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Reinterpreting King Solomon's problem: Malice and mechanism design

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ABSTRACT

I argue for an alternative interpretation of King Solomon's problem in terms of one of the two claimants being "malicious". A "malicious" claimant places no intrinsic value on the object but derives utility from depriving the rival claimant. This new interpretation permits a simpler solution than those considered in the literature; I derive a mechanism that induces truthful revelation where the equilibrium involves a single round of elimination of weakly dominated strategies, and no monetary transfers. I consider extensions which allow for the malicious claimant to also place some low but positive intrinsic valuation on the object; I also discuss the possibility of two-sided malice, and provide examples of several real-life contexts to which the mechanism or its extensions are applicable.

1. Introduction

Following an insightful paper by Glazer and Ma (1989), a small game-theoretic literature has sprung up around economic interpretations of "King Solomon's problem". This literature includes Moore (1992), Perry and Reny (1999), Olszewski (2003), Bag and Sabourian (2005), Artemov (2006), Qin and Yang (2009), and Mihara (2011). Glazer and Ma recast the problem as one of allocating an indivisible object between two claimants with different valuations for the object. The mechanism designer does not know the identity of the high-valuation claimant, though he knows the magnitudes of both the high and the low valuations. While the subsequent literature on King Solomon's problem involved improvements in terms of weaker informational requirements, weaker solution concepts or generalizations to multi-player/multi-object cases, they preserved the essential interpretation of the problem as one of allocating an indivisible object to the person who values it the most. This interpretation has significant consequences. One of these is that this literature maintains that second-price sealed bid auctions (in which each player's dominant strategy is to bid her true valuation) results in an efficient allocation; the object goes to the highest-value bidder. However, the literature then specifies that the mechanism designer does not want the highest-value bidder to have to pay for the object *in equilibrium* and goes on to explore other solutions which do not involve monetary transfers in equilibrium. My paper differs from the literature in adopting a different interpretation of King Solomon's problem based on one-sided malice. Accordingly, the mechanism inducing truthful revelation changes (permitting a considerably simpler solution); and implications for the usefulness of sealed bid auctions also change.

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In this interpretation, of the two disputants, one (the "false mother") is motivated by malice. Her interest in disputing the "true mother's" claim stems not from any intrinsic value she places on the prize (the child) but on a utility she gains from depriving her rival claimant. To understand this interpretation, reconsider the biblical story. Two "mothers" – a true one and a false one – bring a dispute before King Solomon concerning a single child. Both claim to be the true mother. King Solomon proposes to cut the child in half and give one half to each woman. While the false mother agrees, the true mother reverses her statement and asks that the child be given to the other woman. Note that while the false mother will not obtain a child, or at least a live child, either in the case where she agrees with the true mother's claims or when the king cuts the child in half, she strictly prefers the latter case. The false mother's strict preference that the child be killed rather than given to the other woman reveals that she experiences a positive utility from depriving the "true" mother. This is the motive that I label "malice". In addition, the false mother's behavior also indicates that she does not value the child for its own sake, so that she places a negative, or at least a non-positive, valuation on the child itself. She is interested in claiming the child because her utility from malice exceeds any disutility she may incur in actually bringing up the child (assuming that legal restrictions prevent her from disposing of the child herself). My approach is not meant to deny the importance of the mechanisms highlighted in the traditional literature on King Solomon's problem; rather, my paper can be viewed as complementary to this literature, in that it considers a different interpretation based on malice.

As I show below, re-interpreting the problem in terms of one-sided malice has nontrivial implications. The malicious claimant's objective changes from obtaining the object to ensuring that her rival does not obtain it. Thus, for example, while in the literature either claimant would prefer to obtain the prize to the prize being retained by the mechanism designer (because of disagreement), this is no longer true for the malicious claimant in my model.

I extend my basic model to allow for cases where (i) the malicious claimant also places some positive, albeit low, valuation on the object for its own sake, and (ii) both claimants may bear each other malice. I also provide examples of real-life economic contexts to which the mechanism, or its extensions, are applicable. These include malicious patents filed by *non-practicing entities* (NPEs) – firms that file patents primarily to prevent rival firms from developing the patented product. Such firms may never develop the product themselves. Alternatively, firms may consider product development as a relatively minor objective of securing a patent (compared to the main one of harming competitors). The second example is of warring spouses who are separating and contesting rights to an asset on which they place different intrinsic valuations; one or both spouses may be motivated by malice, deriving pleasure from depriving the other spouse of the asset. A third example, related to the second, is about disputed land rights in extended families. In the first example, the mechanism designer's role is played by a patent authority; in the second and third, an arbitrator plays the designer's role.

My interest in modeling malice is also motivated by evidence on the importance of malice in decision-making. Beckman et al. (2002) find that malice and envy motivate over 50% of their subjects, who oppose Pareto improvements which make other people better off without ostensibly making them worse off. Other experimental evidence of spite (malice) and envy in economic decisions is provided by Bosman and van Winden (2002), Bosman et al. (2006), Albert and Mertins (2008), Zizzo and Oswald (2001), Abbink and Sadrieh (2008) and Abbink and Herrmann (2011), among others. For instance, Bosman and van Winden (2002) find that 21% of subjects destroy their own earnings (with almost all of these destroying 99 or 100%) when told that a portion of these earnings would later go to another subject (the power-to-take game). Zizzo and Oswald find, in the "money burning game" that two-thirds of players were willing to **pay** to destroy (burn) other players' money. Abbink and Herrmann (2011) find, in a one-shot "joy of destruction" game, that 10–25% of players destroy each other's endowments without any economic gain to themselves. Thus, if malice motivates at least some agents, as these experiments suggest, it would be interesting to work out the theoretical implications of this. This paper begins to explore the issue.

In Section 2 I first obtain a preliminary (negative) result concerning second price sealed bid auctions. I argue that when the mechanism designer's objective is to allocate the prize to the person with the greatest intrinsic valuation for it (as is likely when, for instance, the designer is child welfare or social services and the "prize" is a child), a second price sealed bid auction may not achieve this objective. I then obtain a simple mechanism that induces truthful revelation at no cost. This mechanism relies on a single round of elimination of dominated strategies, and the informational assumptions underlying it are weak. I assume that both claimants know their own valuations (and the malicious claimant knows the utility she will obtain from malice) but not each other's. However the true claimant is aware that her rival harbors malice and also that the rival places a nonpositive intrinsic value on the prize. The mechanism designer knows that one claimant has a positive valuation for the prize, while the other is malicious and does not value the prize for its own sake. However he knows neither the identity of the malicious claimant nor the magnitudes of the valuations or the extent of malice.[1] I also discuss a real-life example. In Section 3, I extend the basic mechanism of Section 2 to allow the malicious claimant to value the object for its own sake, and consider the possibility of two-sided malice. I also give examples of real-life contexts to which these extensions apply. Section 4 points out a parallel between the Myerson–Satterthwaite theorem and a condition I need for the extension where the malicious claimant also intrinsically values the object. Section 5 concludes with a discussion.

[1] In extensions of the basic model, some more information may be required; however it remains true that neither the designer nor the other claimant need to know the exact valuations or the exact extent of malice; and the designer never knows the identity of the malicious claimant ex ante.