A Note On
The Lack Of Statistical Optimality
In The Judgment Of Solomon

Cyrus K. Motlagh, (E-mail: motlagh@comcast.net)University of Detroit Mercy

ABSTRACT

Solomon, in his most celebrated decision, threatened to cut a baby in half, calculated to elicit such testimony from a claimant that would allow him to identify the real mother and thus grant her custody. Comment from biblical scholars seems to run in the same direction, i.e. Solomon had insight into maternal love. When one of the females offered to withdraw her claim, to save the child, he identified her as the real mother, and this provided the foundation for his Judgment. While the evidentiary trap set by Solomon is genius, his use of the data produced by his trap lacked statistical optimality. The optimality of Solomon's decision has never been challenged in the literature until now. This challenge is long overdue, considering the fact that this decision has been enshrined as the icon of "Superb decision making" in many cultures including our own. This paper points out that, in view of the testimony of the second woman, the optimal decision would have been to identify the second woman as an imposter. Custody should have been given to the first woman by default.

INTRODUCTION

A ccording to the Bible, God gave King Solomon the gift of wisdom, which he then used in making wise decisions and dispensing justice among his people. One of Solomon's most celebrated decisions is his resolution of competing maternity claims of two women. The biblical account provides that he ordered the baby in question be cut into two halves to satisfy both claims. As he expected, the real mother volunteered to give up her claim to save the baby and thus identified herself to Solomon as the real mother. Testimony was neither solicited nor expected from the second woman who kept insisting that the baby should be cut in half.

ORIGINS OF THE STORY

Other cultures have stories very close to the Judgment of Solomon, and different translations of the bible have small differences in their wordings. For example, DeVries [1985] says of the story:

The exact wording of the anecdote may be Israelite, but the story itself comes out of international culture. Hugo Grassmann has identified no fewer than twenty-two stories of an abused mother and her endangered child in the folklore of various peoples. This appeared in his study, "Das salomomsche Urteil," Deutsche Rundschau 130 (1907) 212 ff.

The best-known story, however, remains the biblical account of the decision of Solomon. For our purposes, the exact historical origin, or small differences in wording in the various translations are less important than comments made on the judgment itself.

The Common Wisdom

There is unanimous agreement that Solomon expected the real mother to withdraw her claim in the interest of the child. This is said to have in fact happened and established Solomon as the icon of wise decisions through the ages. What commentators have overlooked is the incredible testimony of the imposter as she insisted that the baby be cut in half as originally ordered. The importance of the words of the imposter has gone unnoticed and sometimes intentionally minimized by biblical scholars. For example, DeVries [1985] comments that the manner in which the second half of 1 Kings 3:23 is translated indicates that the role of the second woman was *intended to be subordinate and minimal.*

Constable [1985] writes, "...The King had insight into basic human nature (in this case, maternal instincts) that enabled him to understand why people behave as they do and how they will respond in various situations." He continues, "Solomon ordered that the baby be cut in two. As he had anticipated, the child's mother, not wanting it killed, volunteered to let the other woman have the baby, rather than have it killed." Constable acknowledges the testimony of the second woman, but fails to identify those utterances as essential for an optimal decision.

Most of the other biblical commentators, such as Gray [1970], Hobbs [1985], Jones [1984], Long [1984], Wiseman [1993] have shown interest in every other aspect of Solomon's decision without commenting on the efficacy of his use of evidence. There has been almost a total absence of comment from decision scientists.

There are no commentators who suggest that Solomon at any time seriously intended cutting the baby in half. The sum and substance of the comments suggest that Solomon anticipated the reaction of the real mother and set an elegant trap to elicit the compassionate reaction from the real mother. There is no suggestion that Solomon foresaw or expected any reaction from the second woman.

Why have commentators written the second woman out of the story? I think it is due to the misguided notion that somehow if we use someone or something evil as the basis for optimal decision-making we are glorifying the evil person or thing. After all this was not meant to be the imposter's story. Giving her any "press" may even serve to humanize the evil woman. Solomon had set the trap and knew how the real mother would react. The imposter was not even expected to insinuate herself into the story, but insinuate she did, and with titanic force.

Unexpected though they may have been, the imposter's words must hold center stage for decision scientists. It was the imposter's words that, by their perversity, provided the greatest information content of any evidence in the case and boosted the probability of the imposter *not being* the biological mother to near certainty. The plea of the compassionate woman could only boost the probability of her *being* the real mother to just over fifty percent. The optimal decision would have been to identify the imposter and deny her claim. The first woman should have then gotten the child by default in the absence of any other competing claimants. Implicit here, is the assumption that the biological mother is one of the claimants and the custody battle is not being waged by two women both strangers to the child.

ANALYSIS

The facts of the case are best quoted from the bible:

[16]Then two harlotrous women approached the king: they stood before him; [17] and the first woman said, "Please, my lord, I and this woman are living in the same house, and I gave birth in the house. [18] And it so happened that on the third day after my delivery this woman also gave birth. Now, we were together, without any stranger with us; there were only we two in the house. [19] But this woman's son died one night when she laid upon him, [20] and she got up in the middle of the night, snatched my son from alongside me while your maidservant was sleeping, and laid him in her bosom, while her dead son she put in my bosom.[21] Then I got up in the morning to nurse my son and he was dead; but I took a good look at him in the morning, and behold he was not my son, the one whom I had borne!" [22] And the other woman said, "No, but my son is the living one, and her son is the dead one!" Thus they spoke before the king; [23] and the king said "This one is saying, 'This is my son, and your son is the dead one,' while this one is saying, 'No, but your son is the dead one and my son is the living one!'" [24] So the king said, "Fetch me a sword." And they
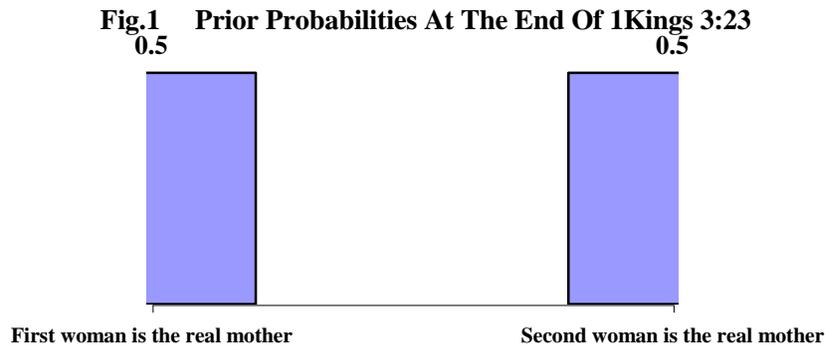
brought a sword before the king. [25] Then the king said, "Sever the live baby into two parts and give a half to one and a half to the other." [26] *And the woman whose son was the living one spoke to the king, for her maternal emotions were stirred on behalf of her son, and she said, "Please, my lord, let them give her the baby, but by no means kill him," while the other was saying, "Let him be neither mine nor yours; sever him!"*

[27] *And the king made response and said, "Give her the baby, and by no means kill him; she is his mother."* [28] And all Israel heard about the judgment that the king had rendered; and they revered the king because they perceived that divine wisdom was in him for performing justice.

1 Kings 3:16-28 (emphasis added).

The engine of analysis will be a Bayesian framework. This is appropriate not only from a decision analysis point of view, but also because the Bayesian analysis has been accepted and applied in our courts.

Note first that according to Solomon, the words in 1 Kings 3:16-23 leave the case exactly tied. In decision analysis language this means perfectly balanced priors at the end of 1 Kings 3:23. The words in 1 Kings 3: 26 would therefore be the only testimony to decide the case

Fig.1   Prior Probabilities At The End Of 1Kings 3:23

First woman is the real mother   **Second woman is the real mother**

Let us concentrate on identification of the first woman as if she alone provided testimony. This, after all, is what has distinguished Solomon as the wise decision maker and has drawn applause from commentators:

The posterior probability of the first woman being the real mother given her testimony would be

$$P(M \mid \tilde{K}) = P(\tilde{K} \mid M) \times P(M) / P(\tilde{K}) \tag{1}$$

Where M stands for Mother and $\tilde{K}$ is the abbreviation for utterance of "Do not kill." The probability $P(\tilde{K})$ is today, as it must have been in biblical days, very close to one. It describes the proportion of the general population who would save a child from assured destruction regardless of ultimate custody. The motivation to save the child would no doubt be heightened when the one pleading for the child's safety is the biological mother. This margin of heightened compassion would have made Solomon's decision statistically optimal had the plea of the first woman been the only evidence in the case. In equation (1) the prior probability is 0.5 and the rest of the fraction is a number that is ever so slightly greater than one due to what we have dubbed heightened compassion of the biological mother. Note that the greater the compassion in the population at large, the smaller is the room for the mother's extra compassion. This infinitesimal increase in the probability of the first woman being the biological mother will be noted in the following posterior distribution as **e**.

**Fig.2   Posterior Probabilities At The End Of 1Kings
3:26 Based On Testimony Of The First Woman**

Here, decision science agrees with the traditional view that the testimony of the real mother does indeed help her cause by identifying her as the biological mother. The problem is that the identification is not very strong. This is because while the desire of the biological mother to save the baby is very noble, it is also a desire shared by almost everyone in the general population and hence not a good discriminator. It is possible that Solomon was willing to accept even such a minute margin of discrimination in a situation that was otherwise hopelessly deadlocked.

Unexpected though it was, the second woman did give testimony. Let us now consider her testimony and the impact on *her* identification as an imposter:

$$P(M \mid K) = P(K \mid M) \times P(M) / P(K) \tag{2}$$

In equation (2), $P(K)$ is a number close to zero. We can safely assume $P(K \mid M)$ is smaller than $P(K)$ by at least an infinitesimal constant **e** to account for attenuated cruelty of real mothers toward their offspring. This makes $P(M \mid K)$ exceedingly small and closer to zero as $P(K)$ approaches zero. $P(\tilde{M} \mid K)$, therefore becomes very close to one.

**Fig.2   Posterior Probabilities At The End Of 1Kings
3:26 Based On Testimony Of The Second Woman**
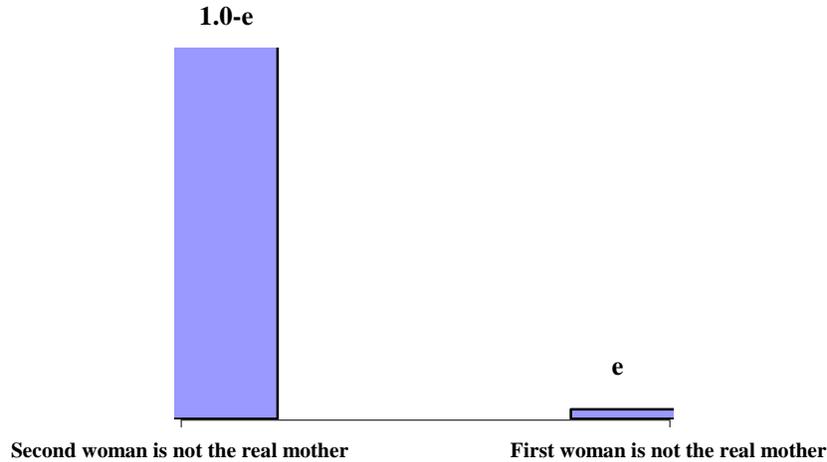
Note that we have assumed independence of the testimony of the two women in 1 Kings 3:26 with good reason. Unlike their testimony in 1Kings 3:17-22 where they contradict each other and try to destroy each other's credibility, in 1 Kings 3:26 neither utters a word about the other. Their only reference is to the child. It is therefore assumed that each woman's words identifies only the woman herself and does not *directly* affect the credibility of the other claimant. We do not therefore need to calculate the probability of motherhood of the first woman given the joint events "first woman says do not kill" and "second woman says kill". Such probabilities would be identical to the probabilities, as we have already discussed if independence is assumed. Another way to explain the independence is that it is not possible for one woman to speak only about killing or sparing a baby and directly affect the probability that another woman is the mother of that baby or an imposter. Obviously, testimony of one will indirectly affect the other only because combined probabilities of motherhood must add up to one.

The only loss attendant to this decision is if the baby ends up with the wrong woman, let us call it L. Because there is only one loss with a fixed magnitude, we can have L stand for a personal loss by the decision maker or a loss of societal welfare that results when the baby is given to the imposter or the loss to the baby that results from being away from its biological mother. L could even stand for a complex combination of losses as long as the combination can be reduced to one number. Obviously if the baby ends up with its biological mother there is no loss. The expected loss in identification of the first woman as the mother, as was done by Solomon, would therefore be $[1 - P(M \mid \tilde{K})] \times L$, slightly less than 0.5$L$. On the other hand the expected loss in identification of the imposter would be $P(M \mid K) \times L$, nearly equal to zero. Focusing on the identity of the imposter would clearly be optimal with the smallest expected loss. The other claimant would get custody not because *she proved herself* to be the biological mother but rather because *the imposter proved herself* not to be the biological mother. The outcome would have been the same as the outcome in the bible, but arrived at through a statistically optimal decision.

CONCLUSION

I have made three reasonable assumptions: (1) the probability of anyone in the general population countenancing to baby cutting is very low. (2) That such probability is even lower among biological mothers of babies facing such peril. (3) Whether one person would have a baby killed or spared does not directly affect the probability that another person is or is not the biological mother of the baby at issue. I have used a Bayesian decision analysis framework to help demonstrate that since compassion for a baby rests within almost all of us, "Don't kill the baby"

uttered by any of us   is hardly "News" and thus lacks sufficient evidentiary force to decisively identify the compassionate woman as the mother.

If the second woman had remained silent, the traditional wisdom would have been well placed, provided silence could not be admitted as evidence of an evil state of mind, which would be contrary to assumption (3) above.

Since the testimony of the second woman would so rarely come from a real mother, it holds a great deal of information and has great evidentiary force in identifying her as the non-mother.

Faced with the prospect of identifying the mother with a relatively low probability (just barely over fifty percent), or identifying the non-mother with a relatively high probability (near certainty), the optimal act, with minimum expected loss, would be to positively identify the non-mother and bar her claim and let the real mother be identified and gain custody by default. Solomon's opinion read from the bench in 1 Kings 3: 27, should be changed to: "By no means kill him. Give him to this (first) woman, since I have decided that (second) woman is not the mother, and there are no others before me."

We should separate Solomon, designer of experiments, from Solomon, user of information. We should bestow our accolades only on the former and acknowledge that at least in the baby decision he could have used the evidence before him in a more statistically optimal manner.

While the decision itself remains unchanged, much needed challenge to the optimality of the traditional path to the decision is provided here.

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