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Oracles

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Abstract
This article uses rational choice theory to analyze oracles: media for divining answers to questions about the unknown. I develop a simple theory of oracles with rational agents. My theory explains oracles as institutional solutions to "low-grade" interpersonal conflicts—petty grievances and frustrations resulting from perceptions or feelings of personal offense—that government is unable to resolve. Oracles secure correlated equilibrium in situations where, without them, individuals would be stuck in a suboptimal world of simple mixed-strategy equilibrium. By randomizing strategies about how to behave in situations of low-grade conflict and coordinating individuals' choices across that randomization, oracles resolve low-grade conflict efficiently. To investigate my theory I consider a society of persons who rely exclusively on oracles to decide how to behave in situations of low-grade conflict: the Azande of Africa. Using the equivalent of a "Magic 8 Ball" to resolve such conflict improves Zande welfare.

Keywords
Azande, conflict, correlated equilibrium, oracles, self-governance, superstition

Introduction

Everyone has heard of the "Magic 8 Ball" or seen one in a novelty shop. The Magic 8 Ball is a softball-sized plastic sphere designed to look like the billiard ball it's named after. Inside the ball is a die suspended in fluid. On the ball's bottom is a window that displays what's written on one side of the die.

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The way you use the Magic 8 Ball is simple: shake it, ask it a yes-or-no question, and let the ball conjure a response.

The Magic 8 Ball is an oracle—a medium for divining answers to questions about the unknown. It's also a toy. No one, it seems—except perhaps a child—would base his life's decisions on one. Yet in some societies individuals rely on Magic 8 Ball-like oracles to make their most important decisions, including how to behave in situations of interpersonal conflict. In the Ndogo tribes of Sudan (Santandrea, 1938), the Balovale tribes of Zimbabwe (White, 1948), the Nzakara and Apagibeti tribes of the Central African Republic (Almquist, 1991; Retel-Laurentin, 1969), the Ngbandi tribe of the Democratic Republic of Congo (Almquist, 1991), the Yoruba tribe of West Africa (Bascom, 1941), as well as in societies in Ghana (Gray, 2001), Cameroon (Zeitlyn, 1993), and elsewhere, citizens routinely rely on oracles for this purpose.[1]

Relying on oracles to prescribe behavior in situations of interpersonal conflict seems unambiguously stupid. This article argues that it is not. I demonstrate that using oracles to mediate conflict can be highly efficient.

I develop a simple theory of oracles with rational agents. My theory explains oracles as institutional solutions to "low-grade" interpersonal conflicts—petty grievances and frustrations resulting from perceptions or feelings of personal offense. Such conflicts are beyond the state's effective reach. Extending and protecting property rights over their sources is often difficult or impossible: individuals typically don't, and can't, have enforceable rights in not being offended by others' behavioral subtleties. Yet conflict arising from such subtleties is ubiquitous and requires resolution to prevent it from undermining social cooperation or erupting into more serious kinds of conflict, such as violence.

I argue that oracles achieve this by securing correlated equilibrium in situations where, without them, individuals would be stuck in a suboptimal world of simple mixed-strategy equilibrium. By randomizing strategies about how to behave in situations of low-grade conflict and coordinating individuals' choices across that randomization, oracles can resolve low-grade conflict efficiently where government cannot.

To investigate my theory I consider a society of persons who rely exclusively on oracles to decide how to behave in situations of low-grade conflict: the Azande of Africa. Zande society consists of one to four million persons who inhabit central Africa. This society was made famous by E.E. Evans-Pritchard's (1937) classic anthropological study of the Azande conducted in the late 1920s.

The Zande belief system is grounded in a superstition that sees persons with whom an individual is in low-grade conflict as potential witches and

sees a poison oracle called *benge* as the unique method of infallibly discovering how to respond to a bewitching. I demonstrate that *benge* oracles resolve such conflict efficiently by operating as correlated-equilibrium devices. *Benge* oracles randomize optimally—i.e., they assign individuals alternative strategies with probabilities that ensure oracles' ability to sustain correlated equilibrium. *Benge* oracles preclude the socially worst strategy pair to which individuals playing simple mixed strategies are led without the aid of a correlated-equilibrium device. And *benge* oracles are deeply trusted, enabling them to serve as correlated-equilibrium devices. Using the equivalent of the "Magic 8 Ball" to resolve low-grade conflict improves Zande welfare.

Oracles, superstition, and self-governance

Economists have said almost nothing about oracles. There are three exceptions to this. Iannaccone et al. (2011) consider how political rulers in ancient Greek city states used Delphi as a "neutral nexus"—a location and venue of political independence that helped rulers improve cooperation across their political economies. Following anthropologist Omar Moore (1957), who highlights how oracles can encourage persons to randomize their choices, these authors describe the Delphic Oracle as a means of assisting political rulers to commit to arbitrary actions that preserved status quo relationships between them.[2] Similarly, Wärneryd (2008) considers how political rulers can use religious rituals, including oracles, to commit to randomizing their choices when confronting imperfectly informed warlords who seek to exploit them.[3]

Like these papers, mine uses rational choice theory to illuminate oracles. But rather than considering how political rulers might use oracles to improve their positions, I consider how private citizens who can't rely on political rulers' assistance to resolve low-grade interpersonal conflicts use oracles for this purpose instead.

My article also emphasizes oracles' randomizing feature. However, in my study oracles don't simply randomize. They randomize optimally, ensuring their ability to sustain correlated equilibrium for the full range of potential payoff values that individuals face.

Most important, while in my theory oracles permit individuals to credibly commit to strategy randomization, the key force behind oracles' power to produce socially efficient outcomes is their power to produce correlated equilibrium—to coordinate individuals' randomization in the face of reciprocal "wrongs," where randomization *per se* leaves conflict unresolved and is socially inefficient.

In this sense my analysis can be seen as building on an observation that Myerson (2009) makes in his appreciation of Thomas Schelling's (1960)

work. Though his paper isn't about oracles, here Myerson notes the role that oracles could play in providing focal points for social coordination. My article develops this idea in the context of interpersonal conflicts that government is unable to resolve and applies it to understand and explain private oracular usage in practice among the Azande.

My study of oracles lies at the intersection of two literatures—one which studies the economics of superstition, and another which studies the economics of self-governance. It contributes to both literatures by filling gaps in each.

The economics of superstition analyzes institutionalized, objectively false beliefs, such as beliefs in witches, miracles, and spirits who intervene in earthly affairs. On the surface, at least, the persistence of such beliefs poses a puzzle for rational choice theorists: superstitions seem to belie rational choice theory's starting assumption that individuals choose rationally. In large part this is so because many superstitions, in addition to being scientifically absurd, appear to be "obviously" unproductive.

As George Stigler (1992: 459) famously remarked, "Tested institutions and practices found wanting will not survive in a world of rational people." Long-standing superstitions have certainly been tested. Thus, if people are rational, societies in which such beliefs flourish must find institutions and practices based on these superstitions productive after all. Before moving to declare the persistence of objectively false beliefs proof of irrationality, the economics of superstition explores how superstitions might benefit the members of societies that adhere to them.

Posner (1980) was the first contributor to this line of research. He highlights superstition's prevalence in primitive societies and provides rational choice explanations for several prominent examples. Consider, for instance, the belief in some primitive societies that wealthy persons are witches. According to Posner, this belief helps the members of such societies enforce a norm of group sharing that permits social insurance. A "wealthy witch" superstition can be socially useful.

More recently, Leeson (2012b) uses rational choice theory to analyze the popular medieval superstition that underlaid the operation of European judicial ordeals—trials by fire and water. Ordeal-based criminal justice systems sought to determine a criminal defendant's guilt or innocence by asking him to plunge his arm into a cauldron of boiling water. According to medieval belief, if the defendant were innocent, God would perform a miracle to prevent his arm from being boiled, evidencing his innocence. If the defendant were guilty, God would allow the water to burn him, evidencing his guilt.

Although seemingly senseless as a procedure for distinguishing the innocent from the guilty, Leeson argues that trial by ordeal was a highly

effective institution of criminal fact-finding and that its effectiveness derived from the superstition on which it was founded. According to his argument, because medieval citizens believed God would protect the innocent but permit the guilty to burn, only innocent defendants would be willing to subject themselves to ordeals. Judicial officials could thus use the specter of ordeals to distinguish the guilty from the innocent and, by ensuring that "boiling" ordeal water wasn't in fact boiling, exonerate the latter in the process. The result was more effective criminal justice achieved on the basis of medieval citizens' superstition.

In another recent paper, Leeson (2013b) uses rational choice theory to explain the strange, early modern European practice of legally prosecuting insects and rodents for property crimes under the belief that God would thwart property infesting vermin supernaturally if they were duly convicted of their crimes in ecclesiastic courts. He concludes that, far from being irrational, this practice and the superstition that underpinned it allowed the early modern Catholic Church to prevent citizens from evading their tithes where heretics encouraged them to do so.

A second strand of literature uses rational choice theory to analyze how various societies lacking central governments manage nonetheless to secure social order by relying on institutions of self-governance. For example, Friedman (1979) studies private law-enforcement mechanisms, among other institutions of self-governance, for crimes such as murder in medieval Iceland. Anderson and Hill (2004) consider settlers' reliance on private clubs, along with other self-governing arrangements, to protect property rights in land in the American West. Leeson (2007a, 2009a) uses rational choice theory to analyze the private system of constitutional democracy that eighteenth-century Caribbean pirates forged to prevent theft and violence, and to prevent captains from abusing their power. Similarly, Skarbek (2010, 2011, 2012) examines the private codes that prison-gang members use to create criminal cooperation by, for instance, defining and enforcing rules against gang-leader predation.[4]

While contributing importantly to our understanding of self-governance, this research focuses on the private resolution of high-grade conflict, such as theft and violence, rather than low-grade conflict. Further, the mechanisms of private order it analyzes have "material" foundations rather than being grounded in superstition.

The economics of superstition literature has largely overlooked the role that objectively false beliefs can play in enabling self-governing solutions to situations of conflict. And the economics of self-governance literature has largely overlooked how superstition can support private institutions of social order outside the state. My study of oracles as a private institutional solution to low-grade conflict in Zande society bridges the

foregoing literatures and helps to close these gaps in each by highlighting one important way in which superstition can be leveraged to secure self-governance.

In this way, my study complements Leeson's (2012a, 2013a) recent research on the role that beliefs in monastic cursing played in protecting monks' property rights in anarchic medieval Europe and that which quasi-religious beliefs play in facilitating the creation and enforcement of private law in Gypsy societies, and Leeson and Coyne's (2012) work on the role that beliefs in magical spirits play in supporting criminal justice without government in contemporary Liberia. As in these papers, in my analysis of Zande oracles, superstition plays a critical role in securing self-governance.

A simple theory of oracles

Unresolved conflict

Consider a society without government inhabited by two, equally strong neighbors, *i* and *j*, who are constantly stepping on each other's toes. Each frequently feels that his neighbor has "wronged" him.

The same occasions that lead *i* to feel wronged by *j* lead *j* to feel wronged by *i*: the "wronging" is reciprocal. For example, *i* is an insecure braggart. He boasts of his every accomplishment, no matter how small. And when others don't flatter him, he feels disrespected.

j is stingy with compliments. He rarely acknowledges others' accomplishments. And when others brag to him, he feels disrespected.

j's praise-stinginess often leads him to offend *i*'s sensibilities. And *i*'s incessant boasting often leads him to offend *j*'s sensibilities. Each is offended by the other's behavior and holds a grudge against the other in consequence. The result is low-grade conflict—antagonism and resentment—between neighbors.

i and *j* each have two choices for coping with such conflict. Each person can "back down" by apologizing to his neighbor, explicitly through words or implicitly through his behavior; or he can "stand tall" by refusing to apologize to his neighbor and insisting that his neighbor apologize to him.

If one neighbor backs down but the other stands tall, the former earns 0 and the latter earns $y > 0$. In this case, one neighbor apologizes and the other doesn't. The apologizing neighbor swallows his pride completely. The neighbor who doesn't apologize preserves his pride completely. An apology is made. So the conflict between them is quashed.

	Stand tall	Back down
Stand tall	x, x	$y, 0$
Back down	$0, y$	$y/2, y/2$

Figure 1. Unresolved conflict.

If both neighbors back down, each earns $y / 2$. In this case, each neighbor apologizes to the other. Each swallows an equal, incomplete part of his pride. An apology is made. So the conflict between them is quashed.

If both neighbors stand tall, each earns $x < 0$. In this case neither neighbor apologizes to the other. Neither neighbor swallows any part of his pride. But the neighbors' animus toward one another grows, straining relations between them further and eventually erupting into a violent—or at least verbal—clash. Neither neighbor wins the clash. And no apology is made. So the conflict remains unresolved.

These outcomes and their resulting payoffs are common knowledge. Figure 1 depicts the situation these unhappy neighbors confront.

This figure depicts an anti-coordination game of the hawk–dove variety. It has three equilibria. Two of these equilibria are in pure strategies: *i* stands tall and *j* backs down and *j* stands tall and *i* backs down. The third equilibrium is in mixed strategies: both neighbors stand tall with probability $p = y / (y - 2x)$ and back down with probability $1 - p$.[5]

This game's symmetry leaves us with no way of selecting one of these pure equilibria over the other. More important, it leaves *i* and *j* with no way of doing so. Because of this, the equilibrium in mixed strategies is most sensible. Unlike the pure equilibria, this equilibrium is symmetric.

Using the probabilities from above, we can calculate each neighbor's mixed-equilibrium expected payoff.[6] Doing so yields $y / 2 - [y^2 / (2y - 4x)]$. The mixed equilibrium is inefficient. The reason for this inefficiency is that conflict may remain unresolved. The strategy pairs that *i*'s and *j*'s uncoordinated randomization produce include both neighbors standing tall with a positive probability. This is the strategy pair that yields both neighbors their lowest payoff.

Resolving conflict through oracles

Introducing an oracle can alter the equilibrium outcome of the game in Figure 1. Oracles have the power to resolve conflict efficiently. They do so by creating correlated equilibrium.

The idea behind such an equilibrium is simple. Before choosing their strategies, players observe a public signal. This signal randomly assigns, or "recommends," a strategy to each player. If no player wants to deviate from his signal-assigned strategy, supposing the others won't deviate from theirs, the strategies chosen constitute a correlated equilibrium. We call this equilibrium "correlated" because the strategies that compose it aren't chosen independently: they're chosen after observing the same public signal, and thus are correlated.

To see how oracles can create correlated equilibrium, suppose that before *i* and *j* decide how to cope with their conflict they consult a Magic 8 Ball. To use this oracle *i* and *j* ask it the following question: "Tell us, oh Magic 8 Ball, great one and infallible teller of eternal truths, is *i*'s (or *j*'s) animus toward *j* (or *i*) justified?"

The die inside the 8 Ball has three sides. One of them reads "Yes. It is certainly true." Another side reads: "No. It is certainly untrue." The third side reads: "Ask again later."

The neighbors put their hands on the oracle and shake it together. They then turn it upside down to see what the oracle has divined. The neighbors believe the 8 Ball is infallible. They repose complete faith in its ability to get to the bottom of their conflict—i.e., to accurately identify which neighbor is in the wrong—and agree to condition their behavior toward the other on whatever it answers.

If the 8 Ball answers "yes," the neighbors agree that *i*'s animus is justified. In this case *i* stands tall by insisting on *j*'s apology and *j* backs down by giving it to him, quashing the conflict between them. If the 8 Ball answers "no," the neighbors agree that *i*'s animus is unjustified, which means *j*'s animus is justified. In this case *j* stands tall by insisting on *i*'s apology and *i* backs down by giving it to him, quashing the conflict between them. If the 8 Ball answers "ask again later," the neighbors repeat the question, shake the 8 Ball again, and see what the oracle divines. They repeat this procedure until the 8 Ball answers their question definitively.

It's easy to confirm that if one expects his neighbor to follow his oracle-assigned strategy, both *i* and *j* will also follow theirs, and thus that both neighbors following their oracle-assigned strategies is a correlated equilibrium.[7] Since when the oracle answers "ask again later" the neighbors repeat the consultation until it answers "yes" or "no," we need only concern ourselves with checking whether either neighbor has an incentive to deviate from his oracle-assigned strategy when the oracle declares a definitive answer.

If the oracle answers "yes" to the question about whether *i*'s animus is justified, *i*'s payoff from following his oracle-assigned strategy, stand tall, is y. If *i* deviates from his oracle-assigned strategy in this case, his payoff is $y / 2$. $y > y / 2$. So *i*'s incentive is to follow his oracle-assigned strategy.

If the oracle answers "no" to the question about whether *i*'s animus is justified, *i*'s payoff from following his oracle-assigned strategy, back down, is 0. If *i* deviates from his oracle-assigned strategy in this case, his payoff is x. $0 > x$. So *i*'s incentive is again to follow his oracle-assigned strategy. The payoffs in Figure 1 are symmetric. So *j*'s incentive is also to follow his oracle-assigned strategy regardless of what the 8 Ball divines.

Each neighbor's expected payoff in the 8 Ball-induced, correlated equilibrium is $(0.5 * y + 0.5 * 0 =) \quad y/2$. Since $y/2 > y/2 - [y^2/(2y - 4x)]$, the oracle improves social welfare compared to the case without it. Indeed, the oracle-created, correlated equilibrium is efficient: one neighbor stands tall, the other neighbor backs down, and the conflict is quashed. There's no equilibrium strategy pair in Figure 1 that produces higher joint payoffs than the oracle-created strategy pairs.[8]

The Magic 8 Ball randomizes strategies for *i* and *j*, as *i*'s and *j*'s mixing strategy does without it. But unlike simple mixing, the Magic 8 Ball coordinates *i*'s and *j*'s randomization. The oracle selects strategy pairs that include only the off-diagonals in Figure 1. It precludes randomization that could result in continued conflict—the strategy pair stand tall–stand tall—which yields lower social payoffs than the strategy pairs stand tall–back down and back down–stand tall that resolve conflict. The Magic 8 Ball isn't truly magical. But in terms of resolving petty conflict between neighbors, it produces "magical" outcomes nonetheless.

Oracles and the Azande

The Azande is a tribe of one to four million persons who inhabit parts of the Democratic Republic of Congo, southern Sudan, and southeastern Central African Republic. The persons in this society put the theory of oracles developed above to good use.

Between 1926 and 1930, anthropologist E.E. Evans-Pritchard lived among and closely studied the Zande people of Anglo-Egyptian Sudan. The British colonized these people in 1905. My discussion of Zande society, beliefs, and oracular usage is based on Evans-Pritchard's (1937) detailed and lengthy account, which is a classic of the anthropological literature (see also Evans-Pritchard, 1928, 1929, 1932, 1933, 1935, 1960a, 1960b, 1963a, 1963b, 1965, 1971).

In the years of Evans-Pritchard's study, Zande society was organized politically on the basis of a chief and several governors, who were typically the chief's sons.[9] Within each of the chiefdom's provinces, local communities selected trusted members to act as deputies in assisting governors to oversee their areas. Zande political rulers administered native and colonial-created laws and operated native courts alongside courts operated by

colonial officials. However, these formal political institutions' purview remained limited to addressing major conflicts, such as those involving adultery, murder, and theft. Low-grade conflicts—the petty, passive, everyday sort that exist between neighbors arising out of feelings of jealously, envy, rivalry, and meanness—fell outside the formally governed arena.

It wasn't possible to take your neighbor to court for petty, passive conflicts occasioned by such frictions. The law didn't recognize them as offenses. A legal system that tried to address petty conflicts would be perpetually inundated with work. Equally important, it's unclear what the legal system could do to resolve such conflict. Ordering squabbling neighbors to "make nice" where "niceness" is vague, subtle, and subjective is, at best, difficult to enforce.

A perhaps still greater problem for government resolution of low-grade conflict is the near impossibility of defining property rights in the sources of such conflict—individuals' perceptions and feelings—on the basis of which a traditional court could decide whether a violation has occurred. It's unclear how property rights could be practically extended to how others perceive one's behavior, or to not being offended by others' behavior. By their nature, perceived slights of action or word depend on the perceptions and sensibilities of the persons who experience them. What one person interprets as a veiled gibe against him will appear totally innocent to a less sensitive sort. This poses a serious problem for establishing enforceable property rights in the sources of low-grade conflict. If the law can't define property rights in these sources, governmental institutions—at least in their traditional forms—can't adjudicate conflict arising from them.

Low-grade conflict doesn't lend itself to traditional procedures of conflict resolution. But it remains tremendously important in societies where neighbors must live and work together inside small communities, and thus opportunity for such conflict is common. As Evans-Pritchard (1937: 101) describes it:

> In the daily tasks of life there is ample scope for friction. . . . Among his neighbours a man is sure to have both secret and open enemies. There may have been quarrels about cultivations and hunting areas. There may have been suspicions about designs on a wife. There may have been rivalry at dances. One may have uttered unguarded words which have been repeated by another. A man may have thought that a song referred to himself . . . . All unkind words and malicious actions and innuendoes are stored in the memory for retaliation.

Such conflicts are especially pervasive among the Azande who, according to Evans-Pritchard, are "extremely, almost morbidly, sensitive, touched

to the quick by any unkindness, insult, humiliation or hostility" (Evans-Pritchard, 1929: 199). Indeed, "in all [Zande] economic and social pursuits there is opportunity for offence to be given and offence to be taken where none is meant" (Evans-Pritchard, 1929: 201)

If left unresolved, low-grade conflict with one's neighbors threatens to undermine social cooperation essential to maintain individuals' livelihoods. To cope with this "underground stream of malice and backbiting, envy and hatred, greed and jealousy, which runs with ceaseless turmoil beneath the calm surface of native life," the Azande must look beyond government (Evans-Pritchard, 1929: 248). It is in the context of the kinds of conflict this stream feeds that I consider Zande oracles.[10]

Mangu

Understanding oracular operation among the Azande requires understanding the superstitious belief system within which they operate oracles. At the core of that system is a belief in witchcraft called *mangu*. According to Zande belief, witch-hood is a physiological condition. In the intestine of some people lies a substance that enables them to send out witchcraft against their enemies. Witch-hood is heritable: fathers pass it down to their sons; mothers pass it down to their daughters.

Most people are witches and most of them don't know it. Their witch-selves may operate when they're sleeping or otherwise unaware. Those witch-selves engage in all manner of nefarious business. They ruin Zande crops, disrupt Zande hunts, cause Zande dwellings to collapse, inflict injury and illness on others, and are responsible for nearly all naturally unaccountable Zande deaths.

"Only in those areas of society which were left unstructured by the political system did men accuse each other of witchcraft" (Douglas, 1966: 128). Witchcraft suspicions and accusations are the means by which the Azande express low-grade conflicts with their neighbors that can't be addressed through government. Thus it's unsurprising that, according to Zande belief, witches' geographic scope of malefaction is narrowly circumscribed. Witches may use witchcraft to injure their neighbors—the persons with whom they may find themselves in low-grade conflict—but not persons outside their communities who they don't interact with, for whom the feelings that generate such conflict are unlikely to arise.

Since most, if not virtually all, commoner Zande families have witches in them, and many of them are unaware of this fact, persons accused of witchcraft are neither maligned nor even looked on with askance for being witches *per se*.[11] Zande witches occupy a very different status than witches in medieval and early modern European history, who were both exceptional

and hunted for persecution on the grounds of being witches alone. For the Azande, what matters is particularized instances of witchcraft—i.e., whether a witch is in a specific instance doing injury to them. A "person who has bewitched a man is not viewed by him ever afterwards as a witch but only at the time of the misfortune that has caused and in relation to these special conditions" (Evans-Pritchard, 1937: 107).

A Zande suffers some misfortune: e.g., his crops fail; his hunt is fruitless; he encounters domestic problems; he or one of his family members becomes ill. This is when he becomes concerned with witches, who are undoubtedly responsible for his difficulty. And it's at these times that he seeks to identify the offending witch so that he can command him to cease his injuries, which the unwitting witch will ordinarily do. Once this is accomplished, the Zande's interest in witches, including the particular witch whom he has requested to cease injuring him or his family members, abates and normal relations with the witch resume.

Benge

To identify the witch offending him in such cases, a Zande consults an oracle called *benge. Benge* works as follows. Poison harvested from a special vine is fed to a fowl. The oracle consulter (or someone on his behalf) treats *benge* to "a speech of five or ten minutes" in which he "puts before the oracle every detail of the situation on which it is being consulted, in much the same way as a case would be stated in the court of a chief" (Mair, 1974: 224).[12]

The consulter then asks the oracle a yes-or-no question about whether some neighbor is bewitching him in whatever manner befits his recent misfortune. He shakes the fowl to ensure that it has swallowed the poison, much as one shakes a Magic 8 Ball to elicit a response. The fowl's reaction to consuming poison—living or dying—is the oracle's means of replying to the question posed to it. *Benge* poison needn't be fatal. Indeed, as I discuss below, it kills the fowls it's fed to in about the same proportion that it spares them.

As he shakes the fowl, the consulter addresses the oracle in the following way: "If [a neighbor's name] is guilty of bewitching my [hunt, person, etc.], poison oracle kill the fowl. If [neighbor's name] is innocent, poison oracle spare the fowl." Alternatively the consulter may ask the oracle to provide an affirmative answer to his question by letting the fowl live, in which case he simply reverses the fowl reaction he requests of the oracle, in the following manner: "If [a neighbor's name] is innocent of bewitching my [hunt, person, etc.], poison oracle spare the fowl. If [neighbor's name] is guilty, poison oracle kill the fowl."

Oracular usage is private and decentralized. Any adult male who respects certain ritual taboos, such as sexual abstention and abstention from eating certain types of meat for a proscribed period, may operate *benge* and may do so whenever he wants. Still, oracular poison is costly and not every Zande possesses fowl.[13] As a result, *benge* is more accessible to married householders, who are typically older and wealthy enough to own the poison and birds that *benge* relies on.

This doesn't preclude poorer Zande (who are often younger) from accessing *benge*, however. As Evans-Pritchard (1937: 283) notes, "Poor men who do not possess poison or fowls but who are compelled for one reason or another to consult the oracle will persuade a kinsman, blood-brother, relative-in-law, or prince's deputy to consult it on their behalf. This is one of the main duties of social relationships."

With women the situation is similar. Custom excludes females from having anything to do with *benge* directly.[14] Thus, unlike poorer persons, women can't ask others to consult *benge* for them. However, their male relations—husbands or kinsmen—can consult the oracle on their behalf. If, for example, a man's wife falls sick, he may and, provided that he's able, almost certainly will inquire of *benge* about the identity of the witch who is causing her illness.

The social obligation of wealthier males to "share" *benge* is mirrored by a state of "indebtedness" on the part of recipients. This situation gives wealthier, male poison and fowl owners social leverage over poorer persons and females. Provided that *benge*'s status in the Zande mind is sacrosanct, and thus precludes oracular manipulation, the social leverage that wealthier males wield over poorer persons or females in light of their more direct access to *benge* doesn't affect the oracle's usefulness as a device for securing correlated equilibrium. And, as I discuss below, this is indeed *benge*'s status among the Azande.

Nevertheless, *benge*'s expense necessarily limits the frequency with which the Azande can resort to the oracle and thus use it to resolve conflict.[15] This costliness prevents the poison oracle from resolving conflict perfectly (as, indeed, the positive cost associated with any device for resolving conflict must do). Since poorer persons and women have only indirect access to *benge*, it stands to reason that conflicts involving them are among those most likely to go unresolved as a result. Individuals with diminished social standing thus bear the brunt of the limits on *benge*'s usefulness that the oracle's costliness creates.[16]

The name(s) a Zande oracle consulter puts before *benge* as a potential person bewitching him is not arbitrary. The reason for this is that the person(s) who he believes may be bewitching him is not arbitrary. "[O]ne does not places names of people before the oracle in a haphazard manner.

One selects only the names of those with whom one is on bad terms" (Evans-Pritchard, 1935: 421).

According to Zande belief, witchcraft is motivated by personal animus. "A witch attacks a man when motivated by hatred, envy, jealousy, and greed . . . . Therefore a Zande in misfortune at once considers who is likely to hate him" (Evans-Pritchard, 1937: 100). For this reason, the person who an oracle consulter suspects may be bewitching him in a particular instance is always the consulter's "personal enemy, the man whose name you chose to place before the oracles because you knew that he would be glad to injure you" (Evans-Pritchard, 1929: 213).

As one scholar of the Azande notes, "It is thus clear that allegations of witchcraft reflect the nature of social relationships in the sense that they indicate where in tribal life tensions and conflicts are most frequent and severe" (Wagner, 1937: 470). Zande "beliefs about witchcraft are linked with misfortune, jealousy and rivalry, and . . . these beliefs can be regarded as an expression of conflicts" (Pradelles de Latour, 1995: 599).

Through *benge* an oracle consulter doesn't seek to determine the culprits of such conflicts directly, however. He seeks to identify the witch behind his recent misfortune—the cause of his crop failure, his unsuccessful hunt, his illness, and so on. Because according to Zande belief, potential witches "are his personal enemies who are jealous of him or dislike him for some reason or other, the antipathy being generally mutual," the suspects he puts before the oracle are neighbors with whom he's in low-grade conflict (Evans-Pritchard, 1929: 248).[17] In this way *benge* identifies and, as I explain below, ultimately resolves low-grade conflict with antagonistic neighbors indirectly.

The Azande consult their oracles with the assistance, or at least observance, of one or several trusted persons. This ensures the fact that the oracle was indeed consulted in the particular case, and consulted properly, can be verified.

If the poison oracle "exonerates" the neighbor whose name the consulter has put before it, clearing him of the particular witchcraft, the oracle consulter is satisfied that this man isn't bewitching him and resumes friendly relations with his neighbor. Whereas before he may have remained cold, distant, and even passively hostile toward the suspected witch, once the oracle has assured the consulter that his suspicion is unfounded, the consulter is likely to "warm" toward the former suspect, his animus now appearing to him unjustified. The consulter apologizes implicitly to his neighbor, quashing the low-grade conflict between them.

If the poison oracle "convicts" the person whose name the consulter has put before it, he's satisfied that his suspicion was correct. In this case the consulter informs his neighbor that the oracle has declared that he's

bewitching him. To do so he takes the wing of the fowl that died in affirmation of his neighbor's witchcraft, fans its feathers, and impales it on a small pointed stick. The consulter then finds a respected man, in many cases one of his community's deputies, to deliver the stick with the wing on it to his bewitching neighbor. Alternatively he delivers the stick to his neighbor himself.

The messenger lays the stick on the ground before the neighbor and states that the consulter's oracle has declared him guilty of witchcraft. For reasons considered in the next section, where I discuss the Azande's faith in the oracle's infallibility, the neighbor's response to this message is ritualistic. "When he is informed that the oracles have declared that he has bewitched a certain man he says that he is very sorry and is totally ignorant of having done so, blows some water from his mouth in a sign of goodwill," recalling or "cooling" his unwitting witchcraft against the consulter, "and the matter is closed" (Evans-Pritchard, 1935: 420).[18]

The neighbor apologizes explicitly to the consulter, quashing the low-grade conflict between them. In this way the consulter's oracular affirmation of his suspicions against a neighbor with whom he's in low-grade conflict, and that neighbor's subsequent "demonstration of remorse" following the oracle's declaration, "set these ill feelings to rights" (Peters-Golden, 2008: 13).

Zande oracle effectiveness

Oracular effectiveness among the Azande requires *benge* to satisfy three conditions. *Benge* must optimally randomize conflicting neighbors' strategies about how to cope with their conflict. *Benge* must coordinate conflicting neighbors' randomization such that it precludes the strategy pair that leaves conflict unresolved. And *benge* must be universally trusted by the Azande. If the Zande poison oracle can accomplish these three things, it can produce correlated equilibrium and resolve low-grade conflict efficiently where government cannot. Below, I consider how *benge* does so.

Optimal randomization

If *benge* always vindicated the consulter's animus or always vindicated his neighbor's, one of the parties would be unwilling to abide by the poison oracle's declarations. Central to *benge*'s ability to produce sustained correlated equilibrium is its ability to generate higher expected payoffs for both parties. If either party finds over time that he earns less when oracles are used than he could earn using a simple mixed-strategy, he will prefer to use the latter, which leaves open the possibility of unresolved conflict.

Let r denote the probability that *benge* vindicates a party's animus. To earn more in expectation when oracles are used than when simple mixed strategies are used, each party requires $ry \geq y/2 - [y^2/(2y - 4x)]$. Solving this expression for r yields $r \geq -x/(y - 2x)$.

When *benge* vindicates one party's animus with probability r, it vindicates the other party's animus with probability $1 - r$. Thus it's easy to see that for both parties to prefer using oracles to simple mixed strategies, we must have $-x/(y - 2x) \leq 0.5$. If not, one party will always earn less in expectation when the parties use oracles than when they use simple mixed strategies.

Since $0.5 \geq -x/(y - 2x) \quad \forall \quad y$ and x where $y \geq 0$, it's at least possible that both parties will prefer using oracles to not doing so. However, for any *benge*-generated probability of animus vindication $r < 0.5$, one party may prefer not using oracles to using them. Whether or not this is the case depends on the payoffs of unilaterally standing tall and mutually standing tall, y and x.

As y shrinks (the payoff from unilaterally standing tall falls) or $|x|$ grows (the payoff from mutually standing tall falls), the probability with which *benge* must vindicate each party's animus to satisfy this condition rises. Thus, depending on the values of y and x, if *benge*'s technical features render it capable of vindicating animus only rarely (i.e., r is low), one party may prefer not to use it, leading to simple mixed strategies that produce socially inefficient outcomes.

The probability with which *benge* vindicates animus that would maximize oracles' ability to remain preferable to both parties—i.e., would render *benge* preferable to both parties for the largest range of y and x values—is 0.5. Indeed, when $r = 0.5$, using oracles is preferred to not using them for all values of y and x where unilaterally standing tall is preferred to mutually standing tall.

If *benge* vindicates a party's animus half the time and rejects its legitimacy the other half, both parties always prefer using oracles to not. Oracles with this property ensure they're used over time and, in doing so, ensure a dynamically stable correlated equilibrium. Optimal oracles in the context of the game described by Figure 1 therefore randomize parties' strategies with probability one half.

Zande oracles—*benge*—are optimal oracles. They vindicate oracle consulters' animus, and thus randomize Zande's strategies, with probability one half. The way they do so is wickedly clever.

When a Zande consults *benge* regarding a particular person, he does so not once, but twice. The first oracular consultation is called *bambata sima.* The second is called *gingo*. "To obtain a conclusive answer the result of the first test has to be confirmed by feeding the poison to a second fowl. The alternatives of

the question are reversed and the effect of the poison must be the opposite to the first test to be accepted as final evidence" (Wagner, 1937: 472).

"[T]he oracle must slay one fowl and spare another if it is to deliver a valid verdict" (Evans-Pritchard, 1937: 330). For example, if in *bambata sima* the oracle consulter inquires of the oracle in the following manner: "If [a neighbor's name] is guilty of bewitching my [hunt, person, etc.], poison oracle kill the fowl. If [neighbor's name] is innocent, poison oracle spare the fowl," in *gingo* he must inquire of the oracle this way: "If [a neighbor's name] is guilty of bewitching my [hunt, person, etc.], poison oracle spare the fowl. If [neighbor's name] is innocent, poison oracle kill the fowl." Conversely, if the oracle consulter inquires of the oracle in *bambata sima* by asking it to spare the fowl if his neighbor is bewitching him and kill the fowl if he isn't, in *gingo* he must inquire of the oracle by asking it to kill the fowl if his neighbor is bewitching him and spare the fowl if he isn't.

Only when both oracular tests agree by the poison acting upon the fowls oppositely has the oracle declared a definitive answer. If the opposing oracular tests disagree, a definitive answer remains elusive. The consulter must "ask again later."

The genius of this dual, opposing-test approach to *benge* is that it tends to permit a definitive oracular declaration only when the poison fed to the fowl is of such strength that it has an equal chance of killing and sparing the fowl. Since the poison harvested and used in *benge* exhibits natural variation in strength, and that strength may change by exposure to certain elements, age, or in principle by manipulation of the consulter, the dual, opposing-test requirement "throws out" oracular declarations influenced by such features, which would produce systematically greater or lesser than 50 percent oracular declarations of legitimate animus.[19]

Overly strong poison will kill both fowls, throwing out that result. Overly weak poison will spare both fowls, throwing out that one too. Only declarations based on poison whose strength gives fowls a roughly equal chance of living and dying will be valid. These are declarations that tend to vindicate and reject the legitimacy of the consulter's animus, and thus vindicate and reject the legitimacy of the animus of the neighbor with whom he's in low-grade conflict, with equal probability.

Other Zande rituals surrounding *benge* preparation and usage also promote definitive *benge* declarations of one kind or the other with 50 percent probability. For example, there are rules about how many doses of poison should be administered to fowls depending on their size. Larger fowls receive more doses. Smaller ones receive fewer. Given variation in fowl size and thus variation in potential susceptibility to oracular poison, this ritual promotes equal chances of alternative reaction to the poison across birds.[20]

Similarly, recall that under *benge* the oracle "operator performs in public. His audience, all parties interested in the dispute or inquiry, sit a few feet away and can see what he does, and they largely direct his actions" (Evans-Pritchard, 1937: 323). This ritual prevents illegitimate oracular administration, for example killing the chicken by shaking it violently, or using only one test instead of the required two. Such rules explain Evans-Pritchard's (1937: 323) oracle observation: "I witnessed cases when it has been to the interests of the operator that the fowls shall live and they have died, and vice versa." *Benge* rituals prevent oracular manipulation.

The Azande also test newly procured *benge* poison before using it in a proper séance. "As soon as the poison is brought back from its forest home it is tested to discover whether some fowls will live and others die under its influence" (Evans-Pritchard, 1937: 336). The purpose of such tests is to determine whether the poison is "good"—i.e., capable of both killing and sparing fowls. As Evans-Pritchard (1937: 330) describes this ritual:

> If at its first séance the oracle kills fowls without discrimination, slaying one fowl after the other without sparing a single one, they say that it is 'foolish' poison. More often it happens at séances that the poison fails to affect the fowls and they say that it is 'weak poison' or 'dead poison'. If some four medium-sized fowls are in succession unaffected by the poison they stop the séance, and later the poison will be thrown away.

Benge results support the argument that it tends to produce opposing results with 50 percent probability. Evans-Pritchard (1937: 328) observed 49 oracular tests first hand in Zandeland. In them, fowls died 22 times, or 45 percent of the time. Fowls survived 27 times, or 55 percent of the time. Given the sample size, the closeness of these rates to equal randomization is impressive.

Assuring conflict resolution

To ensure efficient conflict resolution, *benge* must eliminate the possibility that it will assign conflicting neighbors the socially worst strategy pair: stand tall–stand tall. An effective oracle permits only coordinated strategy pairs, which involve one or the other party standing tall and his adversary backing down.

Benge achieves this by "vindicating one and condemning the other rival" (Douglas, 1966: 128). The oracle declares one party's animus justified in every case in which it declares the other party's animus unjustified, and vice versa. This result is secured by the nature of the question an oracle consulter necessarily uses when inquiring of the oracle about whether a neighbor with

whom he's in conflict is bewitching him. The oracle consulter must ask *benge* a yes-or-no question, and his question about another's witchcraft won't include the possibility that he's bewitching his neighbor in addition to the possibility that his neighbor is bewitching him.

The oracle consulter asks only whether the neighbor whose name he has put before *benge* is bewitching him or not. If *benge* answers "yes," this means the same thing for both the consulter and his neighbor: the consulter is justified in demanding an apology and recall of witchcraft from his neighbor, and his neighbor must apologize to the consulter and recall his witchcraft. If *benge* answers "no," this also means the same thing for both the consulter and his neighbor: the consulter's suspicion is mistaken. So he "apologizes" by resuming friendly relations with his neighbor. His neighbor, who hasn't been instructed to apologize to the consulter, needn't apologize. He stands tall.

In the former case, when one neighbor apologizes to the other explicitly, the *benge* ritual requires the apologizer to display genuineness in asking for forgiveness. This helps ensure that through *benge* the conflict is indeed quashed. As Evans-Pritchard (1937: 123) describes it,

> it is not only laid down by custom that he must blow out water, but the phrases in which he is expected to express his regret are more or less stereotyped, and even the earnest and apologetic tone of voice in which he utters them is determined by tradition.

There is one situation in which it may appear possible for *benge* to assign "stand tall" to both neighbors, leaving conflict unresolved. *Benge*, recall, may be consulted by any adult man who has respected the requisite taboos at any time. Thus two neighbors in low-grade conflict could in principle simultaneously consult their oracles and each of their oracles could in principle vindicate their animus toward their neighbor by declaring that the other is bewitching him.

In practice this is unlikely. First, even if two neighbors do consult their oracles simultaneously, the probability that both of their oracles will vindicate their animus toward the other is low. Approximately half the time, a fowl dies. And to render a definitive verdict, the oracle must produce the "correct" result twice. The probability that one party's oracle will vindicate his animus is therefore $(0.5 * 0.5 =)$ 0.25. Thus the probability that both parties' oracles will vindicate their animus is only $(0.25 * 0.25 =)$ 0.0625.

Among oracular consultations that deliver definitive verdicts, the probability that one or the other party's animus will be vindicated is 0.5. But there's a 75 percent chance that at least one party's oracle will answer "ask

again later." And, when this party does so, he's likely to be the only party consulting his oracle about the other.

Second, recall that the Azande tend to consult *benge* about their neighbors' witchcraft only in particular cases, such as when their crop fails, their hunt is fruitless, or they become ill. The misfortunes that trigger oracular consultation are likely to be distributed randomly among neighbors. Thus situations in which two neighbors in low-grade conflict may simultaneously desire to consult their oracles about the other are likely to be rare.

Third, for exceptional cases in which two neighbors consult their oracles about the other simultaneously and both of their oracles assign them the strategy "stand tall," Zande can appeal to a third oracle, such as a trusted community member's or the chief's, to deliver a definitive verdict.

In benge we trust

If some Zande consider *benge* unfair or prone to error in its divinations, giving false answers to the questions posed to it instead of correct ones, they will be unwilling to condition their decisions about how to proceed in cases of interpersonal conflict based on *benge*'s declarations. These individuals will be unwilling to follow their oracle-assigned strategies, leaving open the possibility that conflict may remain unresolved.

Fortunately for the Azande, faith in the fairness and infallibility of *benge* is universal and nearly perfect. The reason for this is that the Azande "consider the poison" administered to fowl under *benge*—the oracle's ostensible source of divinatory power—"an objective and infallible agent" (Wagner, 1937: 472). This superstition ensures that, as Evans-Pritchard puts it, in the Zande mind the poison oracle has "complete accuracy" (1932: 324).[21] "'The poison oracle does not err' is every Zande's *credo*" (Evans-Pritchard, 1937: 125). This credo is the governing principle of Zande life and decision-making. Because of it, "the Zande puts his full trust in *benge*" (Evans-Pritchard, 1928: 21).

As a consequence of this trust, "the judgments of *benge* are always accepted as final" (Evans-Pritchard, 1928: 49). The oracle consulter whose suspicion *benge* rejects accepts his "wrong" and resumes friendly relations with the neighbor with whom he was in conflict, whom the oracle has exonerated. He accepts that he must "apologize."

Likewise, the neighbor whom the consulter's oracle identifies as bewitching the consulter accepts his wrong and that he must apologize to the consulter. "[T]he poison oracle by itself suffices to eliminate in advance all denial and opposition" (Evans-Pritchard, 1937: 97). Zande belief in *benge*'s infallibility ensures that "the normal reaction to the presentation of a hen's wing" is "one of acquiescence in which assurances of goodwill take the

place of any denial" (Evans-Pritchard, 1929: 230). Indeed, the Zande "believes [so] firmly in the . . . . accuracy of the poison oracle, . . . that when the oracle says that he is killing a man by his witchcraft he is probably thankful for having been warned" (Evans-Pritchard, 1937: 97).

In this way "the great authority of the poison oracle," which renders it "useless to protest against its declarations," contributes to "mak[ing] the [oracular] procedure of advantage to both parties" (Evans-Pritchard, 1937: 96–97). Neither party would contemplate behaving in a manner other than that directed by *benge*. And since *benge* always coordinates parties' behaviors, conflict is resolved efficiently.

Similarly, complete trust in *benge*'s divinations ensures that oracle consulters don't report false results. "[N]o Zande would state the declaration of an oracle other than it was given" (Evans-Pritchard, 1937: 89).[22] Besides the fact that observers are present at oracular consultations who can confirm the oracle's declarations, false oracular reports don't occur because respect for the poison oracle's verdicts is too strong.

Concluding remarks

My analysis of Zande oracles bridges two literatures—one on the economics of superstition, the other on the economics of self-governance. These literatures have much to say to one another but have communicated little. In particular, my analysis highlights the important relationship that can exist between objectively false beliefs and institutions of private order. In doing so it helps fill gaps in each strand of research by suggesting a self-governance, and thus social usefulness, rationale for the persistence of some superstitions on the one hand, and by suggesting that at least some institutions of private order cannot be understood without reference to the superstitions held by the populations they govern on the other.

Several more specific conclusions of relevance to the intersection of superstition and self-governance follow from my study. First, my analysis of oracles reaffirms a finding of previous work on self-governance: decentralized decision-making is capable of generating solutions to problems of interpersonal conflict. When petty, reciprocal grievances build between neighbors, ensuing low-grade conflict can only be resolved by one, or both, persons "apologizing" to the other. The difficulty is that neither neighbor prefers to swallow his pride, particularly when his adversary may refuse to. As they are unable to coordinate their responses in such situations, conflict between neighbors may remain unresolved.

In small communities where interaction is highly personalized, unresolved animus poses a serious problem. Frustrated and angry neighbors don't cooperate well with one another socially or economically. The

consequence of unresolved animus can be dire in primitive communities where individuals operate at near-subsistence levels.

Unable to rely on government to resolve such animus, individuals don't throw up their hands and resign themselves to welfare-undermining outcomes. As the Zande case demonstrates, they find informal solutions to this problem instead.

Second, my analysis highlights the importance of conflict generated by perceptions or feelings of offense and the emergence of institutions that resolve it. Low-grade conflict is pervasive but remains neglected in most discussions of social cooperation, where government is assumed to resolve interpersonal problems, and even in discussions of self-governance, which tend to focus on the problem of high-grade conflict instead. Unlike other kinds of interpersonal conflict, the low-grade variety, rooted in perceptions of behavioral subtleties, isn't amenable to governmental institutions of resolution. My study suggests that this difficulty needn't mean that low-grade conflict must go unaddressed. Oracles are one example of private mechanisms that emerge to mediate low-grade conflict. They fill "institutional cracks" that are left unfilled, and that are often unfillable, by government.

Third, my analysis suggests that solutions to conflict needn't be conventional. Indeed, they may appear to be downright silly. Conditioning one's interpersonal behavior on the divinations of an ostensibly magical device certainly seems absurd. But closer inspection reveals that relying on oracles for this purpose can make a great deal of sense.

Oracles randomize neighbors' strategies about how to cope with the conflict they confront. More important still, they coordinate individuals' randomization. In doing so, oracles eliminate the possibility that conflicting neighbors may make choices that result in the most destructive strategy pair, where both neighbors refuse to recognize their wrong toward the other and conflict remains unresolved. Oracles produce correlated equilibrium where simple mixed-strategy equilibrium would otherwise prevail and, as a consequence, produce socially efficient conflict resolution where socially inefficient, unresolved conflict would otherwise persist.

The Zande poison oracle—*benge*—illustrates how such oracles can operate to successfully produce correlated equilibrium in practice. Further, *benge* highlights how private oracular institutions can be optimal. *Benge* rituals, which ensure that definitive Zande oracular declarations vindicate and reject one neighbor's animus toward the other with roughly equal probability, ensure that Zande oracles produce and sustain efficient correlated equilibrium for a maximal range of strategy payoff values.

Supporting *benge* institutions, such as strong and universal Zande belief in the infallibility of poison oracle results, similarly emerge to support the informal oracular mechanism. Using the equivalent of a Magic 8 Ball to

determine how to proceed in cases of interpersonal conflict can not only be sensible; it can be welfare-maximizing.

Finally, and of particular relevance for research on the economics of superstition, my analysis of oracles suggests that objectively false beliefs can play an important and socially productive role in the conflict-inhibiting institutions of rational people. The reason why some superstitions stand the test of time isn't that the people who hold them are irrational, but rather that these beliefs perform needed and useful social functions. Their persistence is a testament to such persons' rationality, not evidence of its absence. The Azande's scientifically unfounded belief system organized around witchcraft and magical divination devices is a critical part of the reason why their society is able to sustain cooperation. The resolution of low-grade conflict between Zande neighbors is possible because of superstition, not in spite of it.

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Notes

1. This isn't to say that in these societies oracular usage conforms in specifics to those I describe, or that their political–economic function is necessarily the same one I consider. My study restricts its attention to private oracular usage in situations of low-grade conflict among the Azande.
2. For an anthropological critique of Moore's (1957) argument, see Vollweiler and Sanchez (1983).
3. Wärneryd (2008) acknowledges oracular usage among the Azande but is concerned exclusively with rulers' reliance on religious rituals as a means of committing to choice randomization for political ends, rather than private citizens' reliance on oracles for private ends unreachable by political rulers.
4. See also Leeson (2007b, 2008, 2009b) who investigates private institutions of property protection in precolonial African communities and among the inhabitants of the medieval Anglo-Scottish border.
5. To find the mixed-strategy equilibrium, we need to find the strategy mixtures—the probabilities of "stand tall" and "back down"—each neighbor could use that would yield his neighbor the same expected payoff regardless of what strategy his neighbor follows. Doing so is straightforward. Suppose *i* mixes his strategies by standing tall with probability p and backing down with probability $1-p$. If *j* stands tall, he therefore earns $px+(1-p)y$. If instead *j* backs down, he earns $p0+(1-p)y/2$. *j*'s expected payoff is the same no matter what he

does when $px + (1-p)y = p0 + (1-p)y/2$. So the p that makes this equality true is the probability with which *i* will stand tall in equilibrium. Solving for p, we have: $p = y/(y-2x)$. Since the game is symmetric, this is also the probability with which *j* stands tall in equilibrium.

6. To do so we simply multiply the payoff associated with each potential strategy pair by the probability that such a pair is realized in equilibrium and then add the results together. Thus we have $p^2x + p(1-p)y + (1-p)p0 + (1-p)^2(y/2)$. Since we know that $p = y/(y-2x)$, all that remains is to substitute for p and use algebra to simplify the resulting expression.
7. Aumann (1974, 1987) first introduced the concept of correlated equilibrium. A closely related concept is that of sunspot equilibrium. See, for instance, Cass and Shell (1983), Peck and Shell (1991), Forges (1991), and Forges and Peck (1995).
8. As the normal-form representation in Figure 1 suggests, the game analyzed here is one where neighbors choose their strategies simultaneously or, what's equivalent, where neighbors are imperfectly informed about the strategy their counterpart has chosen when they choose their own strategies. My analysis above thus demonstrates how oracles create welfare-enhancing correlated equilibrium when information is imperfect. With minor modification one can also show that oracles can create welfare-enhancing correlated equilibrium when the game neighbors play after an oracle is introduced is sequential or, what's the same, information is perfect. Suppose one neighbor observes the oracle's declaration before the other and, in consequence, is able to reveal his reaction to his neighbor before his neighbor can reveal his reaction to him, creating a potential first-mover advantage. To demonstrate that a correlated equilibrium will still result, we need to show that the first-moving neighbor will abide his oracle-assigned strategy even when it directs him to back down. The oracle enables this by committing the second-moving neighbor to stand tall when the oracle tells him to do so. If the second-moving neighbor's faith in the oracle's authority is such that he will follow his oracle-assigned strategy no matter what, or the first-moving neighbor at least believes this is so, the first-moving neighbor maximizes his payoff by following his oracle-assigned strategy—i.e., backing down.
9. Colonization didn't destroy Zande political organization but rather grafted colonial-created laws and legal institutions onto it. It took several decades for colonial rule to have a noticeable effect on Zande society. In the years of Evans-Pritchard's stay, while some changes were apparent, at the level of ordinary citizens Zande society operated largely as it had before colonization. Private oracular usage (though not governmental usage) remained essentially unaffected by colonization. On how colonization affected Zande life in other ways and over a longer period, see Reining (1966).
10. Political rulers also consult oracles for "matters of state" and for private purposes. However, I restrict my attention to oracles' most frequent use: to address private, mundane matters of interpersonal conflict.
11. Nearly all commoners are accused of witchcraft on occasion. However, persons who are habitually accused of witchcraft may develop reputations as witches and be looked on differently.

12. There are three distinct *benge* consultation roles, which may in principle be occupied by three different persons: a poison owner, an oracular operator who prepares the poison and administers it to the fowl, and a questioner who poses the questions of interest to *benge*. In practice the owner and questioner are nearly always the same person. To most clearly explain oracular usage, I consider the case in which the owner, operator, and questioner are the same individual.
13. In the period of Evans-Pritchard's study, the difficulty of obtaining oracular poison was in large part created, or at least magnified, by restrictions on the movement of Zande in the Anglo-Egyptian Sudan. By law these Zande were prohibited under the threat of stiff penalties from traveling across political boundaries to the Belgian Congo where oracular poison was located.
14. Though this exclusion isn't absolute. "Occasionally very old women in good social position have been known to operate the poison oracle, or at least to consult it" (Evans-Pritchard, 1937: 284).
15. Empirically, the extent of these limits is uncertain. There are no data available that could be used to estimate the frequency with which *benge* is resorted to. And, if there were, rendering these data useful for estimating the extent to which conflict (at least temporarily) goes unresolved because of *benge*'s expense would also require data on the frequency of the misfortunes that would trigger the poison oracle's use if poison could be procured costlessly. Although Evans-Pritchard (1937) is at times inconsistent in his assessment of the frequency with which the Azande consult the poison oracle, the general impression he gives is one of "frequent" *benge* use.
16. But, of course, persons with diminished social position are also less likely to have conflicts in the first place, precisely because they're less socioeconomically engaged with outsiders.
17. In Mair's (1974: 223) words, the names one places before the oracle are of "people whom he dislikes, and who dislike him."
18. The fact that one neighbor observes *benge*'s declaration before the other doesn't preclude the possibility that neighbors choose their *reactions* to that declaration under imperfect information (per a simultaneous-move oracle game). For example, consider the case when a third party delivers the oracular verdict via fowl-wing presentation. Although the oracle consulter necessarily knows *benge*'s declaration before his neighbor, in this situation neither party need know what strategy the other has chosen to play until the parties next encounter one another in person and each reveals his choice to the other through his behavior. When neighbors instead choose their reactions to *benge*'s declaration with perfect information, *benge* also produces correlated equilibrium. Consider, for instance, the case where the oracle consulter delivers the oracular result to his neighbor in person and, at the same time he does so, reveals his strategy choice—or reaction to *benge*—through his behavior, to which his neighbor must now respond. As indicated in note 8, any potential first-mover advantage in such a situation is nullified provided that the consulter believes his neighbor is committed to follow *benge'*s decision, owing to his neighbor's

faith in *benge*'s authority, and thus will do precisely that regardless of how he (i.e., the consulter) has chosen.

19. I say "in principle" here because Evans-Pritchard argues that no Zande would in fact tamper with the poison given his belief in and respect for the oracle, which I discuss below. As he puts it, "A man would not tamper with the poison because he does not believe it possible to alter the verdict of an oracle one the poison has been administered to a fowl" (1937: 328).
20. Though variation in poison doses and fowl size may not be as important for deciding the oracle's result as one might at first think. According to Evans-Pritchard (1937: 326), "It is evident that the number of doses is not the sole determining cause of death. Out of 8 fowls" he observed in oracular consultations, "3 died after a single dose while 5 survived after 2 doses had been administered." Likewise, "it would seem that the size of the fowls is not the deciding factor, since in the tests described above a tiny chicken survived two doses while a very much larger chicken died after a single dose, and the largest fowl of them all, almost a fully developed bird, though it recovered, was very strongly affected by two doses, whereas a tiny chicken showed no discomfort after the same number of doses. I have often seen large fowls die and small fowls recover after the same number of doses." The particular poison the Zande use in *benge* may have been selected over time precisely because of its largely invariant effects on fowls of different sizes and those effects' independence from the dosage of poison administered to them.
21. This distinguishes the poison oracle from several lesser oracles that the Azande also consult for various purposes which, according to Zande thinking, may err. Thus when an Azande consults one of these other oracles, he only accepts its declaration as valid if that declaration is confirmed by the infallible poison oracle this article considers.
22. Evans-Pritchard (1937) notes that if any oracular subterfuge were resorted to, it would involve reporting an oracular result when no oracle had in fact been consulted. However, as indicated above, the presence of observers, who are used to verify that the oracle was in fact consulted, prevents such fabrication.

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