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# Simulated Negotiations in the Hiring of a Salesforce Manager: Tests of Two-Person Bargaining Solutions

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***Abstract***

This paper examines the ability to predict bargaining outcomes consistent with Nash, Kalai-Smorodinsky, and Gupta-Livne bargaining models as well as two heuristic solutions based on interpersonal (cardinal) comparisons of utility. Equal earning and equal loss solutions are developed from bargainers' multi-attribute utility functions. An experimental test of these bargaining solutions is conducted for simulated negotiations between a representative of sales force management and a representative of sales force employees over the hire of a regional sales manager. Results show that proportional (Kalai-Smorodinsky) solutions are generally more likely when bargaining is conducted in attribute space, and equal loss solutions are more likely in utility space.

**Key words:** bargaining models, multi-attribute utility

## 1. Issues and purpose

Research in two party decisions to date has centered on one of two types of bargaining scenarios: *Utility space* where bargainers negotiate a choice based on the overall utilities of choice-options (Eliashberg, et al., 1986; Gupta and Livne, 1989), or *attribute space* negotiations where bargainers negotiate over multiple objectives or attributes (e.g., Curry, Menasco, and Van Ark, 1991). For both bargaining spaces, various bargaining solutions have been studied. These include additive (Harsanyi, 1955), in which the sum of bargainers' utilities is maximized; multiplicative (Nash, 1950), in which the product of utilities is maximized; proportional (Kalai and Smorodinsky, 1975), in which equal proportions of maximum attainable utilities are sought; and reference point (Gupta and Livne, 1988) models, where a prior status-quo or no-settlement point dictates the outcome of negotiations. Two related issues arise from this stream of research. First, is how do bargaining models compare in terms of their predictive abilities across the two types of bargaining spaces and would bargainers prefer to conduct negotiations in one space over the other (Curry, Menasco and Van Ark, 1991)? Second, in traditional negotiations, an arbitrator or mediator finds axiomatic solutions that should be equally satisfactory to both sides. But left to their own skills, as in many marketing scenarios, bargainers are likely to employ strategies inconsistent with axiomatic solutions (Raiffa, 1982, Sebenius, 1992).

In this paper, empirical comparisons between traditional bargaining models and two heuristic models are presented for negotiations in both attribute and utility spaces. The models are termed equal earning (*EE*) and equal loss (*EL*) rules. An assumption that bargainers are making interpersonal comparisons is necessary (contrary to Nash's axiom of non-comparability in utility scales) for either solution to reflect actual bargaining choices. Kalai (1977) and Myerson (1977) previously proposed equal gains solutions based on interpersonal comparisons of utility.

We also examine the effect of two other factors on inducing either equal earning or equal loss solutions. These factors are a bargainer's motivation to seek a bargaining solution favoring his or her most preferred choice and the addition of a non-zero reference point (Gupta and Livne, 1988) that may favor one bargainer over the other. Bargaining choices are made by a sample of non-experts. Implications for expert negotiations are presented in a discussion of results.

## 2. Model development

Solutions for equal gains and equal losses are based on bargainers using individual multi-attribute utility functions. In general, the utility for a single alternative can be expressed as follows:

$$\text{Bargainer 1: } U = \sum_{i=1}^{D} v_i X_i$$

$$\text{Bargainer 2: } Q = \sum_{i-1}^{D} w_i X_i$$

where $U$ and $Q$ are the utilities assigned by bargainer 1 and 2 respectively to each of $n$ choice options in the bargaining set; $v_i$ and $w_i$ are attribute weights reflecting the importance of the $i$th attribute to bargainer 1 and 2, respectively, and the choice options have common attributes with ratings $X_i$, $i = 1 \ldots D$, where $D$ is the number of attributes. Attribute weights are normalized so that $\Sigma_{i=1}^{D} v_i = \Sigma_{i=1}^{D} w_i = 1$ , and the bargaining set is restricted to a Pareto frontier defined by trade-offs of attribute scores, such as $\Sigma X_i = 1$ or $\Sigma X_i^2 = 1$. For the research presented here, we assume a linear (Pareto) frontier in the normalized form, $\Sigma X_i = 1$. Linear utility space frontiers generally consist of single line segments anchored by maximum and minimum utilities for the most and least preferred choice options of both bargainers. Lengths and slopes of different frontiers depend on opposing weight vectors exhibited by the two bargainers.

Solutions developed below are derived from the maximum and minimum utilities available to bargainers assuming they value different attributes as most important. The worst a bargainer can do is to capitulate to an opponent. The best a bargainer can accomplish is to earn the most utility available, thus forcing an opponent to capitulate and earn their minimum utility. The maximum utility for a bargainer is simply the product of the largest weight and the best score on the most preferred attribute. To simplify notation assume attributes are placed in canonical order and weight vectors $v$ and $w$ ordinally inverse. Without loss of generality, let player 1 favor attribute 1; then player 2's most important attribute is $D$. We now have $v_1X_1 = U^{\max}$ and $w_DX_D = Q^{\max}$ where $v_1 > v_2,\ldots,v_D$; $w_D > w_1,\ldots,w_{D-1}$; and $X_1$ is the maximum score on attribute 1 and $X_D$ is the maximum score on attribute $D$ across the $n$ choices. Minimum (capitulation) utilities ($U^{\min}$ or $Q^{\min}$) are determined by applying a bargainer's relevant attribute weight to an opponent's most important attribute, i.e., $v_DX_D$ and $w_1X_1$ for players 1 and 2 respectively. Although capitulation may not be a physical option in the bargaining space, it does provide an anchor (Kahneman, 1992) as the minimum utility a bargainer could earn short of breaking-off negotiations. Under these conditions, two bargaining solutions are defined:

1. $(U^{\max} - U^l) = (Q^{\max} - Q^l)$ is called an 'equal loss rule' for which bargainers seek a choice that equalizes the differences in their utilities from the maximums they would earn if each could select their own *most* preferred alternative. Let $(U^{\max} - U^l) = u^l$ and $(Q^{\max} - Q^l) = q^l$.
2. $(U^e - U^{\min}) = (Q^e - Q^{\min})$ is called an 'equal earning rule' for which bargainers seek a choice that equalizes the differences in their utilities from the minimum they would receive if each were forced to select their own *least* preferred alternative. Let $(U^e - U^{\min}) = u^e$ and $(Q^e - Q^{\min}) = q^e$.

For a given frontier, $u^l = u^e = q^l = q^e$. This is a simple arithmetic outcome for points equi-distant in units of measurement from the respective endpoints of a line segment. Equivalent solutions in attribute space are found by solving for attribute scores that yield equal earning and equal loss utilities with the weight vectors **v** and **w**.[1]

## 3. Experiment

Three factors were specified influencing the outcome of two-party negotiations. (1) The type of bargaining space can have a bearing on the outcome of negotiations. Bargaining in utility space might make interpersonal comparisons easier and equal loss/earning outcomes more likely to occur. (2) While motivation has not been explicitly modeled in axiomatic or process models (Balakrishnan and Eliashberg, 1995) incentives given to agents who negotiate on behalf of parties should have a bearing on a negotiated agreement. (3) The existence of a prior reference point, as is often the case in repeated negotiations, should alter the bargaining game in favor of the side who derives greater utility from the reference option (Gupta and Livne, 1989). Accordingly, a $2 \times 2 \times 2$ experiment was designed in which these three factors were manipulated.

### *3.1. Sample*

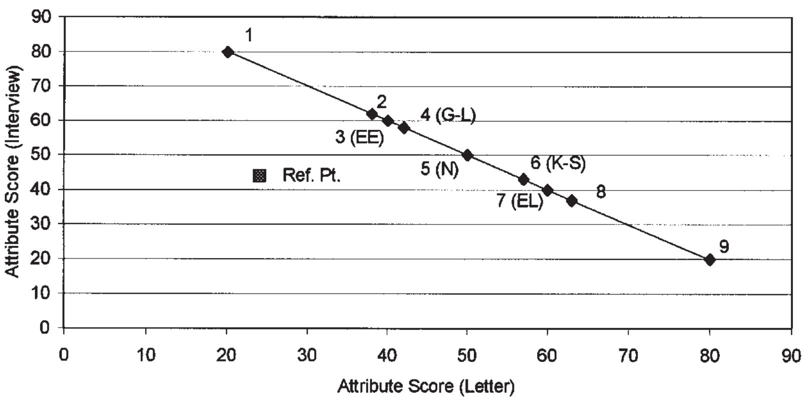
Participants were selected from a pool of students taking undergraduate business classes as well as MBA and executive MBA classes at two universities. A total of 93 pairs of subjects took part in the experiment. Results from 90 pairs were usable. Subjects were randomly assigned to bargaining pairs and pairs were then randomly assigned to each of the eight treatment cells. There were unequal cell sizes ranging from 9 to 19 pairs.

### *3.2. Bargaining scenario*

The problem facing each bargaining pair was one of recruiting a regional sales manager (for a computer manufacturer) from among nine candidates previously rated on evaluations of letters of reference (L) and a personal interview (I). Subjects assumed the role of either the management or employee representative. The scenario was designed to mimic representation in negotiations. Bargainers were allowed ample time to complete their negotiations, but they were not required to reach a settlement. Bargainers were told they would receive $1 if they failed to reach an agreement; otherwise, bargainers were paid according to discussion of the motivation factor presented below.

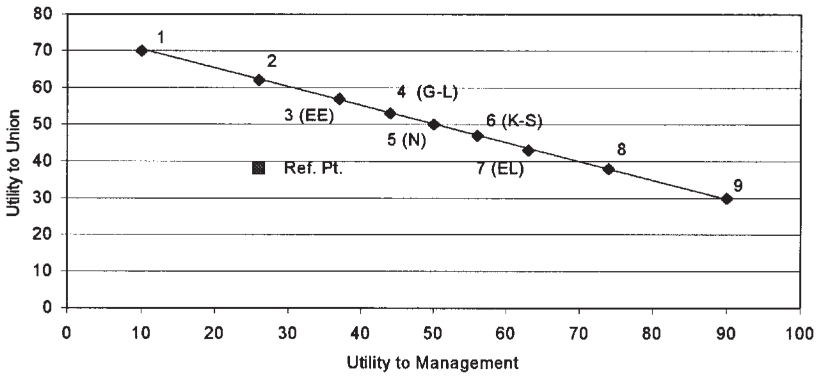
Figures 1 and 2 show the Pareto frontiers in attribute and utility bargaining spaces. One of two versions of these diagrams (with or without a reference point) was shown to bargainers so that maximum and minimum values and trade-offs in attribute or utility scores were made apparent. In the figures, solutions are given as *EE* (equal earning), *G-L* (Gupta-Livne), N (Nash), *K-S* (Kalai-Smorodinsky), and *EL* (equal earning).

In attribute space, attribute weights were assigned to management and union bargainers, and bargainers were instructed as to how they could aggregate their individual multi-attribute utility functions. Attribute scores were standardized on a 0–100 scale described by $I = 100 - L$ with importance weights of (.9,.1) for management and (.3,.7) for union bargainers applied to the attribute scores $L$ and $I$, respectively. The end points used in attribute space were set differently than in utility space to avoid artificial attribute scores




| SCORES | CANDIDATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| LETTERS | 20 | 38 | 40 | 42 | 50 | 57 | 60 | 63 | 80 |
| INTERVIEW | 80 | 62 | 60 | 58 | 50 | 43 | 40 | 37 | 20 |

*Figure 1.* Alternatives in attribute space.




| UTILITIES | CANDIDATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| MANAGEMENT | 10 | 26 | 37 | 44 | 50 | 56 | 63 | 74 | 90 |
| UNION | 70 | 62 | 57 | 53 | 50 | 47 | 43 | 38 | 30 |

*Figure 2.* Alternatives in utility space.

of (0,100) and (100,0). The corresponding utility frontier, however, was constructed using the attribute weights assigned to the two bargaining sides with end points of (0,100) and (100,0). Whether in attribute or utility space, the candidate numbers correspond to the same solution concept. For example, the equal loss candidate was number 7 with attribute ratings of (60,40) and utility scores of (63,43). For utility space negotiations, bargainers were told that utility scores for each candidate were determined from that individual's letters and interviews, but the aggregation rule was not disclosed. Forty-nine pairs were assigned to utility space and 41 pairs to attribute space.

***3.2.1. Motivation.*** Under symmetric motivation, both players received $10 if they achieved a negotiated solution. For the asymmetric condition, one player was promised $10 for an agreed solution (any solution), while the other was promised a maximum of $20 and compensation proportional to the closeness of the solution to their maximum utility point. In this case, only the player with added incentive knew of the other's pay-off scheme. Fifty pairs bargained under symmetric motivation, while 40 pairs bargained under asymmetric motivation.

***3.2.2. Reference point.*** A reference point was created by telling the bargaining pair that a temporary manager (who would not be hired permanently even if negotiations failed) was carrying out the duties of the regional sales manager position. It was clear that the temporary manager was sub-Pareto optimal with utility of 26 to management and 38 to union. The temporary manager's ratings were 24 on letters and 44 on interview. The new reference point did not correspond to bargainers' capitulation (minimum) utilities and it favored the union. Forty pairs encountered the reference point in their bargaining and 50 pairs did not.

## 4. Hypotheses

Three hypotheses examining the main effects of bargaining space, motivation and reference point on selected bargaining solutions and their resulting interactions were tested. These hypotheses reflect noncentral outcomes predicted by equal earning and equal loss rules and by solutions per Gupta-Livne (1988), Kalai, and Smorodinsky (1975). In the interests of space, hypotheses about Nash (central) outcomes are not stated, although a summary of these tests is presented in the Results section.

**H1:** In utility space, there are more choices consistent with equal loss and equal earning than for the corresponding game in attribute space. There should also be more choices consistent with equal loss and equal earning with asymmetric motivation compared to symmetric motivation (main effects of bargaining space and motivation on *EE* and *EL* outcomes).

In attribute space bargainers must find solutions corresponding to equal loss/earning by calculating utilities using their individual multi-attribute utility functions. Alternatively, interpersonal comparisons necessary for *EL* and *EE* solutions are easier to make in utility space, because absolute differences in units of utility can be readily considered. Motivation should have a greater effect on *EL* and *EE* choices in utility space, and thus an interaction between bargaining space and motivation is expected.

**H2:** When a positive valued reference point exists, there is a shifting of choices consistent with a Gupta-Livne solution (main effect on *G-L* outcomes).

When there is a new reference point, which is non-zero, we expect bargaining choices to conform to the Gupta-Livne model. In this case, bargainers would seek a solution by starting from the reference point and moving to an ideal utility defined by each of their maximium scale utilities (100, 100). The *G-L* choice occurs where this ideal-point ray intersects the Pareto frontier (see Gupta and Livne, 1989). Alternatives to *G-L* such as Nash and Kalai-Smorodinsky assume the existence of a natural nosettlement point (Shubik, 1985), and one might expect fewer of these solutions to occur when a reference point emerges. The reference point gives a built-in bargaining advantage to one of the players, and an interaction between motivation and the existence of the reference point is also expected.

**H3:** In attribute space, there are more choices consistent with a Kalai-Smorodinsky solution than for the corresponding game in utility space (main effect of bargaining space on *K-S* outcomes).

The Kalai-Smorodinsky solution is fair in the sense that each player makes the same proportional gain from a natural reference point ($U^{\min}$, $Q^{\min}$) to the maximum utility point ($U^{\max}$, $Q^{\max}$). Because processing requires using attribute scores and weights in attribute space, a proportional solution becomes a more demanding task in than in utility space. In attribute space, equivalent heuristics are available using attribute scores, and Kalai-

Smorodinsky solutions are more likely when bargainers are faced with symmetric motivation compared to asymmetric motivation.[2] In both spaces under asymmetric motivation, bargainers might be induced to choose a more extreme candidate.

## 5. Results

Expected cell sizes in the eight treatment cells of the (2 × 2 × 2) design were too small for a single analysis. Therefore cells were combined and partitions of three 2 × 2 treatment samples were analyzed. This resulted in contingency tables in which the rows changed depending on which treatments were being considered, but the columns always represented the same five responses corresponding to five different bargaining solutions: Equal Earning; Gupta-Livne; Nash; Kalai-Smorodinsky; Additive and Equal Loss combined into a category (there was one instance of an end-point choice, corresponding to an additive solution). The maximum likelihood method of Bishop, Fienberg, and Holland (1975) was used with a linear model and marginal probabilities (relative frequencies) of specific solution outcomes as response (dependent) variables. Estimation was done using PROC CATMOD in SAS (Version 6). The frequencies of each solution type in each cell of the experimental design are shown in Table 1.

### *5.1. Protocols*

Written protocols and any calculations by bargainers were collected after they finished the experiment. These were combined with statements made during exit interviews. Wherever possible, a solution type consistent with a subject's comment was matched to the comment. A tabular summary of protocols may be obtained from the authors. Two results to

*Table 1.* Frequency Data: Treatment Cells and Solution Types

| | (0,0) Status Quo | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Symmetric Motivation | | | | | Asymmetric Motivation | | | | |
| | Earn | G-L | Nash | K-S | Loss | Earn | G-L | Nash | K-S | Loss |
| Utility space | 1 | 1 | 5 | 2 | 10 | 1 | 1 | 1 | 6 | 1 |
| Attribute space | 0 | 1 | 1 | 7 | 1 | 1 | 1 | 1 | 4 | 4 |
| | New Reference Point | | | | | | | | | |
| | Symmetric Motivation | | | | | Asymmetric Motivation | | | | |
| | Earn | G-L | Nash | K-S | Loss | Earn | G-L | Nash | K-S | Loss |
| Utility space | 1 | 1 | 5 | 2 | 1 | 1 | 6 | 1 | 1 | 1 |
| Attribute space | 1 | 1 | 1 | 6 | 2 | 0 | 4 | 0 | 3 | 2 |

be noted from this analysis are: (1) Thirty-one percent of bargaining pairs said they started by eliminating the end-point candidates on the frontier, and (2) thirty-seven percent of bargaining pairs said they eliminated a mid-point solution as being "too obvious, too simple, or too unrealistic."

### *5.2. Motivation check*

From an analysis of protocols, 45% of pairs bargaining in attribute space under asymmetric motivation stated that one bargainer changed his/her attribute weights in response to their opponent's arguments. Considering both attribute and utility spaces together, 33 of 40 bargaining outcomes were skewed towards the party with the greater incentive. In three cases, the bargaining pair arrived at a (central) Nash outcome, and in four cases, outcomes favored the bargainer with the lesser incentive.

### *5.3. Central vs. extreme solutions*

A summary of extreme versus central solutions is presented because of the seminal role the Nash solution has played in empirical testing of cooperative game theory. There were significantly more Nash outcomes under symmetric compared to asymmetric motivation and in utility space versus attribute space ($p \leq .05$). Attribute space yielded only three Nash solutions, while in utility space, 12 of 49 choices (24.5%) corresponded to Nash solutions.

### *5.4. Tests of hypotheses: Extreme solutions*

Table 2 shows estimates of main effects of bargaining space (Bargsp**EL*), motivation (Motivn**EL*), and the interaction of bargaining space and motivation on the probability of an equal loss outcome. The 'intercept' term labeled *EL* represents the intrinsic probability of obtaining an equal loss outcome to this bargaining game. The likelihood ratio is a measure of the overall goodness-of-fit of this model to the data. Contrary to hypothesis 1, there is not a significant effect of bargaining space or motivation on *EL* outcomes (non-

*Table 2.* M-L Estimates: Bargaining Space and Motivation on Equal Loss Solutions

| Effect | Estimate | Standard Error | Chi-Square | Prob |
|---|---|---|---|---|
| E-L | −0.00197 | 0.1463 | 0.00 | 0.9893 |
| Bargsp*EL | −0.03140 | 0.1463 | 0.05 | 0.8300 |
| Motivn*EL | 0.07000 | 0.1463 | 0.23 | 0.6326 |
| Bargsp*Motivn*EL | −0.03061 | 0.1463 | 4.38 | 0.0364 |
| Likelihood Ratio: | d.f. = 12 | | 38.03 | 0.0002 |

significant main effects were also found for the equal earning solution). While the frequency of *EL* bargaining choices is greater in utility space than in attribute space, the difference is not statistically significant.

The interaction between bargaining space and motivation (Bargsp*Motivn*EL) is significant; however, it is opposite to predicted choices. The frequency of *EL* choices should be equivalent in both spaces under symmetric motivation, but the frequency should be greater in utility space compared to attribute space under asymmetric motivation. Instead, symmetric motivation produced more *EL* solutions (11 of 29 choices or 38%) in utility space than in attribute space (3 of 21 choices or 14%). In addition, the frequency of *EL* solutions is greater in attribute space under asymmetric motivation than in utility space (6 of 20 vs. 2 of 20 choices). Motivation thus appears to have no effect in utility space but slightly more of an effect in attribute space. An interpretation of these results is presented in the following section, Discussion of Results.

Table 3 shows weak support for hypothesis 2 (the main effect, Refpt*G-L, is significant at $\alpha \leq .10$). Another analysis, with reference point and bargaining space as the main factors yields a significant effect on *G-L* choices ($p = .02$). Combining these results, there is some evidence that a new reference point leads to bargaining choices that are consistent with Gupta-Livne. While the interaction between motivation and reference point (Motivn*Refpt*G-L) is in the direction hypothesized, it is not significant. However, written protocols indicate that five bargaining pairs in utility space and three pairs in attribute space started their negotiations from the reference point when faced with asymmetric motivation.

Results presented in Table 4 support hypothesis 3. There is a significant main effect for bargaining space on *K-S* choices (Bargsp*K-S). The frequency of *K-S* outcomes is greater in attribute space (20 of 41 choices or 49%) than in utility space (11 of 49 choices or 22%). Furthermore, twenty-one pairs bargaining in attribute space stated in written protocols that they sought equal proportions of maximum scores on their most preferred attributes. The interaction between bargaining space and motivation (Bargsp*Motvin*K-S) is also significant: This interaction is in the direction hypothesized: Under symmetric motivation there are significantly more *K-S* solutions in attribute space (13 of 21 choices or 62%) than in utility space (4 of 29 choices or 13.8%). For asymmetric motivation, the frequency of *K-S* outcomes is the same in both attribute and utility spaces (7 of 20 choices in each space).

*Table 3.* M-L Estimates: Motivation and Reference Point on Gupta-Livne Solutions

| Effect | Estimate | Standard Error | Chi-Square | Prob |
|---|---|---|---|---|
| G-L | 0.1562 | 0.1705 | 0.84 | 0.3596 |
| Refpt*GL | 0.3129 | 0.1705 | 0.05 | 0.0665 |
| Motivn*GL | −0.3129 | 0.1705 | 0.23 | 0.0665 |
| Bargsp*Motivn*GL | 0.2763 | 0.1705 | 4.38 | 0.1053 |
| Likelihood Ratio: | d.f. = 12 | | 30.07 | 0.0016 |

*Table 4.* M-L Estimates: Bargaining Space and Motivation on Kalai-Smorodinsky Solutions

| Effect | Estimate | Standard Error | Chi-Square | Prob |
|---|---|---|---|---|
| K-S | −0.3558 | 0.1264 | 0.00 | 0.9893 |
| Bargsp*K-S | −0.3039 | 0.1264 | 5.78 | 0.0162 |
| Motivn*K-S | −0.0278 | 0.1264 | 0.05 | 0.8260 |
| Bargsp*Motivn*K-S | 0.3041 | 0.1264 | 5.80 | 0.0160 |
| Likelihood Ratio: | d.f. = 12 | | 21.63 | 0.0418 |

### *5.5 Discussion of results*

***5.5.1. Motivation.*** The motivation factor was designed to induce non-central solutions. There were no main effects of motivation on *EL* and *K-S* solutions but a main effect on the *G-L* solution, and significant interactions for motivation and bargaining space on *EL* and *K-S* solutions did occur. For bargaining in utility space, when both bargainers are given equal financial incentives, it appears that maximum utilities attainable to the negotiations will emerge as the relevant anchor rather than minimum utilities. This interpretation is bolstered by the greater frequency of *EL* outcomes (shown in Table 1) in the absence of a reference point that may be perceived by bargainers as a competing anchor.

Since the *K-S* and *EL* candidates are close in space to one another on both attribute and utility frontiers, we might expect them to be viable competitors for bargaining choices under asymmetric motivation. Switches between *K-S* and *EL* outcomes may have occurred to explain the marginally greater number of *EL* choices in attribute space compared to utility space. This was not anticipated under the interaction for **H1**. However, over both spaces, bargainers preferred *K-S* to *EL* solutions (14 of 40 choices vs. eight of 40 choices) under asymmetric motivation.

***5.5.2. Bargaining space and reference point.*** It should be noted that *G-L* and *EE* solutions are also competing for bargaining choices on their side of the frontier, but that overall, the *G-L* solution was preferred to equal earning when bargainers encountered the reference point. Gupta and Livne (1989) showed that a reference point solution was favored to a local *K-S* solution in their research using simulated negotiations between a manufacturer and buyer. Although results for **H3** show that proportional solutions are more prevalent in attribute space, Table 1 indicates possible switches from *K-S* to GL choices when incentives are offered that favors a GL solution in utility space. In our case, the *K-S* solution is global (assuming 0,0 status quo), and further research is necessary to establish the effects of a reference point on *K-S* and *EL* choices competing on the same side of the frontier.

## 6. Conclusions

These results have implications for organizations represented by expert negotiators (Balakrishnan, Patton, and Lewis, 1993; Bui and Shakun, 1996). For example, when there are issues such as credit terms, functional discounts, and end-of-year discounts negotiated between a manufacturer and retailer, extra incentives given to negotiating agents should be considered carefully. Though added incentives may have a gross effect on bargaining choices, it is not clear that extreme solutions favoring one side are any more likely compared to agents receiving equal incentives. Furthermore, when incentives are equivalent, extreme solutions based on proportional or interpersonal comparisons appear to be just as likely whether negotiations are conducted over attributes or over bargainers' overall utilities. On the other hand, a previous settlement (reference point) favoring one side may lead to an agreement skewed towards the advantaged party when the party's representative receives extra incentives.

Results of this research *imply* some preferences in selecting attribute or utility spaces to conduct negotiations. Non-expert bargainers in this study preferred to negotiate over attributes when faced with an attribute bargaining space. Our bargainers were instructed as to how they could convert attribute scores and attribute weights to overall utility scores, but only four pairs chose to do so given an analysis of protocols. It is probably more difficult for non-expert bargainers to integrate multiple issues or attributes than it is for experts, and thus non-experts are more likely to rely on simplifying heuristics to arrive at their joint decisions.

Alternatively, in real world negotiations, only if a mediator were to elicit bargainers' importance weights (e.g., through a conjoint task), provide feedback on the estimated weights for both parties and train them to use the weights and attribute ratings to compute overall utilities, could he/she ensure that weights and attribute ratings were utilized efficiently by bargainers negotiating over multiple attributes or issues. Decisions made jointly about price, product attributes, and distribution requirements are particularly relevant in this context, but it requires that expert negotiators consider the range of multiple issues championed by their respective constituencies (see Balakrishnan, Patton, and Lewis, 1993; and Gupta, 1989). Under these circumstances, expert negotiators might prefer to bargain in the utility space when attributes are integrated into a utility function, and when a variety of solutions are possible given their (or a mediator's) assumptions about what is an equitable choice.

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## Notes

1. A technical appendix detailing general solutions for both linear and non-linear Pareto boundaries in utility and attribute spaces may be obtained from the first author.

2. When the alternatives are presented in the form of attribute scores and importance weights are shared knowledge between bargainers, a proportional gain solution might arise when players use the following heuristic (let *1* be player 1's preferred attribute and *2* be player 2's most important attribute):

   A. each player computes the attribute score proportions $\frac{X_1^c}{X_1^{max}}$ and $\frac{X_2^c}{X_2^{max}}$ for a common subset (consideration set) of likely alternatives $c$ ($c \in P$, where $P$ is the set of all Pareto efficient choices)

   B. these proportions are adjusted for differences in importance weights given to the preferred attribute (e.g., if $\frac{X_2^c}{X_2^{max}}$ is the lower proportion it can be inflated by multiplying by $\frac{v_1}{w_2}$, if $v_1 > w_2$).

   C. players jointly select the alternative that corresponds to equal (adjusted) proportions for each side.

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