



An Evolutionary Account of Suicide Attacks: The Kamikaze Case

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Explanations for suicide attacks abound. Yet the literature remains conceptually fragmented, with different authors focusing on different attitudes, incentive structures, values, psychological processes, strategic imperatives, and cultural, historical, and personal circumstances. Curiously, however, there have been few efforts to cast suicide bombing within the extensive evolutionary literature on human altruism—in which it clearly belongs. Neither have there been more than occasional efforts to mobilize the distinction between “proximate” and “ultimate” explanations, with most proposed explanations being proximate. Here we draw on content analyses from materials written by Japanese Kamikaze pilots to propose an evolvable cognitive algorithm—by hypothesis, species typical—that (1) specifies environmental circumstances under which such “heroic” behavior is likely; (2) is consistent at the proximate level with the Japanese data; and (3) that is not inconsistent with many of the diverse proximate attitudes, values, and psychological mechanisms that dominate discussions of contemporary suicide campaigns. The evolutionary perspective is not an alternative to most of the proximate explanations offered in discussions of contemporary cases but is, rather, a paradigm around which diverse proximate explanations can be organized.

KEY WORDS: suicide attacks, evolution, kamikaze

When trying to explain individuals' participation in suicide attacks,¹ diverse scholars have argued for diverse processes. Among these have been group

¹ By which we understand attacks against members of some group, opposed to one's own group, in the successful execution of which the attacker accepts that his or her life is inevitably forfeit. The frequently used term “suicide terrorism” unnecessarily confounds one proposed consequence of such an attack (“terror”) with the critical idea of the attacker's accepting his or her own death. The more

solidarity and an exclusive identification with the values of the group's leader (Wintrobe, 2006); a willingness to trade personal welfare to support the welfare of future generations (Azam, 2005); the attempt at "significance restoration" after assaults on one's personal significance (Kruglanski et al., 2009); social pressure and contagion within a context of violence and support for violence (Bloom, 2005; Bloom, 2009; Stern, 2004); the limited strategic opportunities with which populations are confronted when threatened or occupied by overwhelming force (Pape, 2003; Pape, 2005); socialization of individuals into a culture or religion that peculiarly permits or requires a willingness to die in its defense (Post, 2007), and so on.

The problem is not that any of these are necessarily *wrong*; all of them might be right, at least up to a point. All suicide attack campaigns happen within a complex mix of military, historical, strategic, cultural, and, sometimes, religious circumstances, any one of which might contribute to leaders' decisions to initiate such a campaign. By the same token, every bomb-carrier's decision to participate in such a campaign happens within a complex mix of personal, psychological, ideological, cultural, religious, social, and community considerations, any one of which might contribute importantly to that individual's decision; intergenerational concern, "significance restoration," social contagion, the absorption of particular religious and cultural values, and no doubt many other similar factors might, on occasion, all be involved, perhaps interacting in complex ways. Arguing about which of such proximate factors is most (or least) important *in general* is a futile exercise.

The confusion, we believe, comes from scholars' failure to discover a set of terms that organizes diverse levels of analysis, concepts, and causal processes in an integrative manner—that is to say, to settle on a paradigm that allows them to organize the processes on which they wish to focus so that a coherent picture emerges, one that specifies just where disagreements exist and what kinds of data might be necessary to resolve them. Such a paradigm would have to include species typical cognitive systems as well as environmental circumstances to which such systems might respond.

Here we argue that such a paradigm is already available. Known variously as "Sociobiology," "Evolutionary Psychology," "Evolutionary Neuroscience," and "Human Ethology," it offers an evolutionary perspective on understanding the full range of human behaviors—including suicide attacks—and exploits the well-developed conceptual and analytic tools of Evolutionary Biology to that end. A goal of the present paper is to show how this paradigm can resolve the analytic confusion that presently surrounds social scientists' efforts to come to grips with suicide attacks.

general term "suicide heroism" would be appropriate if the behavior in question were not an attack per se—as when an individual willingly gives up his or her life to save others.

Curiously, this paradigm has been either ignored by scholars concerned with that topic (although not entirely; see Atran, 2003; Blackwell, 2008) or, too often, just acknowledged and then summarily dismissed, perhaps as too difficult for the task at hand (e.g., Gambetta, 2005, Forward, p. ix; and “Can we make sense of suicide missions?” p. 271). This refusal to come to grips with evolutionary thinking—not unusual across the social sciences—might be studied with profit by philosophers of science (cf. Kuhn’s (1962) analysis of how paradigm shifts happen), but doing so is well beyond our present concern. Here we show that the broad terms of this approach can provide a framework for understanding suicide attacks, one that incorporates several levels of analysis in a coherent manner.

We proceed inductively, starting from a content analysis of writings by pilots who died in the Japanese Kamikaze campaign in the later months of World War II. Of course, we do not claim that the historical and cultural circumstances of this particular campaign were the same as those within which more contemporary campaigns have happened; obviously, they were different in many ways. But it is possible that circumstances that are historically and culturally very different might invoke the same or similar emotional and behavioral responses from species-typical humans, in which case the problem is to recognize the commonalities to which those humans are responding and to understand why they are so responding. By looking in depth at the responses of the Kamikaze pilots to the circumstances in which they found themselves, we can propose species-typical cognitive systems capable of producing a willingness to engage in suicide attacks in circumstances that might *seem* very different in historical or cultural terms, but that do, nevertheless, present humans with environmental stimuli that serve the same *functional* purpose of prompting a willingness to participate in suicide attacks.

Induction does not, of course, prove anything (Popper, 1959), but it can provide a basis for hypotheses about the structure and functioning of human cognitive systems that are testable on different cases of the same behavioral phenomenon. In these terms, our present goal is to induct *from* what we can tell about the emotions and perceptions of the Kamikaze pilots contemplating their missions *to* species-typical cognitive systems that might, plausibly, underlie suicide attacks *in general*.

At core is the proposition that cognitive systems are designed by natural selection to guide animals toward behaviors that increase their probability of surviving in particular environments and (critically) of passing their genes onto subsequent generations, given such environments. Necessarily, therefore, a cognitive system has the broad algorithmic structure IF [environment] THEN [behavior].² Consistent with a broad consensus among evolutionary psychologists and cognitive scientists more generally, we accept that brains consist of a hugely

² We emphasize the *contingency* involved in algorithms governing phenotypically plastic traits, a fact often overlooked by critics. Evolution designs systems to be context sensitive, implying one response to one circumstance and another to another. We also emphasize the *probabilistic* character of the term following [THEN]. While emotions supporting behavior are likely to be reflexive, the behavior itself

complex architecture of more and less specialized systems, each designed to address particular adaptive problems each with distinctive information and behavioral demands (Barrett & Kurzban, 2006; Gigerenzer, 1997; Sperber, 1994).³

Given the existence of such cognitive algorithms, two very different questions require an answer:

- 1) What selective pressures could have produced the hypothesized algorithm during the ancient past in which humans' brains were being shaped by natural selection?
- 2) What design features would such selective pressures have incorporated, sufficient to serve the system's adaptive function in that ancient past, and how might those design features operate in contemporary circumstances?

Following now common usage (Mayr, 1993; Mayr, 1961), these two questions concern, respectively, "ultimate" (or "evolutionary") and "proximate" processes. While explanation in the social sciences focuses almost exclusively on the latter, a great strength of evolutionary analyses is that they require answers to both questions. It is, of course, easy to dream up "just so" (Gould & Lewontin, 1979), ultimate explanations for observed systems, and natural selection has certainly discovered many different proximate solutions to identical adaptive problems (one of the best examples being the problem of incest avoidance that all sexually reproducing animals confront). But a coherent evolutionary explanation requires *both* proximate mechanisms that would have solved a particular adaptive problem in our evolutionary past *and* a plausible account of selective pressures capable of having produced such a mechanism. Granted both of these are provided, a "just so" story might equally (and fairly) be called a "hypothesis" that is available for empirical test.

As a clear case of *altruism*, participation in a suicide attack campaign poses a well-known problem at the ultimate or evolutionary level: *An individual who successfully carries out such a mission cannot, by definition, pass any more genes, meaning that any gene for constructing an appropriate cognitive algorithm is at a selective disadvantage, ceteris paribus.* Addressing a closely related topic, some scholars have proposed selective mechanisms that do not require the actual death of an individual who takes great risks on behalf of a group in warfare. Tooby and Cosmides (1988), for example, have pointed out that an individual who takes the risk of going to war in defense of a group *and survives* will have better odds of finding reproductive mates among that group on his return. Similarly, Smirnov,

is not necessarily so; the evolutionary function of emotions is to *increase the probability* of a response that natural selection—at least in our ancestral past—has "found" to promote transmission of the individual's genes into subsequent generations.

³ There are, of course, disagreements about the relative incidence of specialized versus more general purpose mechanisms, but—other than to note that the best account of the subtleties of this issue is by Barrett and Kurzban (2006)—nothing is gained by reviewing those disagreements here.

Arrow, Kennett, and Orbell (2007) have shown how an “heroic” individual who also takes such risks *might*, by his efforts, be critical to the success of his group, thus again—given survival—*might* reap reproductive benefits from his action. Yet, a successful suicide attacker would, by his action, have limited his or her own reproductive potential to the period before the attack, often placing him at a disadvantage relative to those who are unwilling to take such action. How, then, might a gene supporting a cognitive algorithm in which the THEN term is followed by [participate a suicide attack campaign] have evolved in competition with others through evolutionary time?

Some solutions that have been proposed to the *general* problem of altruism also seem to flounder here on the fact of a suicide attacker’s *certain* death. Thus, arguments that involve reciprocity (most notably Axelrod, 1984; Trivers, 1971) could not work for the reason that they require the “altruistic” individual to receive some future benefits in return for his present action, as do more current arguments that propose reproductive benefits accruing to individuals who are prepared to punish defectors at cost to themselves (viz, theories of “altruistic punishment” as developed by, notably, Boyd et al., 2003; Fehr & Gächter, 2002; Nowak & Sigmund, 2005). All these theories of altruism require the altruistic individual to be *around*—at least with some reasonable probability—to reap a reproductive benefit from his or her altruistic action after that action is completed, and the most arresting feature of suicide attacks is precisely that those who carry them out *are not*.

One type of solution does have promise—W. D. Hamilton’s (1964) “inclusive fitness.” Hamilton’s seminal insight was that selection depends on *genes* surviving rather than, necessarily, the acting individual who carries them, and that this can happen insofar as an individual’s genes are *also* carried, to some extent, by his relatives. By “Hamilton’s Rule” a gene for altruism could survive under the condition $C < R * B$ when C = the reproductive cost to the actor; R = the genetic relatedness of the actor to the beneficiary; and B = the fitness benefit to the recipient of the action.⁴ Granted some mechanism for recognizing both kin *and* varying degrees of kinship, a gene supporting altruism directed toward family members *could*, by this model, spread through a population—and an appropriate algorithm would look something like [IF] certain individuals, under threat of some kind, are sufficiently close kin [AND IF] my death will save the reproductive lives of those individuals [THEN] incur emotions (or other proximate mechanisms) that would support suicide altruism.

Although this is, certainly, persuasive as an ultimate account of kin-directed altruism in general (granted appropriate kin-recognition mechanisms are also in place), is not sufficient by itself to account for well-known cases of suicide attacks

⁴ Thus, for example, an individual who gives up his or her life but in doing so saves the lives of two siblings and (say) one cousin leaves more of his genes in living bodies (each sibling would carry, on average, 50% of the actor’s genes while the cousin would carry, on average, .25%).

in the modern environment, including that of World War II in the Pacific. In some instances, modern suicide attackers *might* conceive themselves as saving their close kin by their actions, or perhaps as contributing to their welfare and reproductive success (Blackwell, 2008). But there is no doubt that in many modern cases, if not the overwhelming number of them, a suicide attacker's family members are in no way uniquely threatened or likely to survive as a consequence of their kin's sacrifice. Inclusive fitness is a direction in which we might turn for components of an ultimate or evolutionary account but, without elaboration, it is not sufficient to explain individuals' participation in suicide attacks on behalf of very large *collectives*—nations or breakaway groups aspiring to be nations, religious groupings, and tribes—that are vastly larger than any that could have meaningful kinship connections.

Accordingly, it is time to look at what the Kamikaze pilots thought about their own actions. Did they, in fact, understand those actions as directed to the benefit of the Japanese nation, or *were* their family members uppermost in their mind? If it *was* the nation, might their writings provide clues as to how inclusive fitness could support an evolved cognitive algorithm that *does* account for their behavior?

The Military Context of the Kamikaze Campaign

Several historical facts surrounding the initiation and course of the Kamikaze campaign⁵ are not in dispute.

First, the Japanese military—its army and its navy with their associated air forces—was in desperate circumstances by shortly after the start of the Allies' Philippine campaign on 20 October 1944. After the Battle of Leyte Gulf (23–26 October 1944)—which saw the first Kamikaze attacks—Japan had essentially no aircraft carriers left while the Allies had about 34. In addition, Japan's fuel supply from Indonesia was almost cut off as a result of relentless air and submarine attacks and its mainland was exposed to massive and systematic aerial attacks against which it could mount little defense.

Second, although some Japanese leaders minimized the magnitude of the threat (perhaps in the interests of maintaining morale, perhaps out of self-

⁵ While the term "Kamikaze" is standard in the West, "Tokkōtai" (Special Attack Force) and "Shimpū" (Divine Wind) were employed by the Japanese military at the time. According to Ivan Morris (1975) "Kamikaze" is a Japanese reading of characters that in Sino-Japanese are pronounced Shimpū. The Kamikaze campaign began on 25 October 1944, during the Battle of Leyte Gulf, and reached its peak during the battle for Okinawa—the defense of which, known as "Kikusui" ("floating chrysanthemum"), was conducted between 6 April and 22 June 1945. Approximately 3,848 pilots died in the whole campaign, and many more were in training or waiting for their missions when the war ended. The campaign included manned torpedoes (known as "Kaiten" or "Reversing Fortune"), speedboats, and rocket-propelled "human bombs" launched from the air (the so-called "Ohka" or "Cherry Blossom" campaign), as well as the better-known attacks by manned fighters and light bombers. Ramming tactics, in which the probability of death was very high but not certain, were also employed—but with little success—against American bombers over the Japanese mainland. We use "pilot" to refer to those who operated any of the above.

delusion), most recognized the gravity of the situation. For example, Vice Admiral Ohnishi, the earliest advocate of the Kamikaze campaign, is recorded by his personal representative for operations, Captain Rikihei Inoguchi, as having said to pilots in central Luzon on 20 October 1944:

Japan is in grave danger. The salvation of our country is now beyond the power of the ministers of state, the General Staff, and lowly commanders like myself. It can only come from spirited young men such as you. Thus, on behalf of your hundred million countrymen, I ask of you this sacrifice, and pray for your success. (Inoguchi, Nakajima, & Pineau, 1958, p. 19.)

In the same vein, Commander Nakajima, flight operations officer for the unit selected by Ohnishi to initiate the campaign during the Battle of the Philippine Sea (the 201st Air Group in the Philippines), said to his pilots:

The war situation is extremely grave. If the enemy succeeds in establishing air bases on Leyte, the operational radius of his B-24 bombers will reach across the China Sea to the mainland. Thus he would jeopardize Japan's fuel supply from the south. Without fuel our ships will be immobilized and have no chance to fight. . . . These [enemy] forces in the Philippines area are exceedingly powerful, however, and our Navy will have to fight against overwhelming odds. . . . If the *Sho* Operation [the Navy's effort to oppose the Leyte landings] is to have any chance of success, it is up to pilots of the Japanese Navy to disable the American task force. But Japanese air strength in the Philippines is too hopelessly depleted to oppose the enemy effectively by orthodox methods of attack. The moment calls for the employment of crash-dive tactics . . . (Inoguchi, Nakajima, & Pineau, 1958, pp. 39–40).

Third, no matter how successful the proposed campaign might be in practice, nobody within the Japanese leadership could have believed that Japan could now *win* the war in the sense of having the Allied forces surrender. Hastings suggests that, after Pearl Harbor, any thought of an Allied surrender was “. . . wildly fanciful” (2008, p. 6). Nevertheless, he also suggests that by mid-1944 many Japanese leaders felt it was time to end the war when the phrase “. . . ‘end the war’ was fraught with equivocation. In the minds of almost every senior Japanese, it meant the pursuit of acceptable terms . . .” (p. 42). Might a Kamikaze campaign accomplish “acceptable terms”?

In retrospect, we should remember: (1) The spearhead of the American attack was the carrier fleet, overwhelming in number but still finite. If that fleet were destroyed or even seriously compromised, the idea that the Allies would accept peace terms short of an invasion of the mainland could not have seemed totally implausible. The Japanese leaders must have known that the Allies would want to

avoid an invasion of the mainland if at all possible, and if the back of the carrier armada could be broken, their accepting a peace short of an invasion was at least imaginable—granted a thought imbued with a large measure of wishful thinking (Johnson, 2004) about the Allies abandoning their stated goal of “unconditional surrender.” (2) Serious carrier losses were, in fact, *not* totally beyond the realm of possibility. While unlikely, a single carrier *could* be destroyed by a single pilot flying a single plane. And although only three escort carriers⁶ were, in the end, put out of action by the kamikazes, the campaign did succeed in destroying more Allied ships than all the other Japanese naval operations in the Pacific combined, Pearl Harbor included. Of course, the Japanese did not anticipate the atomic attacks then in the works, but absorbing the immense losses that conventional bombing was now imposing on the country’s cities could have seemed a smaller price than would be imposed by an actual invasion. In short, the logic of the Kamikaze campaign was not as flawed as often portrayed—at least when it is accepted as a desperate last play by a desperate military. There is no reason to doubt that their stated logic was how they genuinely saw things or that the pilots accepted that logic when the leaders laid it out to them.

Fourth, certainly, the pilots themselves could hardly have needed persuasion about the desperation of the situation. During the Battle of the Philippines Sea (19–20 June 1944), the so called “Marianna Turkey Shoot” lost the Japanese about 429 planes to the Americans’ 29. The Japanese were already having problems with training; gasoline shortages necessitated cuts in training flights; new planes were slow in coming off the assembly lines; and those that did had been falling technically behind American fighters for at least a year. Despite the biased feedback that they often received, the remaining Japanese pilots were as well positioned as any to appreciate the disastrous present course of the war as well as to recognize the slim basis for hope that their leaders offered them.

Whatever the reasoning behind the strategic planning of the campaign, the question that concerns us is the motivation of the pilots themselves, the ones whose lives would be forfeit in any attack however successful the campaign itself might be. To address that, we turn to the letters, poems, and wills that they left behind.

Method

The Kamikaze campaign is unique among suicide attack campaigns insofar as participants left an extensive record of letters, poems, wills, and memoirs that are available for systematic study. These materials are a substantially untapped resource; while many authors have used at least some of them in nonsystematic

⁶ The *St Lo* (sunk on 24 October 1944), the *Ommaney Bay* (put out of action 4 January 1945), and the *Bismarck Sea* (put out of action 21 February 1945). Note that the odds of a given pilot making such a contribution are suggested by the fact that the loss of ninety pilots was sufficient to put those three carriers out of action (Hastings, 2008, p. 170)—much better than could have been expected by conventional methods, certainly during this later period of the war.

ways, we have found none who conducts a formal content analysis.⁷ We provide such an analysis here.

We content analyzed materials left by 661 of the individuals who died in the Kamikaze campaign (viz 17% of the total). These materials came from diverse sources, including collections put together by families, various military and non-military groups, and the Yasukuni Shrine for fallen Japanese soldiers. (An annotated bibliography of the materials used can be found on the online Appendix A.) We did not attempt to draw a random sample from the universe of such materials, although we did include all the readily available materials. Neither did we attempt to characterize each writer's thoughts in overall terms ("what motivated *this* individual") but we did characterize each writer by the various mentions he made—allowing us to observe the frequency with which particular themes appeared in the population as well as the frequency with which diverse themes appeared together in given writers' materials. When one pilot made several mentions in a given category, we counted only one.

The Kamikaze pilots were, of course, only a small subset of the several million Japanese soldiers who served in China and the Pacific during the war, but as such they did have the same indoctrination as all members of that military. The Japanese culture of the time had a notable tolerance of suicide, but the 1872 Military Code for the Imperial Navy and Army (*Kai-Rikugun Keiritsu*) institutionalized this by mandating death for any soldier who should attempt to survive defeat. Might not this cultural and military expectation be sufficient by itself to account for the participation of pilots when Japan *was* clearly confronting very likely defeat in the near future?

To address this issue, we also content analyzed 402 of the same kind of materials left by other members of the Japanese military who died in the Pacific War and who we will characterize here as "rank-and-file."⁸ This control is not perfect, of course; the pilots were much more highly educated than the rank-and-file, for example, and—like pilots in most modern militaries—were generally confident of their elite status. Yet both populations were from the same broad culture, both had been trained and socialized into the same understandings as to behavior appropriate for members of the Japanese military, and both were confronting imminent defeat from the seemingly unstoppable Allied advance. The important difference between the two populations was that, while members of the rank-and-file normally died making hopeless gestures in the context of defeat, the pilots were in a unique position of being able to inflict, by their deaths, considerable damage on the Allied fleet and, imaginably at least, to bring the Allies to the bargaining table short of invading the Japanese homeland. By comparing the

⁷ Ohnuki-Tierney (2006), for example, bases a book-length argument that the pilots were unwilling victims of an exploitative class system on items written by only seven individuals. Hill (2005), Morris (1975), and Sheftall (2005), among others, use selected items to illustrate points they wish to make.

⁸ More than 2.3 million Japanese personnel died in the Pacific War. We used only rank-and-file materials contained in the same sources that we used for the Kamikazes.

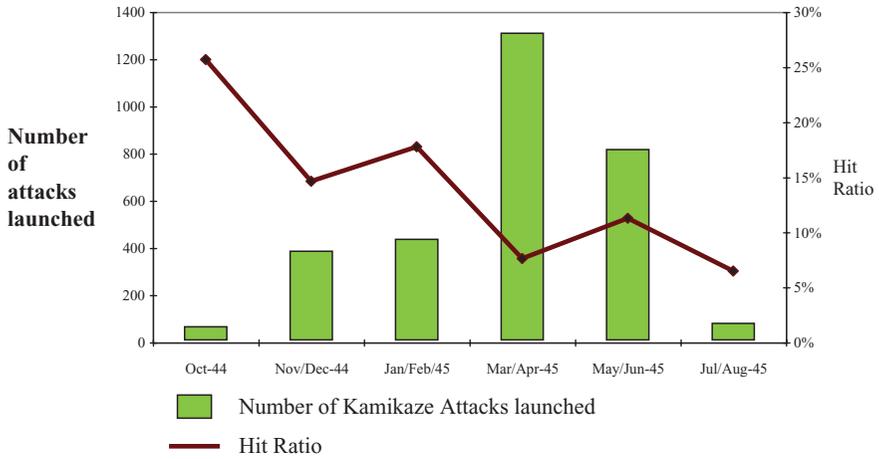


Figure 1. Varying Success of the Kamikaze Campaign.

¹⁴“Hit ratio” is the number of Allied ships that were hit (although not necessarily sunk) as a ratio of the number of individual attackers in a given period. The graphic is compiled from the statistical appendix to Nagatsuka’s book “I was a Kamikaze” (1972/1973).

pilots’ materials and those of the rank-and-file, we will be holding constant cultural values and indoctrination that were normal within the Japanese military at this point in history, allowing us to look for cognitive and emotional responses to this unique position of the pilots when confronting *their* probable future deaths.

As Figure 1 shows, the Kamikaze campaign had significant initial success, but within a few months the ratio of hits to sorties declined rapidly as the Allies developed effective defensive tactics (picket ships and constant air presence over the fleets) and as the most experienced Japanese pilots were killed and replaced by pilots who had only the most minimal training. As the Allied advance continued essentially unchecked, the rationale for the campaign as enunciated by leaders such as Ohnishi and Nakajima must have become progressively less plausible, raising the possibility that the pilots’ belief in their own critical importance to the Japanese war effort declined accordingly—and that, increasingly, they saw their own forthcoming deaths in the same noninstrumental terms as the rank-and-file saw theirs. To test for this, we have also analyzed the pilots’ letters across three different periods—between 25 October 1944 and 5 April 1945; between 6 April and 22 June 1945; and between 23 June and 8 August 1945.⁹

⁹ As can be seen from Figure 1, the first of these periods includes the time at which the Kamikaze campaign was most successful; the second includes the battle for Okinawa when the campaign reached its height but when its effectiveness had also declined markedly; and the third includes the period from the defeat at Okinawa—to the actual occupation of Japanese home territory—to the end of the war.

For the most part, we allowed the materials themselves to suggest the coding categories we employed. We first reviewed a randomly selected subset of about 75 items, organizing comments and ideas that appeared within that subset into provisional categories—always attempting to strike a balance between the *generality* of such categories and the frequency with which comments and ideas could reasonably fit into them. Although it did not show up much in this initial sample, we also included the broad category “religion-based comments” because of the frequency with which such motivations are seen as underlying contemporary suicide attacks. We included the category “coercion” even though the fact of censorship provided good reasons for being skeptical that any comments about coercion—if it *did* exist—would appear in these materials. We included “ambivalence” about their forthcoming deaths to address the possibility of differences between the pilots and the rank-and-file in the willingness with which they faced their pending deaths.

Three native Japanese speakers independently coded the written materials using the categories developed in the above manner; two of the coders were undergraduate students at a major Japanese university who had become familiar with the coding categories developed above during an initial training period and the other was coauthor Morikawa. Given that there were 1,063 written items to be coded (661 by Kamikaze and 402 by rank-and-file) and 19 coding categories by which each of those items might have been characterized, there were 20,197 possible points at which disagreement could have arisen among the coders. In fact, there were only 107 such differences of opinion among the three coders, just 0.5% of the number possible. Many of these disagreements were attributable to ambiguities in the written materials themselves or to the difficulties of the classical Japanese language often employed by the writers of poems and wills. The three coders discussed such cases at length among themselves and reached agreement on how to code them. We have coupled nine of the broad categories—most of which we subdivided in the following report—with illustrative coding decisions in the online Appendix B.

In Summary

We content analyzed materials written by 661 Kamikaze pilots and 402 rank-and-file members of the Japanese military, none of whom survived the war. The rank-and-file data provided a control for standard Japanese military indoctrination about the necessity of suicide in the face of defeat. The objective was to identify cognitive and emotional responses uniquely associated with the Kamikaze pilots' forthcoming participation in the suicide attack campaign—justified, at least at its outset, as representing Japan's only prospect of ending the war short of total defeat. (An annotated bibliography of sources used, and a table showing examples of coding decisions across the categories employed are available in the online version of this article. Please note: Wiley Publishing are not responsible for the content or functionality of any supporting materials supplied by the authors.

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Findings

Several explanations for pilots' participation in the Kamikaze campaign are quite straightforward, not requiring possible evolved, species-typical cognitive systems. Most obvious of these is *coercion*—the possibility that the pilots were *not* acting on their own free will, but under duress. As mentioned earlier, the fact of censorship means there are obvious problems with this category; if the pilots were, in fact, subjected to coercion they would have had good reason to not comment on the fact in their letters, just as any such comments would likely have been excised by the censors. And, in fact, Table 1 shows *no* mentions of coercion from among the Kamikaze, and only one from among the rank-and-file. Given the problems with this particular category, however, we must turn to other sources for whatever evidence we can find about coercion's possible role.

Certainly, the rhetoric of the commanders emphasized volunteerism, at least in the initial stages of the campaign. In one of the best known postwar accounts, Tadashi Nakajima, a surviving flight operations officer of the 201st Air Group at Mabalacat, describes how he offered participation as a choice when announcing the forthcoming campaign to his men:

Any non-commissioned officer or enlisted flier who wishes to volunteer will so signify by writing his name and rate on a piece of paper. Those who do not wish to volunteer will submit a blank paper. Each piece of paper is to be placed in an envelope which will be delivered to me by 2100 today. It is not expected, however, that everyone should volunteer. We know that you are all willing to die in defense of our country. We also realize that some of you, because of your family situation, cannot be expected to offer your life in this way. You should understand also that the number of volunteers required is limited by the small number of planes available. Whether a man volunteers or not will be known only to me. (Inoguchi, Nakajima, & Pineau, 1958, p. 40)

Every one of the pilots in this group did volunteer. The broad thrust of Nakajima's announcement seems to have been echoed in other announcements made to many different units across the country and other war zones in the next few days, and with comparable results (Naito, 1989, pp. 6–7; Yokota & Harrington, 1962, p. 10). Such post-war accounts by surviving commanders obviously could be self-serving, post hoc fabrications. Nevertheless, Lamont-Brown—responding to claims that “. . . Kamikaze were drugged, forcibly strapped-in to their cockpits . . . or pressured by blackmail that their families would be punished

Table 1. The Percent of Coded Items with Specified Thematic Content: Kamikaze Pilots (n: 661) and Rank-and-file (n: 402)

Category	Sub-categories	Kamikaze		Rank and File	
		Sub categories	Collapsed across categories	Sub categories	Collapsed across categories
“Honorable” or “beautiful” death”	Honorable death	71.9% (n = 475)	78.8% (n = 521)	52.9% (n = 213)	60.0% (n = 225)
	Beautiful death	28.4% (n = 188)		9.7% (n = 39)	
Mentions of war effort	War effort, general	37.8% (n = 250)	52.5% (n = 347)	28.1% (n = 113)	29.4% (n = 118)
	My contribution critical to war effort	26.9% (n = 178)		0.5% (n = 2)	
	Inspiration to others	6.7% (n = 44)		2.7% (n = 11)	
Expressions of family love, filial piety	Expression of filial piety	18.9% (n = 125)	33.7% (n = 223)	18.4% (n = 74)	31.3% (n = 126)
	Comfort to Family	23.1% (n = 153)		17.4% (n = 70)	
Religion-based comments	Any mention of the afterlife	15.9% (n = 105)	28.4% (n = 188)	10.9% (n = 44)	28.6% (n = 115)
	Any mention of religion	8.3% (n = 55)		10.7% (n = 43)	
	“See you at the Yasukuni Shrine”	10.0% (n = 66)		11.9% (n = 48)	
	Dying for religious beliefs	0.0% (n = 0)		0.5% (n = 2)	
“I’m doing it for my country”	For Japan/country	36.0% (n = 238)	49.2% (n = 325)	23.4% (n = 94)	35.8% (n = 144)
	For the Emperor	32.5% (n = 215)		25.6% (n = 103)	
	For my hometown	0.8% (n = 5)		1.7% (n = 7)	
“I’m doing it for my parents/family”	For my parents, brothers, sisters, and children	2.9% (n = 19)	18.5% (n = 122)	0.0% (n = 0)	8.0% (n = 32)
	For my parents conflated with country	16.8% (n = 111)		8.0% (n = 32)	
I’m doing it for my squad	For my group, comrades	0.1% (n = 1)	0.1% (n = 1)	0% (n = 0)	0% (n = 0)
Ambivalence about task	Ambivalence about task	9.1% (n = 60)	9.1% (n = 60)	24.9% (n = 100)	24.9% (n = 100)
Coercion		0.0% (n = 0)	0.0% (n = 0)	0.2% (n = 1)	0.2% (n = 1)

for any default” (1997, p. 117)—argues that the consistency of these many postwar accounts contradicts claims of widespread coercion.

There may, nevertheless, have been an important difference between the enthusiastic early stages of the campaign and the later stages (Hastings, 2008, p. 166) when its failure to check the Allied advance must have become manifest. Certainly, some memoirs suggest that not only were some pilots starting to question the value of the campaign by this time, but physical punishment was also meted out to those whose decisions to turn back were held to be suspect (as described, e.g., by Nagatsuka, 1972/1973; Sheftall, 2005). Perhaps by the last hopeless stages of the war, the Military Code had come to dominate the thinking of at least some commanders—meaning that flying missions had become, for them, *primarily* a means for the pilots to commit an honorable and appropriate suicide in the face of defeat (as some commanders themselves did at the very end).

There may also have been differences between the Japanese Army and Navy with respect to coercion. As Hoyt (1993) comments, by the winter of 1945:

... the army began assigning men to suicide units. Any who indicated that they were reluctant to die for the Emperor were put in the forefront, to be gotten rid of on the first possible suicide missions. But, at least up to this point, the navy had no such problem. There were plenty of young pilots who were eager to give their all for the Emperor. Admiral Ugaki’s basic task was to find the best way to employ them. (p. 173)

Such possibilities aside, we conclude that, while coercion certainly did play at least some part, particularly toward the very end, claims—such as those by Ohnuki-Tierney (2006)—that the entire campaign was based on coercion are simply not tenable.

A further possibility that requires no particular attention to species-typical cognitive evolution is *culture*—the idea that we need look no further for an understanding of the Kamikaze phenomenon than the peculiarly permissive Japanese cultural attitudes toward suicide. Both the Kamikaze pilots and the rank-and-file were exposed to those cultural values both informally and via their indoctrination into the Japanese Military code, but the Kamikaze pilots were distinct insofar as they were the *only* group that could implement the last, desperate strategy of crashing planes into the advancing Allied fleet. Did the writings of the two groups reflect this difference vis-à-vis Japan’s war effort?

Table 1 shows similarities between the Kamikaze and rank-and-file in expressions of “Family love and filial piety”—included in the writings of 33.7% of the former’s materials and 31.3% of the latter’s. Explicit statements to the effect that “I am doing it for my parents or family” were rare by comparison, although significantly more frequent among the pilots than among the rank-and-file (18.5% and 8.0%, respectively; $p = 0.001$). As has long been observed (Benedict, 1946), traditional Japanese culture places strong emphasis on the importance of family

and it is perhaps not surprising that soldiers facing death in the Pacific War would take the opportunity to express their love for family in whatever materials might be returned to their parents and siblings. Important in the present context, however, is the fact that both groups did so to an almost identical degree. Filial concern did not differentiate those facing death as a consequence of forthcoming defeat and those facing it through their participation in the Kamikaze campaign.

Table 1 also shows close similarities in “Religion-based comments.” In this case three facts stand out. First, only two individuals said they were dying for their religious beliefs, and both of those were from the rank-and-file. The closest that substantial numbers of either population came to this was “See you at the Yasukuni Shrine,” which, as Axell and Kase (2002, p. 108) observe, was more an expression of solidarity or comradeship than a literal belief about any reunion after death. Still, only 10.0% of the pilots and 11.9% of the rank-and-file said this (NS). Second, while there are occasional mentions of an afterlife and of God or Buddha, these were normally made in passing, seemingly intended more as comfort for those left behind than as an expression of the writer’s own religious belief. We see no reflection in the pilots’ writings of the assertion that appears to have been made frequently by their commanders that “you are already gods” (Cf. the sub-title “Japan’s suicide gods” of Axell & Kase, 2002). If the commanders meant this in any literal sense—and we doubt it—the pilots themselves do not seem to have bought into it.

Third and most important, there is no significant difference in the incidence of religious content between the writings of the Kamikazes and those of the rank-and-file (28.4% and 28.6% respectively (NS), and close similarities across the three subcategories). Our data are therefore consistent with Morris (1975), who observes:

While religious influences were important in the psychological preparation of the kamikaze fighters, this certainly does not mean, as non-Japanese readers might suppose, that most of them were comforted (let alone motivated) by any idea that they would survive after death and reap the benefit of their sacrifice in some paradise or pantheon. Buddhism not only posited a goal of total annihilation but, being an eminently pacifist doctrine, was hardly going to offer rewards to men who had died while deliberately inflicting violence on themselves and others. . . . Even when faced with imminent death, few of these young men appear to have accepted the consolation of a possible afterlife. (p. 317)

We conclude that neither concern for family nor religious motivation played a *peculiar* role in persuading the Kamikaze pilots to carry out their suicide missions; mentions by the pilots in both these categories simply reflect cultural values widely shared in Japan at the time.

Table 1 contains suggestive evidence that the pilots, peculiarly, found “honor” and “beauty” in the manner of their forthcoming deaths: 71.9% of the pilots

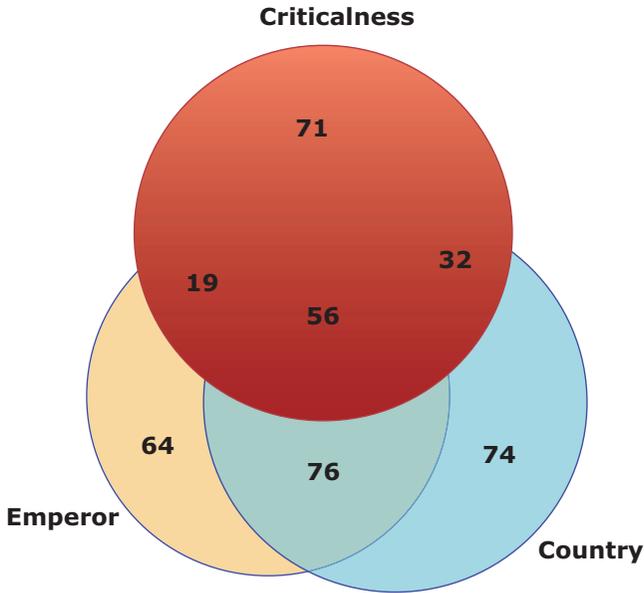


Figure 2. Juxtapositions of “For the Emperor,” “For the Country,” and “Criticalness” Kamikaze Materials (n: 661).

mentioned the former compared with a relatively smaller 52.9% of the rank-and-file ($p < 0.001$), while 28.4% of the pilots mentioned the latter compared with only 9.7% of the rank-and-file ($p < 0.001$). The absolute incidence of such mentions in both cases is, no doubt, a reflection of Japanese cultural values, but their significantly greater incidence in the writings of the pilots is reasonably laid at the door of their belief that their deaths could make a positive difference—a speculation that is supported by the fact that, while 26.9% of the pilots made an explicit statement to the effect that their deaths *could* have a critical effect on Japan’s war effort, just two individuals (0.5%) from the rank-and-file mentioned anything positive coming from their deaths ($p < 0.001$). Similarly, the pilots were also significantly more likely to invoke more generalized benefits to “the Emperor”—32.5% of the time compared with 25.6% for the rank-and-file ($p = .02$) and to “Japan”—36.0% of the time compared with 23.4% of the time for the rank-and-file ($p < 0.001$). In contrast, that they were dying for their hometown or village was only seldom (and *equally* seldom—NS) indicated by individuals in either population.

In Figure 2 we use Venn diagrams to show how “for the Emperor,” “for Japan or the country,” and “criticalness” were juxtaposed among the pilots.¹⁰ Among the

¹⁰ With only two members of the rank-and-file suggesting that their deaths could have a positive or critical effect on Japan’s war effort, we do not report a similar figure for that population.

Table 2. Kamikaze Content as the Campaign Progressed

Categories	Time 1 (10/25/44-4/5/45)	Time 2 (4/6-6/22/45)	Time 3 (6/23-8/15/45)
Samples Sizes	173	451	37
“For the emperor”	34.1% (59)	31.9% (144)	32.4% (12)
“For Japan/country”	35.8% (62)	35.7% (161)	40.5% (15)
Honorable death	72.8% (126)	72.3% (326)	62.2% (23)
Criticalness	16.2% (28)	30.6% (138)	32.4% (12)

26.9% of the pilots who made comments about a possible military contribution from their deaths, 60.1% were also explicit that they would be dying either “for the Emperor” or “for the country.” Remembering that, in this period of its history, “the Emperor” was synonymous with “the Country” or “Japan,” we conclude that *the belief that their deaths could contribute importantly to their country’s fortunes in the war—and that honor and beauty were therefore associated with those deaths—appears to have been strong among the Kamikaze pilots.*

Changing Content through Time?

As Figure 1 above shows, the early successes of the campaign were followed by mounting losses with progressively less and less to show for them. Despite the biased feedback they received about their predecessors’ successes,¹¹ the pilots were in as good a position as anyone to recognize the declining effectiveness of the campaign, and we expected that an early emphasis on their own potential military impact would be replaced later by an emphasis on the honorableness of their deaths. In other words, if the campaign was not producing the desired results then would not the Japanese military’s insistence on death in the face of defeat become the pilots’ predominant motivation? Table 2 shows that the pilots’ response was just the opposite. While the “honorableness” of their forthcoming deaths received more emphasis than “criticalness” throughout the campaign, comments about “honor” *declined* after the Okinawa invasion began while those about “criticalness” *increased*. In retrospect, Okinawa’s being part of the Japanese homeland may have been pivotal here. When the campaign began at the time of the Battle of the Leyte Gulf, the war situation certainly was desperate and the pilots’ contributions

¹¹ Most Kamikaze attacks were accompanied by observers whose job was to evaluate the effectiveness of the attack and, when possible, to occupy enemy fighters. Such observers were often shot down, but they often returned to base without waiting to determine whether a hit ship actually sank and, indeed, whether there were hits at all. Comparison of postwar American data with Japanese claims at the time also suggests considerable exaggeration of successes by Japanese leaders—either knowingly or because of poor intelligence.

might, plausibly, have made a difference to the course of the war. Nevertheless, at that time the Allies were still a long way from the Japanese homeland, and the later fact of an attack on that homeland must have carried considerable emotional impact—perhaps sufficient to boost still further the pilots’ focus on the idea that their deaths could *matter* to the survival of Japan.

In Summary

Data from our content analysis are *not* consistent with any of the following: (1) the Kamikaze pilots acting under coercion—at least at the early stages of the campaign; (2) their being decisively motivated by Japanese cultural attitudes toward suicide per se; (3) their being peculiarly motivated by religious concerns; or (4) their being particularly motivated by concern for the welfare of their families in a forthcoming invasion. On the other hand, *those data are consistent with the pilots’ being motivated by an awareness that their deaths could, possibly, help improve Japan’s rapidly declining military fortunes, and that with their deaths they were making a contribution both honorable and beautiful.* Their concern for making a difference to the war effort crowded out their concern with having an honorable or beautiful death as an invasion of the homeland appeared increasingly imminent.

A Proposed Cognitive Algorithm

Suicide attacks *might* be simply an aberration within humans’ broad behavioral repertoire, a form of behavior that is not a response to natural selection, but one that happens because natural selection has left at least some leeway for maladaptive actions. On the other hand, occasions on which individuals willingly give up their lives *with certainty* to the benefit of others have been sufficiently frequent throughout history that the possibility of their having firm evolutionary roots in the ancestral past where such behavior served some adaptive purpose deserves systematic attention. Here we build from our data about the Kamikaze campaign to explore what a cognitive algorithm supporting such behavior might look like. Doing so requires understanding processes at both the proximate and ultimate levels.

The Kamikaze case is, of course, *only* a case, but our content analysis suggests the following about proximate mechanisms: (1) Religious motivation is *not* a necessary precursor of such behavior; both the pilots and the rank-and-file did pay some lip service to religion, but equally so, with no indication that the former were particularly interested in an afterlife or rewards in heaven following their deaths. (2) The pilots *were* aware of their potentially pivotal or critical role in preventing an invasion of the Japanese homeland and associated their deaths to that end with “honor,” seeing it as a “beautiful” way to die. (3) The beneficiary that the pilots recognized from their pending deaths was the nation of Japan, often seen as

embodied in the person of the Emperor, not their family or close kin. While they did express great love for their families and culturally appropriate filial piety, saving their families appeared to be far less a motivator than saving the nation of Japan.

Consistent with these findings, and consistent, too, with what we know about the pilots' understanding of the war situation and of the uniqueness of their pilots' skills for implementing a suicide attack campaign, the following seems a reasonable first pass at a possible cognitive algorithm underlying suicide attacks:

IF [my kinship group is under dire threat from a powerful aggressor],

AND IF [my death is a necessary cost of mitigating that threat],

THEN [emotions and other mechanisms supporting a willingness to accept that death].

While this does not explicitly address the importance of military leaders, it is consistent with leaders having contributed importantly to the information that would lead a pilot to an affirmative response to the first two contingencies. If Ohnishi and other leaders had not been so convincing in making the case; if there were not plausible reasons for thinking the campaign *might* be successful; if the pilots could see only chaotic organization and wishful thinking from their leaders; and if their personal capacity to (for example) sink an aircraft carrier was just not credible, then—granted this algorithm—their response could well have been *not* to participate or, at least, to express muted if any enthusiasm in their written materials. Even if the pilots believed that their chance of dying in the forthcoming battles was very high or almost certain—as was surely reasonable—their death in a suicide attack would serve no instrumental purpose for the Japanese war effort, and continuing with “conventional” attacks would be the only path to that end. As is now apparent, following that path would have meant that they would soon have found themselves in essentially the same position as the Japanese rank-and-file, presumably being willing to commit suicide in response to the imperative of the Japanese military code. As we have shown from their writings, however, there is little to suggest that the Kamikaze pilots were thinking in such terms when they undertook their missions.

Yet there is a problem at the *ultimate* or *evolutionary* level with this algorithm: It does not explain the fact, supported by our data, that the pilots saw themselves as dying for their *nation* of approximately 100 million individuals—certainly not a plausible “kinship” group in terms that would satisfy the logic of inclusive fitness. As pointed out above, Hamiltonian logic *could* support selection on willingness to give up one's life for relatively close kin, but a concern for saving the lives of kin was not peculiarly motivating for the Kamikaze pilots while a concern for mitigating *Japan's* dire military situation does seem to have been powerfully

motivating. How could an algorithm supporting suicide altruism to the benefit of 100 million people have evolved in the circumstances of our ancestral past?

Of course, we might discount comments about dying for “Japan” and “the Emperor” as empty nationalistic rhetoric disguising the pilots’ real concern for saving their close kin from the dangers of a forthcoming invasion. Certainly, a pilot’s parents and family would be more likely to survive if Japan did avoid an invasion. But there is no apparent reason for the pilots to dissemble in this respect; the censors would have been unlikely to insist on their articulating nationalistic rhetoric over concern for family. The question is, therefore: *How could a cognitive algorithm designed in the Pleistocene produce sacrificial behavior directed to the benefit of multimillion-person modern nations—not to mention large ethnic groups, clans, tribes, and religious groupings?*

A simple answer might accept kinship as a base for an appropriate cognitive algorithm but propose that those engaging in suicide attacks have come to “identify” such large groupings with their family—meaning that, from a genetic perspective, modern suicide attacks directed to saving such groupings are simply an error. Within an evolutionary frame, however, invoking “identification” is an inadequate move, one that just avoids addressing the further question of how a propensity to think of a very large group as if it were a very small kinship group could have evolved. Most notably, it ignores the problem of strong selective pressures *against* a willingness to die for the benefit of nonkin. Surely a corollary of such an algorithm would be a propensity to recognize nonkin and avoid dying for *their* benefit?

A more promising direction involves reexamining the selective environment in which ancient warfare happened, raising the possibility that more than simple kinship groups were involved. Victory and defeat in war are public goods, and they are notably *pure* public goods when the stakes are genocidal—as Keeley (1997) and LeBlanc and Register (2003) suggest they often were in ancient times. Given that the relative *size* of contending groups can make a decisive difference to the outcome of a war, it is likely that, in those ancient times, alliances formed among sets of quite small kinship groups (cf. Wrangham, 1999), a process that would make the warring sides *not* consist exclusively of relatively close kin, but rather of *coalitions* of kinship groups, with each coalition including sets of only very distantly related individuals.

If so, then attention turns to the selective pressures associated with *coalitional* fighting. In particular, it seems certain that, to be successful (thus to survive in the event of genocide), coalitions of kinship groups would have to include significant numbers of individuals who were prepared to fight and perhaps die for individuals who were *not* close kin—whatever primary loyalties might be owed *to* close kin. A coalition of kinship groups whose members fought only for their own group would be a notably ineffective coalition, likely to be defeated by a coalition of kinship groups *whose members mobilized kinship-based emotions on behalf of the entire coalition, kin and nonkin.*

Such transference of kin-based emotions to a coalition would certainly have contributed to the coalition's military success but in doing so would also contribute to the *evolutionary* success of genes supporting such transference of kinship emotions that resided in coalition members who *were* close kin. In a larger group, of course, the probability of an individual's death being critical for his coalition's success would be less than the probability of his death being critical for the success of a smaller, kin-based group, but it could happen and, in happening, would contribute to the evolutionary success of whatever genes supported such behavior. In the context of coalitional warfare, therefore, natural selection could favor genes that led an individual to respond to all members of a coalition as if they were close kin—and not just to those members of the coalition who were *in fact* close kin.

This suggests, then, the following somewhat modified algorithm:

IF [my coalition is under dire threat from a powerful aggressor],

AND IF [my death is a necessary cost of mitigating that threat],

THEN [respond to members of one's coalition *as if* all its members were relatively close kin]

AND [emotions and other mechanisms supporting a willingness to accept that death].

Beyond the Kamikaze case there are, of course, famous instances in which events are consistent with such a cognitive algorithm playing itself out. Perhaps the most famous is the 300 Spartans at Thermopylae, facing certain death in order to hold up the overwhelmingly powerful Persian army on its way to invade the city states of southern Greece. Sparta might have been a particularly important member of the Greek coalition, but it was, certainly, incapable of defeating the Persians alone. On the other hand, if the 300 Spartans (carefully chosen for their fighting abilities and carefully located where such a group could have an impact disproportionate to their relatively small number) could delay the Persian advance long enough for the Greek coalition to get organized, Sparta itself—including the kin of that heroic 300—might be saved. Before the fact this was clearly a long shot; the Spartans at Thermopylae might have failed miserably. But it *was* the only possibility for preventing a Persian victory over the Greek coalition and the 300 certainly recognized this—just as they also recognized that this long shot would involve their own certain death.

There are other less well-known cases of a similar logic from World War II—cases that also contradict any claim that the Kamikaze campaign was a peculiar product of Japanese culture. As the Allied forces closed in on Germany, there were moves to organize a “ramming” response similar to the Japanese

Kamikaze force. Hanna Reitsch, an aviatrix, test pilot, gliding champion, and close friend of Hitler's, argued for a manned version of Germany's flying bomb as an antitroop ship response to the anticipated invasion of Europe but the proposal was eventually turned down by Hitler, who claimed that Germany's position was not in fact dire, thus suicide-based tactics were not warranted. Toward the very end of the war, Germany organized *Sonderkommando Elbe* task force with Dr Goebbels's support but after much political maneuver, argument, and problems finding the necessary resources. The force was intended to bring down attacking bombers by ramming them with Bf 109s in the hope of buying time for full deployment of the new Me 262 jets, but it only flew one rather disorganized and not very successful major mission (Irving, 1977; Price, 1991; Weir, 1997). There was, however, no shortage of volunteers for either the *Sonderkommando Elbe* force or the earlier force proposed by Reitsch (Weir, 1997). British pilots flying in the Battle of Britain in the early stages of the war—when there were very heavy odds against survival and defeat seemed probable—can be seen in the same light, as can the actions of Soviet pilots when, after the initial and overwhelmingly powerful German attack, there was an organized ramming campaign.

We believe that the Japanese Kamikaze pilots in the closing months of WWII were responding to the same evolved psychology that underlay all of these cases—just as many unknown heroes seem likely to have responded in a similar manner throughout our apparently bloody evolutionary past.

Discussion and Conclusions

If the cognitive algorithm proposed here is, in fact, species typical among humans, self-sacrificial heroism will be particularly likely in desperate circumstances when there is, nevertheless, believed to be at least at least *some* chance of a coalition's avoiding defeat as a result of some small number of individuals' sacrifice. Conversely—and remembering that cognitive algorithms specify *contingency* dependent on signals from the environment—such behavior would be very *unlikely* among members of an overwhelmingly powerful coalition with every reason to expect victory. In fact, we might expect that information producing the response “my coalition is *not* under dire threat” would likely leave kin-based “politics as usual” *among* members of a coalition, however defined. By a parallel logic, such behavior would also be unlikely among members of a coalition with *no* imaginable prospect of staving off defeat. In *that* case, participation in a suicide attack would make no adaptive sense at all. Adaptive sense would appear to reside, instead, either in saving significant numbers of one's close kin or, if that were not possible, in saving oneself.

Remembering that diverse proximate mechanisms can address the same adaptive function, we now speculate about mechanisms that might have evolved to address the terms of the algorithm proposed here. We know, of course, that humans

have a hair-trigger propensity to associate their fortunes with those of particular groups (the central finding of the extensive “minimal group” literature, notably: Kurzban, Tooby, & Cosmides, 2001; Rothbart & Taylor, 1992; Tajfel et al., 1971; Tajfel & Turner, 1979), a propensity that could facilitate “my group” being anything between a kinship group, a tribe, a clan, a nation, or a population of coreligionists. Beyond that, what would provoke a belief that “my group” is “under dire threat from a powerful aggressor”—and, thus, increase the probability of suicide attacks in defense of that group?

Xenophobia is a good candidate. The human propensity to exaggerate the threat posed by other groups has been well addressed in evolutionary terms (Thayer, 2004; van der Dennen, 1995), and it is sufficient here to point out that, by increasing the likelihood of a *positive* response to the first contingency in the proposed algorithm (“my coalition *is* under dire threat from a powerful aggressor”), xenophobia could also increase the probability of heroic sacrifice and, thereby, the probability of a heroic individual’s coalition’s actually being victorious—thus also by the above logic, of increasing the evolutionary success of genes supporting not only heroism but also xenophobia itself.

Fraternal emotions among members of a coalition under threat is another. Such emotions are, of course, commonly observed in warfare, both among fighting troops and among populations not directly involved in the fighting and need little elaboration. Gary Johnson has provided a useful account of the rhetoric of kinship in warfare, developing the link to Hamiltonian logic (Johnson, 1987).

What would facilitate the belief that “my death is a necessary cost of mitigating that threat”? Johnson and his collaborators (2004, 2006) have usefully discussed the adaptive value of *overconfidence* in warfare, and it is clearly an important candidate here—at least, if “overconfidence” concerns the critical importance of one’s own efforts, not the probability of oneself surviving. Hector outside the gates of Troy obviously did feel fear in confronting Achilles, but his belief that he was the only Trojan with *any* chance of defeating the Greek hero must have been a necessary condition for him to make the attempt. More generally, overconfidence in one’s ability to make a critical difference to the coalition’s effort would certainly increase the probability of the effort being made, and the effort being made is a necessary condition of its succeeding—although not, as Hector’s and the Kamikaze cases illustrate, a sufficient one.

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