration. Rather than the smooth movement in the proximal regions of the offer space as demonstrated in the previous pattern, these patterns describe fundamentally new refinement sets that are not unrelated (as the first ''random'' pattern described), but have at least one common offer from the prior refinement set, and represent distinct changes in the regional boundaries that are explored. Subsequent movements are localized in this region that converges to a final offer that is likely already specified in this new refinement set. In this pattern, negotiators are *redefining* their neighborhood.

Patterns of Search and Quality of Agreement

The nature of the search patterns engaged in a negotiation should influence the likelihood of optimal agreements. Accordingly, we offer the final propositions, necessarily speculative, which relate these predicted patterns to negotiation success or failures. First, unless an early offer happens to be proximal to the optimal frontier, negotiators are unlikely to discover an optimal agreement when they prematurely form a refinement set. This type of analysis can serve as a barometer to likely solutions using such ''thin-slices'' of negotiation behavior (e.g., Curhan & Pentland, 2007). For example, in our illustrative data set, initial refinement sets that were ''farther'' from Pareto optimality tended to also be farther from Pareto optimality in terms of their final solution ($\gamma = .72$, $p < .05$). If these initial refinement sets are far from the optimal frontier it may signal that the negotiators do not have adequate insight into the negotiation landscape which may also lead to limited subsequent search and suboptimal agreements.

Proposition 10: Negotiations characterized by initial refinement sets that are farther from the Pareto optimal frontier and early or inflexible proximal search are less likely to reach optimal agreements.

Second, as initial refinement sets may not contain solutions on, or even close to, the Pareto optimal frontier, search patterns that systematically extend the refinement set have a higher likelihood of reaching optimal solutions. Given the anchoring effect of the initial agreement region, subsequent refinement search patterns are likely to be content-based being substantially influenced by content options within those sets, thus adjustments by value can be used to ''push'' the composition of the refinement set toward a value-gaining region. When extensions occur, we expect them to move towards the Pareto optimal frontier because movements away will not be reinforced by the other party as they reduce value for one or both parties. In fact, if we examine the geometric distance between the average individual values to the Buyer and Seller in the initial refinement set and compare those to their eventual agreement values, we see that the improvements offer values to the individuals that are significantly increased (paired $t = 3.79$, $p < .01$).

Proposition 11: Search patterns that systematically extend the refinement set are more likely to reach optimal agreements.

Finally, discontinuous reorientations of the refinement set shifts the negotiators into a new region of the offer space and have the potential of reframing the negotiation. Reorientations are indicated when a new exploration-refinement pattern occurs and likely reflect insight into the integrative potential of the task, as they rely on some commonalities, but re-content the offer in a way that redefines the active refinement set. A reorientation pattern embodies reengagement of the Exploration phase; however, it carries with it information obtained by the history of the exchanges, so the likely result of the new Exploration phase would be repositioning in a more advantageous region of the offer space. The combination of insight and reframing should help the parties move toward optimality.

***Proposition 12*:** Reorientations of the refinement set should increase the likelihood of reaching optimal agreements.

Discussion

In thinking about the how this model advances the field of negotiation, we need to consider how it relates to prior research on negotiation processes. Earlier we mentioned research on distributive bargaining offer patterns, systematic concession making, and package offer patterns and considered how our approach extended that work. Whereas previous theories of offers took a more individual negotiator-centric approach, our model considers the co-construction of knowledge and search via offers. Our model suggests an alternative way to conceptualize offer exchange and novel approaches to tracking and predicting the effects of offers on negotiated agreements. Rather than focusing exclusively on the individual without consideration of context, our model embodies the social interaction. As a result, we provide a more comprehensive representation of negotiator cognition and add to the understanding of negotiation process and the potential for more accurate predictions of offer making and outcomes. Rather than focus on concession rate and systematic value-based search, our model considers proximity of offers and exploration (value based) versus refinement (content based) search processes. Rather than focus on point predictions of outcome optimality, our model focuses on predictions of patterns (as refinement sets) and properties of patterns, such as proximity and size, as a consequence of boundedly rational beings engaging in a collaborative problem solving process. By recognizing the cognitive limitations of negotiators and considering how that influences offer-making, we gain a better understanding of how negotiators actually compose offers and how they lead to agreements. We build off Raiffa (1982) and Raiffa's et al.'s (2002) distinction between the dance of packages and the joint construction of a compromise contract to do so.

We can also relate this model to the use of negotiation *reference points*. Reference points are relevant comparators that can serve as cognitive anchors for subsequent offers and outcomes (Blount, Thomas-Hunt, & Neale, 1996; Galinsky, Mussweiler, & Medvec, 2002). Both internal (e.g., reservation prices, aspirations, or opening offers) and external (e.g., market value) reference points have been examined in the context of two-party price negotiations (Galinsky et al., 2002; Kristensen & Garling, 1997, 2000; Van Poucke & Buelens, 2002) and the relative weighting of these reference points depends on the context of the negotiation (Blount et al., 1996) and can be influenced by simple task manipulations (Ritov, 1996). Whereas this literature considers the impact of fixed reference points on initial offers and outcomes, as well as on satisfaction with outcomes, our model takes a more dynamic approach by framing all offers as potential cognitive anchors from which negotiators will formulate their responses based on the presentation of the task. Thus, our model picks up from where the reference point literature leaves off by considering how negotiators update their framing of the negotiation in response to subsequent offers.

Finally, we can consider articulating a description (not prescription) of the general process in terms of Gigerenzer's (2007) ''fast and frugal'' methods of heuristic search, adapted to the task at hand and under the constraints of bounded rationality, that is

both efficient (in terms of search) and effective (in terms of solution quality). The search rules are simple, first relying on value-based cues to explore the search space, and stop when at least one issue agreement can be made (albeit tentative). Search then moves to content-based cues to refine the search space and coordinate toward crafting a comprehensive agreement. If aspirations can be met within this reduced space, then search is stopped and an agreement is made. If not, minor additional value-based cues drive adjustments; otherwise, a shift back to value-based cue exploration ensues.

Additional Model Development

An obvious refinement of the model is needed to consider the treatment of issues that are continuous in nature, like price, when capturing offer movement and refinement sets. Additional work is needed to expand the conceptualization to include negotiations that include issues whose options are continuous, or afford more complex contingencies in the value structures that cause various forms of discontinuities in the landscape of the offer space. At the most simplistic level, discrete options could be generated by identifying ranges of values. Content could be examined for the discrete issues and continuous options could be added in when plotting the offers and identifying the refinement sets. In the case where the issue options are monetized (e.g., price), the distinction between value and content search becomes blurred.

Our model focuses on a two-party situation; extensions into multi-party settings present an interesting challenge. The current approach maps refinement sets and offer patterns in terms of value to each party. As we add more parties into the mix, the mapping would be in *n*-dimensional space. While visualization may be difficult, calculation of exploration, refinement, equivalence sets, structural distance, and refinement sets would largely be the same because those measures tap offer-content rather than offer-value change to each of the parties. Similar extensions can be made by increasing the number of issues. In either case, would exploration sequences be extended? Would refinement and common ground be more resistant to change?

Our model examines situations where the negotiation terrain is fixed; that is, the issues, options, and values are set. However, negotiators often introduce new issues during the course of a negotiation or reformulate existing issues to find solutions that bridge negotiators' interests in novel ways. When new issues are added or reformulated, the negotiation terrain changes, requiring a more dynamic representation of the solution set. Many interesting questions arise when considering a dynamic solution set. Do prior offer patterns trigger reconsideration of the framing of issues? Are bridging solutions more likely to arise after negotiations get stuck in a local space?

Model Extension

While developing our theoretical model, we delineated propositions regarding the mechanisms of search. Our propositions addressed how negotiators would search the offer space, how offers build on other offers, the differential roles of value-based exploration

and offer refinement, and heuristics of search. Once these mechanisms are well understood, additional theory should be developed and empirical research conducted relating external causal factors that affect search and its subsequent influence on quality of agreement. External factors of interest could include social motives (discussed in more detail below), deadlines, knowledge of other parties' priorities, negotiation expertise, among others. For example, shared deadlines may motivate negotiators to reach an agreement quickly, perhaps increasing the likelihood of suboptimizing via local search. Or, if one negotiator is more expert than the other, she might be able to influence the extension of the refinement sets in her favor. Future research should also consider how to embed our theory of negotiation into more behavioral and strategic models of negotiation.

The model also suggests the need for possible interventions that might help negotiators break free from the content bias. For example, post-settlement settlements provide the opportunity for negotiators to revisit a negotiated agreement by searching for Pareto superior agreements after a mutually acceptable potential agreement has been reached (Bazerman, Russ, & Yakura, 1987; Raiffa, 1985). As such, post-settlement settlements can serve as a discontinuity in the search process, allowing negotiators to reframe the issues and the relationships amongst them. This could increase the probability of exploration and reorientation of refinement sets. Another intervention might be instructing negotiators to propose two or more value equivalent offers (to oneself) and allow the other party to choose which offer is most beneficial to themselves (Bazerman, 1990; Leonardelli, G. J., Galinsky, A. D., Gu, J., & Medvec, V. H. (2009) Manuscript under review.). Using one's indifference set to formulate offers increases the odds that one of the offers will be Pareto superior and will be responded to by the other party in the ensuing search. The response will also provide insight into the others' preferences and priorities across the issues.

As search is goal-directed behavior, our model should be extended to consider the role of social motives (e.g., whether negotiators are more cooperative or individualistic in their orientation toward a negotiation; De Dreu, Weingart, & Kwon, 2000). Social motives are typically defined in terms of goal maximization—individualists work toward a goal of maximizing their own outcomes whereas cooperatives work toward maximizing their own and others' outcomes simultaneously (Deutsch, 1949). We might expect individualists to be more exhaustive than cooperatives in their indifference set search, being reluctant to sacrifice their own value, but less concerned with their opponent's outcome. They might also be less likely than cooperatives to incorporate information from their opponent's offers into their own, such that their offer is more similar in content to their own prior offer (e.g., ''within party'') than to the other party's prior offer (e.g., ''across party'').

Perhaps one of the most important extensions to the model will be the understanding of how offer content, in conjunction with other tactical behavior, influences quality of agreement and the discovery of Pareto optimal solutions. Offers are not the only mechanism for search and discovery; information exchange, a foundational tactical behavior, also serves a search function. Interesting questions arise when considering both approaches simultaneously. How do information exchange and offer content play off

one another? Do negotiators use information exchange to "fill in the blanks" between offers—that is, will simultaneously capturing information exchange help us predict the ways in which offers are altered and when negotiators might engage in exploration as opposed to refinement? If a negotiating group relies on one mechanism (offers or direct information exchange) over the other, will that influence their ability to discover an optimal agreement? Are there situations where exploration with offers is more effective than information exchange-as-search (or vice-versa)?

In conclusion, Raiffa et al. (2002) notes that in the real world, negotiators often exchange packages and advises that the worst thing a negotiator can do is to "go into the details of AAA's package and propose amendments to it" (p. 274). We agree that this approach will be counterproductive for a negotiator when those details anchor the negotiator in terms of offer value. However, negotiators must, and we believe do, pay attention to the information embedded in those offers to help them find agreements that are mutually acceptable, if not Pareto optimal. This is the role of offers as search. Negotiators also must, and we believe do, accommodate the demands of the task complexity with their limits as boundedly rational individuals. This is role of refinement sets. We believe our model moves us toward understanding how negotiators use offers to search via exploration and refinement of the potential set of agreements. A more complete understanding of the progression of offers during a negotiation can move us closer toward mapping the routes through which agreements are reached and toward predicting the regions of agreements.

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