A Game-Theoretic Approach to Resolving an Authorship Conflict

SCOTT B. CANTOR

ABSTRACT

Using concepts from game theory, this paper presents a model of authorship conflict, a common concern presented to ombuds in academic institutions. The model demonstrates that when ombuds can encourage visitors to think cooperatively – rather than competitively – better outcomes can result. This paper addresses (1) the importance of authorship in academic institutions and guidelines for authorship; (2) a hypothetical example of a conflict between two researchers concerning two manuscripts; (3) a brief introduction to game theory, including a discussion of the Prisoner's Dilemma, a two-person non-cooperative game; (4) modeling the contrived authorship example as a Prisoner's Dilemma; and (5) implications for authors in conflict and ombuds who mediate between those authors. This paper demonstrates that by using a game-theoretic model to identify options and possible outcomes, an ombuds can help frame the decisions that their visitors make and perhaps free them from a Prisoner's Dilemma.

KEYWORDS

authorship, game theory, ombuds, dispute resolution, negotiation, mediation, mathematical models.

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INTRODUCTION

Authorship conflicts are a common issue raised by academic faculty and other researchers who visit ombuds offices in higher education institutions. In academia, authorship of publications – and the order of authors for a journal article – matters, whether in the humanities, social sciences, natural sciences, or medicine. Demonstrating that one has contributed to a body of work within academic inquiry is a critical component of applications for jobs, grant funding, and tenure and promotion. Authorship and authorship order are ways of identifying an individual's contributions to a study and signify accountability and responsibility for the publication's work (ICMJE, 2024).

Because authorship is so important to researchers' careers, disputes can arise over issues such as who should be listed as an author, the order in which the authors are listed, in particular, the first and last authors, and who should be designated as the corresponding author. Authorship issues should be resolved before submitting a manuscript to a journal; for example, the editorial staff of Journal of the American Medical Association and JAMA Network journals will suspend evaluation of a paper until disagreements are satisfactorily resolved amongst all authors and documentation of resolution is provided (Fontanarosa et al., 2017).

Ombuds can be called upon to assist with authorship disputes. In fact, the International Ombuds Association (IOA) Uniform Reporting Categories includes "scientific or research misconduct" related to authorship (category 9.c, Scientific Conduct/Integrity) (Dale et al., 2008). Thus, the IOA has recognized that authorship conflicts frequently occur in academia. Authorship disputes often involve the lack of effective communication about who should be included as an author on a paper as well as authorship position. Although there are well-established guidelines for determining authorship published by academic organizations and many peer-reviewed journals, established guidelines for determining the order of authors in a publication are rare. Thus, authorship order is typically left to co-authors to negotiate, making authorship disagreements even more challenging.

Tools within the decision sciences, including game theory, may offer guidance to both ombuds and researchers who are experiencing conflicts around authorship. Game theory is an academic discipline rooted in economics and mathematics that examines how parties strategize in seemingly competitive scenarios or "games" (Luce & Raiffa, 1957). The discipline of game theory has tools that can help identify pathways towards solutions that are applicable to disputes among academics, including authorship conflicts.

This article presents a hypothetical case study of a conflict between two researchers concerning two manuscripts. Through application of a mathematical model and game theory principles, the paper shows how game theory can provide guidance for ombuds in authorship disputes. Additionally, the article discusses how an ombuds might use game theory to guide visitors in identifying beneficial options that may make satisfactory outcomes more likely.

METHODS

HYPOTHETICAL CASE STUDY

As a teaching tool, I will present a hypothetical and contrived example of an authorship conflict. Alex Bell and their colleague, Bobby Socks, are professors at a large research university. The two researchers are having a disagreement regarding the authorship of two papers. They each wish to be first author on both of the two papers. Prior to their meeting to determine the order of authorship for the two papers, each researcher considers two strategies:

1) Compromise strategy: The researcher is willing to yield first author position on one or both papers.
2) Competing strategy: The researcher will only accept being first author on both papers; otherwise, they will no longer participate in the research process and the papers will not get published. In this case, they will instead pursue publishing a first-authored, high-impact paper from a different project.

Consider the following utility scale of possible outcomes for each researcher. We will use a utility scale from 0 to 100, where a utility of 0 is the worst outcome and a utility of 100 is the best outcome:

- Great outcome (utility of 100): First author on both papers.
- Good outcome (utility of 50): First author on one paper and second author on the other paper.
- Fair outcome (utility of 25): No papers with the other collaborator go out; spend time working and publishing a paper based on another project.
- Worst outcome (utility of 0): Second author on both papers.

What are the potential outcomes?

- If both researchers use the competing strategy, then neither paper gets published. However, they both will work (separately) on other first-authored papers that could get published in high-quality journals. This would be a **fair** outcome (utility of 25) for both researchers.
- If both researchers use the compromise strategy, each researcher will be first author on one paper and second author on the other paper. This is a **good** outcome (utility of 50) for both researchers.
- If one researcher uses the compromise strategy and the other researcher uses the competing strategy, the researcher who uses the competing strategy becomes first author on both papers – a **great** outcome. That researcher would achieve the maximum utility of 100. However, the researcher who uses the compromise strategy becomes second author on both papers – a **worst** outcome (i.e., utility of 0).

MODEL STRUCTURE

We can model the situation using the structure of game theory in a modified 2x2 diagram (see Table 1). Alex's options are shown down the first column of the table; Bobby's options are shown across the first row of the table. Outcomes are shown at the intersection of the selected row and column.

Outcome (Alex, Bobby)		Bobby's Options	
		Compromise Strategy	**Competing Strategy**
Alex's Options	**Compromise Strategy**	Alex: First author on paper #1. Bobby: First author on paper #2. (Good, Good) (50, 50)	Alex: Second author on both papers. Bobby: First author on both papers. (Worst, Great) (0, 100)
	Competing Strategy	Alex: First author on both papers. Bobby: Second author on both papers. (Great, Worst) (100, 0)	Neither paper gets published. Both authors publish their separate papers. (Fair, Fair) (25, 25)

Table 1. A game-theoretic model of the authorship conflict, as described in the hypothetical case study. The utilities of the outcomes are shown in the table as an ordered pair, with Alex's utility first, and Bobby's utility second.

The structure of this authorship problem mimics the "Prisoner's Dilemma", a classic problem in game theory, which forms the basis for many real-world issues requiring conflict resolution (Schelling, 1960). The setup for the Prisoner's Dilemma is as follows: Two suspects are arrested for a crime. The suspects are separated and are not allowed to speak to one another before being interrogated separately. If they both keep quiet, then each, when convicted, will have a light sentence. If one confesses and implicates the other, the one who confessed to the crime will receive a very light sentence and the one who kept quiet will get a serious jail term. However, if both suspects confess, then both will receive a moderate sentence, since they both cooperated with the prosecution. Table 2 displays the available options and potential outcomes for the two suspects, Ryan and Casey.

Outcome (Ryan, Casey)		Casey's Options	
		Remain Silent	**Confess**
Ryan's Options	**Remain Silent**	Ryan: 2 years in jail. Casey: 2 years in jail. (Good, Good)	Ryan: 10 years in jail. Casey: 1 year in jail. (Worst, Great)
	Confess	Ryan: 1 year in jail. Casey: 10 years in jail. (Great, Worst)	Ryan: 5 years in jail. Casey: 5 years in jail. (Fair, Fair)

Table 2. A game-theoretic model of the Prisoner's Dilemma.

What should Ryan do? Ryan might reason as follows: If I knew that Casey was going to remain silent, then I should confess to the crime, since one year in jail is better than two years in jail. And what if I knew that Casey was going to confess? Then I should also confess, since five years in jail is better than 10 years in jail. No matter what strategy Casey chooses, I should confess, since it leads to a better outcome for me in either scenario. In the terminology of game theory, the strategy to confess is a dominant strategy for Ryan, as it yields the best outcome for Ryan, no matter what Casey chooses.

But since the situation is symmetrical, Casey follows the same reasoning. Casey reasons: If I knew that Ryan was going to remain silent, then I should confess to the crime, since one year in jail is better than two years in jail. And what if I knew that Ryan was going to confess? Then I should also confess, since five years in jail is better than 10 years in jail. So whatever Ryan does, I should confess, since it leads to a better outcome for me. Thus, Casey also determines that the strategy to confess is also a dominant strategy for them, as it yields the best outcome for Casey, no matter what Ryan chooses.

If both suspects confess, the outcome, in game-theoretic terms, is a Nash Equilibrium, i.e., for each of the selected strategies (in this case, the dominant strategy of confessing), there is no benefit to changing strategies, even if the other participant's strategy is known (Dixit & Nalebuff, 1991). As described by Pinker (2021), in the Nash Equilibrium, each participant "…is playing the best strategy given the opponent's best strategy; any unilateral change would make them worse off" (p. 230). What's troubling about the Nash Equilibrium is that there *is* a better outcome for both suspects. If both suspects remain silent, then both would receive two years in jail, whereas if they both confess, both would receive five years in jail. As Dixit & Nalebuff (1991) state, "The problem is the interdependence of decisions: the *jointly* preferred outcome arises when each chooses its *individually* worse strategy" (p. 13).

Returning to the authorship case study, we find a parallel analysis. Let's first consider Alex's perspective.

- If Bobby uses a compromise strategy, then Alex should use a competing strategy – the **great** outcome for Alex is better than a **good** outcome.
- If Bobby uses a competing strategy, then Alex should again use a competing strategy – the **fair** outcome for Alex is better than the **worst** outcome.

Thus, no matter what strategy Bobby chooses, Alex should use a competing strategy.

But the same logic can be used from Bobby's perspective. Regardless of what strategy Alex uses, Bobby should use a competing strategy.

But wait! If both researchers use (the dominant) competing strategy, then the outcome will be **fair** for both and will represent the Nash Equilibrium. Both participants in the game have nothing to gain – and much more to lose – by changing their own strategy when the other strategy is known.

But wait, again! If *both* researchers refuse to use this dominant strategy and decide to use the compromise strategy instead, then the outcome will be **good** for both researchers! Thus, just like in the Prisoner's Dilemma described above, the Nash Equilibrium does not necessarily lead to the best possible outcome for the researchers.

If they decide to communicate and cooperate with each other, even though it is not the best option from a game-theoretic perspective, it will yield a much-improved outcome for both researchers! This is the essence of the Prisoner's Dilemma: selecting strategies based on dominance may not necessarily yield the best outcome for all participants.

DISCUSSION

This paper applies game theory to model an authorship conflict involving two authors who disagreed about the authorship order of two papers. The model demonstrates the classic example of the Prisoner's Dilemma. If not careful, authors can fall into the "trap" of the Prisoner's Dilemma, i.e., seemingly rational decisions can lead to inferior, if not disappointing, outcomes.

From the game-theoretic model, we can identify several lessons – both for ombuds and those who use the services of ombuds (i.e., visitors). While this study focuses on theoretical modeling, its framework provides ombuds with valuable tools for analyzing authorship conflicts and facilitating productive negotiations between researchers.

IMPLICATIONS FOR OMBUDS PRACTICE

Experimental research using repeated plays of the Prisoner's Dilemma model draws conclusions that are comparable to the Conflict Styles analysis developed by Thomas and Kilman (2008). For a one-time conflict, Thomas and Kilman suggest that using a competing style can be appropriate. For ongoing relationships, collaboration and cooperation are more optimal styles. This is similar to the results of an analysis of sequential outcomes of the Prisoner's Dilemma applied to a computer simulation tournament (Axelrod, 1984). In that tournament, repeated cooperation led to better results overall.

As in most conflict situations brought to the attention of an ombuds, when mediating authorship conflicts, it is important to identify all of the potential strategies. In the hypothetical case study presented here, only two strategies were considered by the authors – be the first author on both papers or walk away from the collaboration. Those who participate in academic authorship conflicts might not wish to accept the limited strategies shown in this contrived example. Instead, they may choose additional options that might avoid the inferior outcome as predicted from the analysis of the Prisoner's Dilemma. For example, by including the option of pursuing other manuscript opportunities together, one can avoid the dominant strategies that exist in this simplified model.

When presented with dyadic conflicts, ombuds can be mindful of scenarios that may be evolving into examples of the Prisoner's Dilemma and be alert to the outcomes that may ensue. It may be that the dominant strategy could lead to suboptimal outcomes. In dispute resolution, ombuds can take full advantage of the fact that communication and cooperation are allowed. A key element in the Prisoner's Dilemma is that the parties' strategic intentions are unknown to one another. Facilitation techniques such as sharing interests, exploring options, and other "expanding the pie" attempts are approaches ombuds can employ to dismantle the binary nature of Prisoner's Dilemma–type conflicts. Mediation attempts can lead to cooperation and better outcomes than resolutions that occur without communication.

LIMITATIONS

Perhaps a limitation of this paper is that, in real life, the simultaneous revelation of strategies does not typically occur. However, authors do have discussions, and there is some back-and-forth dialogue between researchers that should lead to better outcomes. Moreover, through such discussions, the outcomes of a negotiation can be modified – creating a different game structure. If the best alternative to a negotiated agreement (BATNA) is changed appropriately, then the Nash Equilibrium might no longer be suboptimal (Raiffa, 1982; Raiffa et al., 2003). Thus, mediation, effective communication between parties, and the creation of new alternatives and outcomes can avoid situations like the Prisoner's Dilemma.

This model also oversimplifies the typical collaborations in academia. For example, frequently there are several authors involved in a research project, and several papers that are being developed, and the authors may need to protect their ongoing relationships. However, including other elements of game theory, such as games with multiple players and repeated games, may extend the model to these more likely types of situations.

In a sophisticated theoretical and technical paper, Lazebnik et al. (2023) describe a game-theoretic model of multiple co-authors who may enhance their authorship status by raising an

ultimatum. To my knowledge, this was the first (and perhaps only) application of game theory to authorship conflicts. More technically-trained ombuds may wish to review this earlier paper to examine how a game-theoretic model could be used to simulate such conflicts. The model presented here is much simpler as a teaching tool to demonstrate game theory principles without requiring sophisticated theoretical mathematics.

The current paper does not include recommendations for managing potential authorship disputes specifically. Guides for how researchers can manage such disputes can be found elsewhere (Cooke et al., 2021; Albert & Wager, 2023). Nor is this a paper that explains how to handle authorship disputes from the perspective of a neutral third party (Faulkes, 2018).

SUGGESTIONS AND SUMMARY

Similar to achieving good health, agreement among authors can be achieved through preventative approaches such as having discussions as early as possible regarding what roles will be taken in the research, who will be an author on the paper, and the order of the authorship list. In addition, participants in the research process should meet periodically to remind everyone of their obligations as authors (Bennett et al., 2010; Burroughs Wellcome Fund & Howard Hughes Medical Institute, 2006).

Even with good planning – and especially when there is no or poor planning – authorship conflicts can arise. This paper demonstrates a different way of thinking about how an ombuds can analyze such a conflict – by using a game-theoretic model. It is hoped that ombuds can more easily recognize that authorship and other workplace conflicts can be modeled using this paradigm. By identifying options and possible outcomes, an ombuds can help frame the decisions that their visitor must make and perhaps free them from a Prisoner's Dilemma. With the use of good communication, mediation, and cooperation, an ombuds can increase the likelihood that a Prisoner's Dilemma situation can be avoided, making optimal outcomes achievable for those involved.

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AUTHOR BIO

Scott B. Cantor is a Professor in the Department of Health Services Research at The University of Texas MD Anderson Cancer Center. He received his BA degree in Applied Mathematics from Yale and his PhD in Decision Sciences from Harvard. Since August 2018, he has served as a part-time ombuds in MD Anderson's Ombuds Office, serving faculty, administrative staff, classified staff, and trainees. He is a Certified Organizational Ombuds Practitioner® (CO-OP). (sbcantor@mdanderson.org)