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C. A. Soper

The Evolution of Suicide

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To Hattie, Mo, and Fred.

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Glossary of Abbreviations and Neologisms

CMDs	Common mental disorders (Goldberg & Goodyer, 2005)
EP	Evolutionary psychology (Buss, 2005)
fender	Front-line, active, anti-suicide, evolved psychological mechanism
ID	Intellectual disability (Lunsky, Raina, & Burge, 2012)
keeper	Last-line, reactive, anti-suicide, evolved psychological mechanism
SSSD	Self-serving self-deception (Paulhus & Buckels, 2012)

Contents

List of Figures

Chapter 1
Introduction

> *To understand suicide is one of the absolutely fundamental and puzzling challenges of the human condition.* (Maris, 1981, p. 339)

This book seeks to explain the evolutionary origins of suicide – how deliberate, intentional self-killing came to be part of the behavioural repertoire of the human species.

There are, of course, many intellectual domains from which to approach suicide as a topic (Nock, 2014; Shneidman, 1989). Philosophers have grappled with the motivations and ethics of self-killing at least since the schools of Pythagoras and Plato, and the question of whether life is or is not worth living remains, according to Camus (1955), the only truly serious philosophical problem. Cultural historians and anthropologists have charted humanity's diverse and shifting attitudes towards suicide – sometimes approving, but more often abhorrent (Colt, 1991; Fedden, 1938). The sociologist Emile Durkheim (1897/1952) chose suicide as the subject of a monograph with which he aimed to assert the credentials of sociology as a scientific discipline, a work which remains seminal today. Psychological theories of suicide have been put forward at least since the time of Freud (1917/1964), primarily in search of more effective ways to tackle suicide as a clinical and public health problem (Gunn & Lester, 2014; Selby, Joiner, & Ribeiro, 2014). Today, branches of neurobiology and genetics spearhead the natural sciences' efforts to understand the behaviour (Dwivedi, 2012; Turecki & Brent, 2016). This inquiry's focus on an evolutionary perspective is not to suggest an incompatibility with, or to diminish the value of, these alternative directions of research: indeed it draws upon many for its theoretical and empirical material. Rather it is to highlight the fact that, for evolutionists, suicide presents a specific and as yet unresolved scientific puzzle: how it is that an organism could have evolved by natural selection with the capacity wilfully, and yet for no apparent biological purpose, to kill itself (Aubin, Berlin, & Kornreich, 2013; Confer et al., 2010).

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1.1 Definition of Suicide: Deliberate, Intentional Self-killing

Notwithstanding the scientific context, suicide carries a commonplace meaning for the purpose of this book: *deliberate, intentional self-killing* (Ivanoff, 1989; WHO, 2014).

Although outwardly simple, such a definition hides complications and calls for some provisos. There is, first, the question of what constitutes the intended self-killing. While the discrete outcome of death is of primary interest to statisticians tracking completed suicides for epidemiological purposes (Silverman, 2013), Shneidman (1989, p. 28), from a clinician's perspective, observes that cessation, rather, is the suicide's salient intent – specifically, that "the common goal of suicide is cessation of consciousness." He writes:

> …once the idea of cessation crosses into consciousness, the suicidal act has begun. The idea of cessation – that you can be free if all your problems, get out of this mess, cancel your debts, release yourself from this anguish, stop this disease – is the turning point in the suicide drama. (Shneidman, 1980, p. 13)

Shneidman's psychological perspective has empirical support and broad currency in suicidology (Leenaars, 2017) – a field which he effectively founded – but it implies *inter alia* that a suicide attempter's view of "successful" self-killing, an ending of consciousness, may not necessarily tally with a medical or statutory definition of death (Youngner, Arnold, & Schapiro, 2002).

Second, the notion of intent is both central to the idea of suicide and highly problematic, inasmuch as perhaps all studies in suicide must take a view on what are ultimately unknowable states of mind: did the suicide really mean to take his own life? How would we know? Suicidal people often have ambivalent intentions – what proportion of the intent should be suicidal for an act to count as suicide (Maris, Berman, & Silverman, 2000)? Suicidologists have sought technical definitions of suicide that avoid direct reference to intention, but the implication of intent resides nonetheless (Andriessen, 2006; De Leo, Burgis, Bertolote, Kerkhof, & Bille-Brahe, 2006; Fairbairn, 2003; Silverman, Berman, Sanddal, O'Carroll, & Joiner, 2007). To keep its scope manageable, this study takes the pragmatic position that a death can be taken as suicide if self-killing (i.e., the permanent cessation of consciousness), rather than some other goal, is presumed to have been the primary objective of the act. The first of three specific exclusions follows from this stance: there is no attempt, at least directly, to deal with the unusual but topical phenomenon of suicide terrorism. Rather, for our purposes, if cessation of consciousness is viewed as the primary purpose of the act, with the deaths of others being an incidental side effect, then no special explanation may be required: suicide terrorism in this case can be viewed as suicide (Lankford, 2013). Alternatively, if cessation of consciousness is not the primary objective of the act but is rather a concomitant of some other goal, such as the murder of others by a bomb, or the achievement of a supposedly better consciousness in an afterlife, then the act is not suicide by this book's definition and falls outside of its scope.[1] Second, by the same criterion, the rare phenomenon that Durkheim (1897/1952) termed altruistic suicide — exemplified, he thought, in deeds of battlefield heroism— is also set aside for the purpose of this discussion (Johnson, 1965). Third, the incidental deaths of insects and non-human animals that may follow from their sometimes self-sacrificial efforts to defend territory or escape entrapment are also excluded. The question of supposed animal suicides will be discussed further in a later section.

As a further exclusion, there is no aim to formulate an evolutionary account of mass suicide – like suicide terrorism, an exceptional but high-profile phenomenon – which probably involves an unusual and special set of conditions and processes (Mancinelli, Comparelli, Girardi, & Tatarelli, 2002; Meerloo, 1962). The focus of this investigation is personal, solo, self-killing – what Cholbi (2017) calls “run-of-the-mill" suicide. A theoretical explanation might emerge which may incidentally help to account for mass suicides, acts of terrorism, and other forms of homicide, but that is not its primary objective. More will be said about research goals later in this chapter.

1.2 Suicide as an Evolutionary Puzzle

A brief introduction to Darwin’s theory of natural selection will serve to justify the premise that suicide constitutes an evolutionary puzzle. Darwin’s idea has its roots in Thomas Malthus’s (1798) notion of the tension between the finite resources available to an organism and its indefinite capacity to procreate: if left unchecked, organisms reproduce at a geometric rate, their populations multiplying eventually to exhaust the available nutrients and other resources. Sooner or later, a point is reached at which not all offspring can stay alive, and at this stage, according to Darwin, a relentless struggle to survive and reproduce ensues, a struggle for which some organisms are better equipped than others. If an organism bequeaths to its offspring a heritable trait that gives them an advantage in the struggle, then that trait will gradually spread across the entire population. In the opposite direction, any heritable trait that disadvantages the reproductive prospects of an organism’s progeny will be duly eradicated. Natural selection works to the same rule that plant and animal breeders follow to mould the features of domesticated species. Unifying both natural and artificial selection, as Darwin explained, there is just “one general law, leading to the advancement of all organic beings, namely, multiply, vary, let the strongest live and the weakest die” (Darwin, 1859/1996, p. 198). This principle, as developed by biologists, palaeontologists, and geneticists in the first half of the twentieth century (Huxley, 1942/1963; Mayr & Provine, 1980), is accepted today across mainstream science as the only credible explanation for the ordering of life, and all life,

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[1] Suicide terrorism may not present so neat a dichotomy: acts of martyrdom may integrally entail an intention to kill both self and others (Liddle, Bush, & Shackelford, 2011; Sela & Shackelford, 2014; Townsend, 2014).

on earth (Dobzhansky, 1973; Mayr, 1982; Williams, 1966, 1996). But if natural selection axiomatically entails the survival of the fittest (Darwin, 1868),[2] how then to explain the success of an organism that, as a phenotypic trait, can opt out – thereby deselecting itself from the struggle?

Some might argue that suicidality does not need, or is not amenable to, an evolutionary explanation and that it falls outside of the scope of Darwinian theory. Perhaps the emergence of human freewill and culture renders the laws of nature inapplicable (Dennett, 2003). Human behaviour, modified by the cultural transmission of ideas, is clearly characterised by a remarkable degree of freedom from biological constraints (Kitcher, 1985; Sahlins, 1976; Slobodkin, 1978). Perhaps Darwinism is no more relevant to suicide than it is to other dysgenic practices such as contraception, celibacy, or adoption, behaviours which demonstrate not the supremacy of genetic selection but the flexibility of human behaviour and the self-transmitting nature of ideas – or, to use the term coined by Dawkins (1976), memes. Following trajectories of their own, memes can spread across a population sometimes in direct conflict with the reproductive interests of individuals' genes (Blackmore, 1999). The meme for planned childlessness, for example, comparable to suicide – "a reversal of the fundamental strategy of all life" (Dennett, 1995, p. 330) – has propagated itself widely. A suicide meme too might be communicable, as evidenced by the clusters of imitative suicides that sometimes follow high-profile exemplars (Kral, 1994; Marsden, 1998; Stack, 2003). The notion that suicidality may be exempt from Darwinian processes may be valid to an extent, but only inasmuch as it acknowledges that different levels of analysis – proximate, ultimate, and others – can be brought to bear on any biological trait (Symons, 1979; Tinbergen, 1963). While proximal mechanisms may explain how a maladaptive cultural practice may provisionally prevail, in the long run, culture can be expected to adjust towards maximising reproductive success (Harris, 1974; Whiten, Hinde, Laland, & Stringer, 2011). To use Lumsden and Wilson's (1981) metaphor, genes hold culture on a leash. There are disputes about the nature and elasticity of the leash, and it may be hard to discern at times what is pulling what. Memes and genes may be best understood as co-evolving, as with the genes that confer lactose tolerance, for example, that have apparently spread in populations that practice dairying (Feldman & Laland, 1996). But in any conflict, so Lumsden and Wilson (1981) argue, genes are the final arbiters. To illustrate, it is easy to understand the immediate appeal of contraception and to accept that the practice may loosen the grip of natural selection for a while (Laland, Odling-Smee, & Myles, 2010), but at some stage, a group shrunken by such a "race-destroying vice" (Fisher, 1930/1958) would eventually be expected to give way to more fertile populations. At an ultimate level, the study of learned behaviours cannot be entirely sealed off from biological science not least because

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[2] "This preservation, during the battle for life, of varieties which possess any advantage in structure, constitution, or instinct, I have called Natural Selection; and Mr. Herbert Spencer has well expressed the same idea by the Survival of the Fittest. The term 'natural selection' is in some respects a bad one, as it seems to imply conscious choice; but this will be disregarded after a little familiarity" (Darwin, 1868, p. 6).

our capacities for behavioural flexibility and the acquisition of cultural ideas are themselves evolved faculties (Tooby & Cosmides, 1992).[3]

In sum, it is hard to see how suicidality could remain indefinitely immune from selective pressures: at some point, self-destructive individuals and groups would expectably be supplanted by the more self-preserving. There is an intuitive logic in the argument made by Farber (1980) that suicide ought to operate as one of natural selection's most powerful agents, weeding out the psychologically weak from the breeding population. It is a view traceable to Darwin himself in one of his rare and passing comments on the subject: "Melancholic and insane persons … commit suicide," he writes, to illustrate how "some elimination of the worst dispositions is always in progress even in the most civilised nations" (Darwin, 1879/2004, p. 162).

And yet there is a reason to believe that the human capacity for suicide is not only ultimately constrained by natural selection but is positively born of it. At least three observations point in this direction.

1.2.1 Variability, Heritability, and Differential Fitness Effect of Suicide

First, suicidality appears to offer the three handles – variability, heritability, and a differential effect on reproductive fitness (Darwin, 1859/1996) – by which natural selection would be expected to gain purchase, systematically favouring the offspring of the less suicidal. Variability can be seen in the contrasting propensities for suicidal behaviour that prevail across different individuals, cultures, nations, and ethnic groups (De Leo et al., 2013; Nock, Borges, & Ono, 2012b; Värnik, 2012; WHO, 2014). Across the countries of Europe, for example, rates vary spatially by an order of magnitude (Schmidtke, 1997; Voracek, Loibl, & Kandrychyn, 2007) in a persistent pattern of differentials that caught Durkheim's (1897/1952) attention more than a century ago. This unevenness seems to have a heritable component: suicide runs in families, and apparently not just because of learned behaviours and shared family

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[3] E. O. Wilson argues a case for accepting suicide, or rather the mind that can contemplate suicide, as ultimately a biological phenomenon from a philosophical stance at the beginning his book, *Sociobiology*:

"Camus said that the only serious philosophical question is suicide. That is wrong even in the strict sense intended. The biologist, who is concerned with questions of physiology and evolutionary history, realizes that self-knowledge is constrained and shaped by the emotional control centers in the hypothalamus and limbic system of the brain. These centers flood our consciousness with all the emotions – hate, love, guilt, fear, and others – that are consulted by ethical philosophers who wish to intuit the standards of good and evil. What, then, made the hypothalamus and limbic system? They evolved by natural selection. That simple biological statement must be pursued to explain ethics and ethical philosophers, if not epistemology and epistemologists, at all depths. Self-existence, or the suicide that terminates it, is not the central question of philosophy. The hypothalamic-limbic complex automatically denies such logical reduction by countering it with feelings of guilt and altruism. In this one way the philosopher's own emotional control centers are wiser than his solipsist consciousness, "knowing" that in evolutionary time the individual organism counts for almost nothing." (Wilson, 1975, p. 3) upbringings. Twin and other studies in behavioural genetics report that some 30% to 55% of variability in suicide risk may be attributed to heritable factors (Fiori, Ernst, & Turecki, 2014; Roy, Nielsen, Rylander, & Sarchiapone, 2000; Voracek & Loibl, 2007), reducing to about 17% after setting aside the overlapping heritability of certain psychiatric conditions (Turecki & Brent, 2016).[4] There are critics of the soundness of behavioural genetic methodologies and of the meaningfulness of heritability measures in human psychology generally (e.g., Joseph, 2001; Lewontin, 2011; Loehlin, 2010; Rose, Lewontin, & Kamin, 1984; Sarkar, 1998), as well as warnings voiced within the field of genetics about the validity of claimed genetic explanations for complex human traits (Turkheimer, 2000). But nonetheless, even allowing for an arguable inflation in some findings, the consensus among suicidologists is that there is a significantly heritable component to suicidality (Baldessarini & Hennen, 2004; Brent & Mann, 2005; Dwivedi, 2012; Fiori et al., 2014; Goldney, 2003b; Lin & Tsai, 2016; Mann & Currier, 2010; Marušič & Swapp, 2004; Turecki & Brent, 2016; Voracek & Loibl, 2007; Zai et al., 2012). That marked heritability should be found in a trait as self-destructive as suicide calls for an explanation, because even a minimally disadvantageous effect on reproductive fitness ought to be enough to drive a heritable trait out of a population. Keller and Miller (2006) advise that an allele (variant gene) would be subject to natural selection in a sizable breeding population on the strength of a fitness coefficient of only 0.003% – equivalent to just one offspring more or fewer than average in 15 generations. Putting this minimal rate into perspective, Roy (2001) observes that Margaux Hemingway's suicide in 1997 was the fifth suicide among four generations of Ernest Hemingway's family, a familial clustering of suicidality that is apparently not unusual (Roy & Segal, 2001; Roy, Segal, Centerwall, & Robinette, 1991).

Taken together, the apparent variability, heritability, and differential fitness effect of suicide risk suggest that the levers exist by which natural selection could do the expected thing – to produce proportionately more offspring from the less suicidal, with the eventual result of eradicating the behaviour. That natural selection has not done so suggests that some countervailing evolutionary mechanism or mechanisms has actively sustained suicidality in the human population. As Darwin (1859/1996) first explained, a trait will endure in a population only if it is held in place by pressure of natural selection. A characteristic that brings no selective advantage to the organisms that have it can be expected to go the same way as the legs of snakes and the tails of human primates – to disappear.

1.2.2 Universality of Suicide

Second, we can infer that the potential for suicidality has been so maintained in the human species since primordial times from the ubiquity of the trait. It may be impossible to prove by exhaustive survey the universality of suicide, or of any

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[4] This does not mean, as the point can be easily misread, that, say, 43% of suicides are caused by genes but rather that 43% of the deviation from mean suicide risk in the studied population may be heritable.

other behaviour for that matter (Brown, 1991, 2004), but it can be said that, as far as it is known, no human culture is entirely free from the phenomenon (Desjarlais, Eisenberg, Good, & Kleinman, 1995; Mishara, 2006; Zilboorg, 1936). Notwithstanding a lack of reliable statistics from many countries, Durkheim (1897/1952) deduces that suicide probably occurs everywhere on the basis of the footprint it leaves in ubiquitous legal and cultural prohibitions: as he points out, whether suicide is currently observable or not, it must have been a sufficiently pressing problem to have attracted and sustained societal concern. Suicide prevails as a temporal as well as a spatial fixture: references to self-murder have been found in a 4,000-year-old Egyptian poem (van Hooff, 1990) and in literature through every historical era since (Colt, 1991; Fedden, 1938; Mishara & Tousignant, 2004). Not only is suicidality itself apparently universal, so are the risk factors: although the suicide rate varies between nations, its correlates show a remarkable cross-national consistency (Bromet, 2012; McLean, Maxwell, Platt, Harris, & Jepson, 2008; Nock et al., 2008, 2009). Econometric models point to the existence of natural levels of suicide in human populations, above zero even if known social and economic risk factors could be adjusted to the most favourable settings (Andrés & Halicioglu, 2011; Goldney, 2003a; Lester & Yang, 2005; Yang & Lester, 1991, 2009): analogous to the existence of a natural rate of unemployment, the implication is that an underlying incidence of suicide is a normal condition of human societies. These modern statistical findings echo those of Durkheim (1897/1952): observing no social conditions under which zero suicides can be expected to occur, he infers that suicide prevails as a "necessary imperfection" – a "social fact." Many researchers have come to the view that some level of suicidality probably comes with the territory of being human (Baechler, 1975/1979; Fox, 1971; Maris, 1981; Stengel, 1964), an assessment reflected in an acceptance in some quarters that, while some suicides may be prevented, the complete elimination of suicide can be set aside as an unrealistic goal (O'Connor, Platt, & Gordon, 2011).

Suicide's ubiquity over time and place allows a tentative inference to be made about its evolutionary origins: a behaviour that occurs globally was almost certainly already universal among the original Palaeolithic humans that dispersed from Africa (Behar et al., 2008; Underhill et al., 2000), thereafter spreading with migrations, whether directly by a genetic commonality, or a cultural continuity, or both (Antweiler, 2015). The occurrence of suicide today in small-scale, pre-literate, and hunter-gatherer societies provides supportive evidence of its ancient roots (Brown, 1986; Hezel, Rubinstein, & White, 1985; Jollant, Malafosse, Docto, & Macdonald, 2014; Macdonald, 2007; Reser, 1990; Tousignant, 1998; Zilboorg, 1936): for a trait to recur among these closest observable analogues to ancestral human societies suggests that it is no mere product of modern, urban lifestyles, but that it rather follows a continuous line of descent from our ancient forebears (Kappeler, Silk, Burkart, & van Schaik, 2010). Suicide probably emerged among humans in the primeval past and, for reasons as yet unclear, has endured.

1.2.3 Suicide as a Species-Specific Human Behaviour

Third, suicide appears to be a uniquely human behaviour (Comai & Gobbi, 2016; Maltsberger, 2003; Preti, 2005). Non-existence of evidence is, of course, not the same as evidence of non-existence, but it is telling that, while animal suicides feature widely in mythology, folklore, and anecdote, no scientifically reliable account of actual suicide among non-humans has yet surfaced. This void in the record remains despite at least three forces which can be expected to have brought evidence of non-human animal suicide to light, if it exists. Firstly, the vast number of potential observations may be considered. There have been countless opportunities over the centuries, around the globe, for humanity's cumulative millions of breeders, farmers, and naturalists to have observed and documented the phenomenon of non-human suicide, if indeed it occurred (Preti, 2007, 2011b). Secondly, the silence holds despite an active and long-standing academic and scientific search for evidence of animal suicide, both in the field and the laboratory. In the field, observations by O'Connor (1978), after modelling the conditions of starvation in which a burdensome nestling might theoretically be expected to sacrifice itself for the sake of inclusive fitness – to aid the survival of the genes it shares with its stronger siblings – found that in reality a nestling will let its entire brood starve rather than preemptively volunteer to die. In the laboratory, more than a century of experiments have likewise evidenced no actual non-human suicides. Many scorpions, for example, were burned alive by Victorian investigators seeking to demonstrate the then popular idea that scorpions sting themselves to death when faced with inevitable death by fire (Ramsden & Wilson, 2010) – in vain not least because, as is now known and presumably for reasons of natural selection, scorpions are resistant to their own venom (Legros, Martin-Eauclaire, & Cattaert, 1998). Schaeffer (1967) devised half a century ago a laboratory experiment designed to establish whether an animal could be induced to kill itself, but there are no reports of positive results arising from his experimental design – or from any other, for that matter (Lester, 2014b). Thirdly, the record remains mute despite strong commercial motivations in favour of finding cases of non-human suicide: if discovered, an animal model of suicide would be expected to attract keen interest from the pharmaceutical industry for the possibilities it could create for testing the suicidogenic or protective effects of drugs (Comai & Gobbi, 2016; Malkesman et al., 2009; Preti, 2011a). Others may also be motivated to document animal suicide, if it exists, for its popular journalistic value: illustrating the pressure to produce such a story, the myth of lemming suicide appears traceable largely to a 1958 documentary, *White Wilderness*, the makers of which, having failed to find actual cases of lemmings voluntarily leaping into the sea, are reported to have thrown captive animals off a cliff to obtain the desired footage (Chitty, 1996; Woodford, 2003).

To be clear, certain eusocial species – non-breeding castes of hymenopteran insects, snapping shrimp, naked mole rat, and possibly others – are often ready to sacrifice their individual somas in the genetic interests of their colonies (Joiner, Buchman-Schmitt, Chu, & Hom, 2017). Animals can certainly injure themselves, usually as a side effect of defending territory (Crawley, Sutton, & Pickar, 1985), and perhaps most noticeably under exceptionally stressful conditions in captivity (Jones, 1982; Jones & Daniels, 1996). Animals may eventually die from the resulting wounds (Goldney, 2000, 2001; Jones, 1982; Lester & Goldney, 1997). But it is hard to argue that such attendant deaths, occurring incidentally in the pursuit of other goals, constitute the intentional, deliberate cessation of consciousness that defines suicide at least for the purpose of this analysis (Goldstein, 1940; Preti, 2011b).

The apparent specificity of suicide to the human species together with its universality indicates that suicidality arose at or after the juncture of speciation – the divergence of human evolution from that of our closest extant primate relations. The curiosity is not just that the capacity for suicide should have evolved in the first place but that it has remained with us: observing that suicidality has apparently not been eliminated in any part of the world, we can infer that some process of natural selection has actively maintained the trait and presumably continues to do so. An evolutionary explanation is called for.

1.3 The Fitness Costs of Death and Suicide

Suicide, an apparently variable, heritable trait, presents an evolutionary puzzle because to be dead, and to be dead by one's own hand especially, would appear to incur a severe fitness cost.

1.3.1 The Fitness Cost of Death

It is true that, while organisms may usefully be viewed as survival machines (Dawkins, 1976), it is not survival for its own sake that natural selection favours: the Darwinian rule of thumb – survive and reproduce – reminds us that evolutionary success requires reproduction, not just survival. But for most organisms, most of the time, future reproduction is predicated on staying alive now. There are exceptions: organisms that breed only once in a lifetime, for example, may indeed reproduce at the cost of their own survival, as is the case with certain male spiders that are eaten by their mates after copulation. But usually, for reproductive purposes, as Duntley & Buss (2004) put it, it is "bad to be dead": an organism's death by whatever cause usually brings with it multiple and serious problems for the future propagation of its genes.

First, most obviously, the dead can no longer reproduce: death guarantees that the most direct means by which an individual's genes can be transmitted is permanently closed off. Huxley (1942/1963) distinguishes between those selective pressures that promote survival and others that promote reproduction, and he provides a commonsense reason why survival selection is generally the more powerful force: while reproduction selection affects the size of a clutch, survival selection affects whether there is a clutch at all.

Second, if there are already offspring then, for humans perhaps more than other animals, a parent's untimely death tends to throw severe obstacles in the way of those progenies' own prospects for raising future generations. Some of the human handicaps of a parent's death are itemised by Duntley (2005), starting with the repercussions of the deceased's inability further to contribute to a child's or grandchild's safe upbringing. Into adulthood, bereaved descendants may find it harder to secure a place in society, to select high-quality mates, and to raise children of their own. Lacking a co-parent's support, and with his or her own survival needs to prioritise, the remaining partner may be poorly resourced to care for the deceased's surviving young. What resources are available may be diverted into new mating relationships: if a new relationship begins, then the dead person's children may find themselves at the mercy of a stepparent with competing genetic interests. At an apparently heightened danger of neglect, abuse, or homicide, a stepchild's position may be perilous (Daly & Wilson, 1988). The general disadvantage incurred by children as a result of a parent's death may be a cross-cultural outcome: in tribal societies, for example, children raised without fathers tend to be less popular and to die younger (Geary, 2005). For orphans, the prospects are predictably harsher: poverty, exploitation, abuse, and neglect can be found the world over, even, or perhaps especially, in traditional societies (Bailey, 2009). That the disadvantages of being bereaved recur in pre-literate societies suggests that such adversities are no mere novelty of modern cultures and might expectably have prevailed deep into human prehistory.

Third, more widely, death ends an individual's ability to support his extended family – relations who, by dint of inclusive fitness (Hamilton, 1964) could indirectly propagate the individual's genes through their reproduction. Wider still, Duntley (2005) notes the potential for power struggles, disrupted family networks, and other complications that can impair the reproductive prospects of an entire kin group in the wake of an individual's death.

1.3.2 The Fitness Cost of Suicide

If in evolutionary terms it is bad to be dead, to be dead by suicide appears to be even worse, due to the added psychological and social penalties imposed on surviving kin (Andriessen, Rahman, Draper, Dudley, & Mitchell, 2017; Bolton, Au, Leslie, & et al., 2013; Carter & Brooks, 1991; Cerel, Fristad, Weller, & Weller, 1999; Dunne, Dunne-Maxim, & McIntosh, 1987; Erlangsen et al., 2017; Jordan, 2001; Jordan & McIntosh, 2011; Mishara, 1995; Parker, 2014; Pitman, Osborn, King, & Erlangsen, 2014; Sveen & Walby, 2008; Wilcox, Mittendorfer-Rutz, Kjeldgård, Alexanderson, & Runeson, 2015). For those bereaved by suicide, economic hardship and rejection by the community are commonplace outcomes (Grad, 2011; Healey, 1979; Poole, 1985). One effect of strong social mores against at least some forms of suicide – a disapprobation found across human cultures (Fedden, 1938) – is that the families of suicides tend to receive less social support than those bereaved in more socially acceptable ways (Akotia, Knizek, Kinyanda, & Hjelmeland, 2014; Chapple, Ziebland, & Hawton, 2015; Jordan, 2001; Knizek, Kinyanda, Akotia, & Hjelmeland, 2013; Macpherson & Macpherson, 1985; Wertheimer, 2014). In many traditional cultures, self-killings are viewed as the work of evil spirits (Akin, 1985; Macpherson & Macpherson, 1985; Mishara & Tousignant, 2004) with commensurately dark consequences for surviving kin. Mugisha, Hjelmeland, Kinyanda, and Knizek (2011), observing the severe social distancing faced by Baganda tribespeople bereaved by suicide, record disinheritance, the severing of the suicide's lineage, the ritual destruction of their homes, exile, and other punishments. The emotional effects for children bereaved by suicide can be particularly severe, including guilt, blame, and confusion about responsibility for the death, a heightened risk of mental illness, and a greater likelihood of themselves dying by their own hands (Cain & Fast, 1966; Calhoun, Selby, & Selby, 1982; Carter & Brooks, 1991; Cerel & Aldrich, 2011; Jordan, 2001; Pitman et al., 2014; Range & Calhoun, 1990; Turecki & Brent, 2016). In his analysis of the ethics of suicide, Hook (1927) concludes that the strongest argument against taking one's own life is that it is simply cruel.

1.3.3 The Fitness Cost of Suicide as a Basis for a Bargaining Hypothesis

So dire are the economic, social, and emotional sequelae of suicide for the surviving kin and community that suicide is often interpreted – and routinely misinterpreted (Bancroft et al., 1979; Hawton, Cole, O'Grady, & Osborn, 1982; Valach, Young, & Michel, 2011) – as an interpersonal rather than a private act. Suicides are sometimes deemed to be motivated by a desire to exact revenge or to manipulate others (Brown, 1986; Canetto, 2008). Indeed, Syme, Garfield, and Hagen (2016) posit, and explore with cross-cultural data, a bargaining hypothesis — that an evolutionary impetus for suicide, or at least for attempted suicide, may lie in its extortion value. The suggestion is that a suicide attempt constitutes a drastic Machiavellian gamble, consciously or unconsciously taken by the otherwise powerless individual – modally, by a young uneducated woman (Nock et al., 2008) – and aimed at coercing others to improve her lot (Hagen, 2003). The gamble pays off if she survives and gets what she wants, but to lose is to die. There is some empirical and theoretical support for the idea: a "cry for help" component in suicidal behaviour has long been recognised (Nock, 2008; Shneidman & Farberow, 1961b; Williams, 1997), in part reflecting the characteristic ambivalence of the suicidal state of mind – people may simultaneously determine to die but also hope to be rescued (Shneidman, 1985). It has also long been clear that completed suicide (the focus of this study) and attempted suicide (the focus of the bargaining model) are to some extent distinct behaviours, undertaken by separate populations, with distinguishable motives and epidemiologies (Hawton & van Heeringen, 2000; Shneidman & Farberow, 1961a; Stengel, 1964): while non-fatal suicide attempts are made more often by the young and females, actual suicides are more often completed among the old and males, and there are other differences *inter alia* in the lethality of the methods used.

There are, on the other hand, at least six problems with an evolution-informed bargaining model of suicide. First, for a suicide threat to be credible on the basis of its inclusive fitness logic, the victim of the blackmail would need to believe that it would actually be in the blackmailer's genetic interests to carry out the threat. It is hard to imagine a real-life scenario by which this outcome could arise: a ploy by which, say, a bride threatens her father with suicide to forestall an arranged marriage might work on fitness grounds only if the father assessed the marriage as being so certain to annihilate her prospects of producing any viable offspring, within or outside of that marriage, or of helping her kin to raise their children, that she may as well die now – otherwise, bluff would expectably be called.

Second, it is hard to see how a psychological device that would arrive at a supposedly fitness-maximising suicide threat could have evolved. Modern evolutionary theory holds that such a high-level generalised fitness-maximising mechanism is unlikely to come about, because natural selection operates, rather, on the basis of specific informational cues that, in our ancestral environment, helped to solve particular, recurring, fitness problems (Tooby & Cosmides, 1990b). That we are not equipped with a generalised urge to spread our genes or with a measuring instrument that, taking everything into account, would inform such an urge is belied, among many other contraindications, by the use of recreational drugs, widespread participation in extreme sports, the practice of voluntary childlessness, and Symons's (1992) observation that sperm banks do not attract queues of would-be donors.

Third, while it is notoriously difficult to discern the intentions behind suicidal acts, sometimes even for the actors themselves (Andriessen, 2006), the main source of evidence for extortion as an alleged motive for suicide – other peoples' opinions and hearsay – is particularly unreliable (Hjelmeland, Dieserud, Dyregrov, Knizek, & Leenaars, 2012). Culturally loaded meanings and messages are perhaps bound to be read into self-killing if only on account of the act's deviancy and extraordinary social impact (Counts, 1991; Knizek & Hjelmeland, 2007; Lester, 2014a). Folk interpretations abound: supernatural forces are often opined by non-Western and tribal informants as causing suicide (Hezel et al., 1985; Mugisha, Hjelmeland, Kinyanda, & Knizek, 2013; Syme et al., 2016; Tousignant, 1998),[5] mystical explanations that would arguably be as evidentially well supported by third-party accounts as putative interpersonal motives. It is telling, however, that the causes presumed by others for suicides are frequently at odds with the actors' own accounts (Bancroft et al., 1979; Hawton et al., 1982; Michel & Valach, 2001; Valach et al., 2011): observers often (mis)judge suicides to be gestures or manipulations, while suicide attempters themselves – whether in person after a failed attempt (Boergers, Spirito, & Donaldson, 1998; Bowles, 1985; von Andics, 1947) or in their suicide notes (Chávez-Hernández, Leenaars, Chávez-de Sánchez, & Leenaars, 2009; Chávez-Hernández, Paramo, Leenaars, & Leenaars, 2006; Gunn, Lester, Haines, & Williams, 2012; Meyer, Irani, Hermes, & Yung, 2017; O'Connor, Sheehy, & O'Connor, 1999) – are more likely to explain their own actions as a desperate escape from an intolerably painful situation. Suicide notes indeed frequently contain messages of

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[5] Some would argue that psychiatric explanations for suicide favoured in Western cultures are no less mythological (Hjelmeland, 2013; Linehan, 2008).

remorse and apologies that seek to absolve other people of blame (Meyer et al., 2017).

Fourth, survey evidence suggests that in practice, suicides usually offer little scope for a round of bargaining: significant others are unlikely to find out about suicide attempts even after the event, let alone get prior warnings. Brezo et al.'s (2007) longitudinal study of a cohort of 1,715 adolescents in Quebec found parents were unaware, four times in five, of their children's history of attempted suicides, or at least claiming to be unaware. It seems that those at highest risk of attempting to take their own lives are those least likely to offer opportunities for intervention (Berman, Jobes, & Silverman, 2006).

Fifth, suicidality appears to be universally accompanied by intense emotional pain (Shneidman, 1993; Troister & Holden, 2012; Verrocchio et al., 2016), and it is unclear why this particular affective link should hold if suicide attempts were aspirational gambits: lifestyle-changing inheritances, high-value mates, or other fitness-enhancing ransoms could as plausibly be demanded with menaces in other mood states – the excitement intrinsic to gambling perhaps (Wulfert, Franco, Williams, Roland, & Maxson, 2008).

Finally, empirical counter-evidence against the notion that attempted suicides can look forward to fitness payoffs lies in the typically, and predictably, unrewarding social reactions actually experienced by those who try but fail to kill themselves: they can expect to win little sympathy and few concessions that would come close to compensating for the extreme fitness costs and risks involved – the prospect of death or of permanent disability from a failed suicide attempt (Brown, 1986; Hawton et al., 1982; Knizek et al., 2013).[6]

On this basis, while a bargaining hypothesis might help to elucidate some unintended deaths, it would seem to be an unsatisfactory basis for an evolutionary account of deliberate, intentional self-killing. Nonetheless, a bargaining hypothesis of suicide is instructive: that it can be plausibly posited at all illustrates the central point being made here that suicide not only terminates the individual's prospects for direct reproduction, but it also predictably and seriously disadvantages the suicide's kin. From an evolutionary standpoint, there remains a need to reconcile the tenets of natural selection and inclusive fitness with this particularly dysgenic human propensity.

1.4 Epidemiology and Theory of Suicide

Suicide is not rare. It may appear exceptional from an individual's perspective, as might be said of death generally – suicide reportedly occurs at an annual rate of "only" about 11.4 per 100,000 population globally (WHO, 2014) – but it is far from an uncommon cause of mortality. No less than 1.4% of all deaths are attributed to

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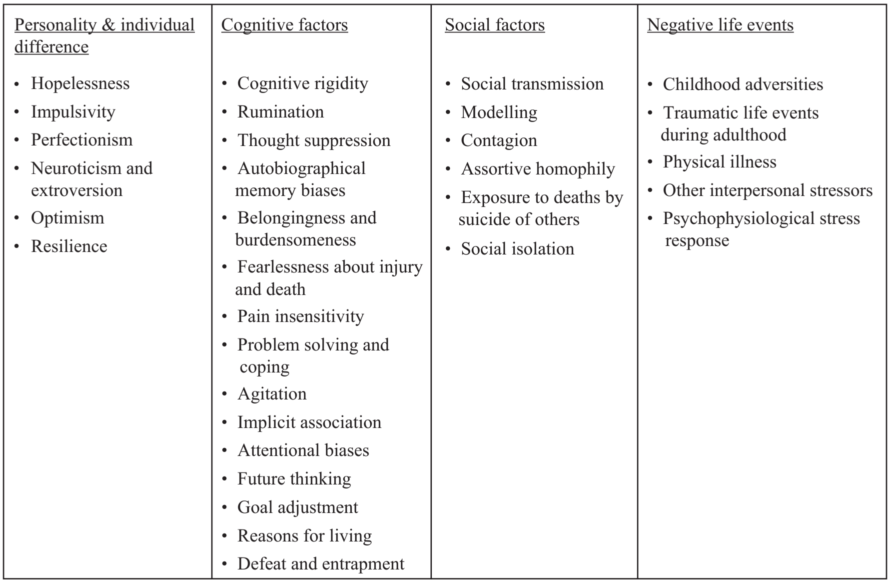
[6] Illustrating the scale of the gap between the mortal fitness risk taken in a suicide attempt and the questionable bargain value of its supposed fitness rewards, the latter posited in Syme et al. (2016) include "swayed parents" and, perhaps most oddly, "prevented ear modification."

suicide, some 800,000 per year, which makes it the world's leading cause of violent fatality: more people die by self-murder than by wars and homicide combined (WHO, 2012a, 2014). The real incidence may be higher, with perhaps a fifth of suicides going unreported in official statistics (Kapusta et al., 2011; Rockett, Kapusta, & Bhandari, 2011): such is the stigma that often surrounds suicide that many cases are misclassified as deaths by other or unknown causes (Tøllefsen, Hem, & Ekeberg, 2012). Actual deaths can be viewed as the tip of an iceberg of suicidality: it is estimated that for each completed suicide, there are 20–25 "unsuccessful" attempts (Troister, 2014) and that 2.7% of people in the world have tried to take their own lives at some stage, 0.4% over a 12-month period alone (WHO, 2014). Reported rates of suicidal ideation very widely: an international study found that 10–18% of the general population reported having had suicidal thoughts at some stage (Weissman et al., 1999); towards a higher end of results, a survey of shoppers in Seattle found that 53–67% admitted to have seriously considered suicide at some stage, 20% in the past year alone (Linehan, Goodstein, Nielsen, & Chiles, 1983).

1.4.1 Correlates and Unpredictability of Suicide

A large body of empirical data has accumulated concerning the factors that correlate with suicide risk. It is known, for example, that suicidal behaviours are more common among people with a history of previous suicide attempts (Haglund, 2015); with mental disorders (Nock et al., 2015); who are female, younger, unmarried, and unemployed (Nock, Deming, et al., 2012); who are experiencing feelings of hopelessness (Davidson & Wingate, 2013); with certain neurochemical characteristics (Dwivedi, 2012) and genetic predispositions (Zai et al., 2012); and so on. Indeed, empirical studies have confirmed hundreds of disparate danger signs and risk factors (Tucker, Crowley, Davidson, & Gutierrez, 2015). Figure 1.1 shortlists more than 30 risk factors in the psychological domain alone, as identified by O'Connor and Nock (2014). Frustratingly, however, and despite decades of concerted research, no combination of variables has yet been found that usefully predicts where suicide is likely to strike (Borges et al., 2012; Chang et al., 2016; Haney et al., 2012; Hawgood & De Leo, 2016; Large et al., 2016). In clinical settings, some 95% of those assessed as high risk do not commit suicide, while a bulk of actual suicides occur among supposedly low-risk patients (Carter et al., 2017; Mulder, Newton-Howes, & Coid, 2016). Nor do statistical associations in themselves provide an account of the processes and causalities involved or indicate what to do about them. A recent World Health Organization report acknowledges that "we continue to lack a firm understanding of why, when, and among whom suicidal behavior will occur" (Nock, Borges, & Ono, 2012a, p. 222).

A better understanding is urgently sought. Preventing suicide has been accepted as a major public health challenge across the world (Satcher, 1999; WHO, 2014), and a clinical and research effort has been directed at the problem over many



Personality & individual difference	Cognitive factors	Social factors	Negative life events
• Hopelessness • Impulsivity • Perfectionism • Neuroticism and extroversion • Optimism • Resilience	• Cognitive rigidity • Rumination • Thought suppression • Autobiographical memory biases • Belongingness and burdensomeness • Fearlessness about injury and death • Pain insensitivity • Problem solving and coping • Agitation • Implicit association • Attentional biases • Future thinking • Goal adjustment • Reasons for living • Defeat and entrapment	• Social transmission • Modelling • Contagion • Assortive homophily • Exposure to deaths by suicide of others • Social isolation	• Childhood adversities • Traumatic life events during adulthood • Physical illness • Other interpersonal stressors • Psychophysiological stress response

Source: O'Connor and Nock (2014)

Fig. 1.1 Some key psychological risk and protective factors for suicidal ideation and behaviour

decades. Reliable data on global suicides are hard to obtain, with most World Health Organization member states unable to provide good-quality vital statistics (WHO, 2012b). One recent report suggests the global suicide rate has fallen by 26% during the 12 years to 2012, although the reasons for this movement are unknown (WHO, 2014): a previous report pointed to a 45% increase over a 45-year period (Yip et al., 2012). While mankind has apparently made strides in reducing other forms of violent death (Pinker, 2011), it may be that the global rate of suicide is no lower now than it was 50 or 100 years ago (Linehan, 2006, 2011; Nock, Borges, Bromet, et al., 2012). There are some indications of progress (Bertolote & De Leo, 2012) and occasional reports of effective therapies among high-risk groups (e.g., Ellis, Rufino, Allen, Fowler, & Jobes, 2015). Nonetheless, the aggregate of interventions appears to be largely ineffectual, with little headway being made (Kessler, Berglund, Borges, Nock, & Wang, 2005; Nock et al., 2012a).

Understandably the call is not just for more research but for the identification of fresh directions for research (Rogers & Apel, 2010; Silverman, Pirkis, Pearson, & Sherrill, 2014). There are formidable obstacles: researchers in suicidology face an array of special logistical, methodological, and ethical difficulties (Prinstein, 2008). But the main obstacle to progress, in the opinion of some leading workers, is the continuing lack of a comprehensive, generally accepted conceptual model by which to understand suicide and to make sense of the data (Lester, 2000b; Rogers & Lester, 2010; Van Orden et al., 2010). Joiner (2000), a prominent suicidologist, writes of a theoretical vacuum in suicidology, evidenced by the perennial influence of Durkheim

(1897/1952) – a pioneering researcher cited a few times already in this chapter. Durkheim's proposal – that the highest suicide rates are found in extreme conditions of societal integration or deregulation – endures after more than a century as one of suicidology's principal theories (Selby et al., 2014) and as a basis for empirical research, but not, in Joiner's view, because of its exceptional utility, but rather for want of anything more interesting. Durkheim's model may indeed be disputed by most researchers in the field, but then no other theory attracts a consensus either (Saint-Laurent, 2003).

1.4.2 Recent Developments in Suicide Theory

The theoretical vacuum has begun to be filled in recent years with three new strands of thinking that may lead to progress. First, some theorists draw attention to an important and categorical difference between suicidal thoughts and suicidal deeds – notably Klonsky and May (2015), who give credit in turn to the Integrated Motivational-Volitional model of R. C. O'Connor (2011) and the Interpersonal-Psychological Theory of Suicide (IPTS) originally formulated by Joiner (2005). Their common stance is an "ideation-to-action" framework (Klonsky & May, 2014; Klonsky, Saffer, & Bryan, 2017), which acknowledges that, while many people think seriously about suicide at some point in their lives, and while around a third of these ideators do go on to attempt suicide (Nock et al., 2008), most do not. The epidemiological data suggest that thought and deed may not be entirely continuous phenomena: the risk factors usually associated with suicidality, such as depression and most other mental illness (Nock et al., 2008), psychological pain, and feelings of hopelessness (May & Klonsky, 2013), correlate with suicidal thoughts better than they correlate with the enactment of those thoughts – for suicidal thoughts to translate into suicidal deeds, a separate set of influences come into play (Dhingra, Boduszek, & O'Connor, 2015; May & Klonsky, 2016). Illuminating how different drivers of risk associate with different stages in the progression, Klonsky and colleagues propose a three-step theory: step 1 of their model sees suicidal ideation arising from any kind of physical or emotional pain combined with a hopeless inability to foresee any relief from the pain. As step 2, ideation will intensify if the pain is not outweighed by an ongoing connectedness – someone or something that constitutes a strong enough reason to stay alive. A suicide attempt, step 3, occurs only if the individual has the practical and mental wherewithal to carry it out (Klonsky & May, 2015; Klonsky, May, & Saffer, 2016).

A second new focus of research connects with one of the implications of the ideation-to-action framework, that the path to suicide is guided not just by conditions that promote risk but also by protective counterforces that block the way. With a few exceptions (e.g., Linehan et al., 1983) and perhaps understandably, researchers have tended to focus on the drivers of suicide, at the expense of neglecting other elements that may have a life-preserving effect. O'Connor (2011) and J. Johnson et al. (2008, 2010, 2011) are among those leading a correction of this imbalance, examining the attitudinal, cognitive, and other personal characteristics associated with resilience in the face of stressors.

While both these developments no doubt help to focus attention on, and refine an understanding of, the correlates of suicidality, their major limitation is that they are agnostic with regard to the causal processes that underlie the correlations. Most theoretical approaches in suicidology focus on collections of risk factors – some distal/predisposing (e.g., genetics, parasite infestation), some developmental (e.g., early-life adversities, personality traits), and others proximal or precipitating (e.g., mental disorders, access to means) (Turecki & Brent, 2016). It remains unexplained as to why a certain blend or sequence of risk factors should produce specifically suicide, as opposed to other deviant behaviours. The specificity of suicide persists as a conceptual missing link, a gap noted decades ago by Atkinson (1978):

> As is usual with almost all post-Durkheimian studies of suicide, it is nowhere spelled out precisely how the independent variable (be it social integration, status integration, lack of external restraint or whatever) is linked with the dependent variable (suicide rates). In other words, a characteristic feature of such works…is the failure to explain why suicide in particular, rather than some other course of action, is a likely consequence of the particular structural condition posited as the independent variable. (1978, pp. 14–15).

It may be that a third recent development in suicide theory may help to break the impasse: a fresh attempt to understand the evolutionary roots of suicide may help to take the knowledge of correlational associations forward into an understanding of the causal processes. The appearance of certain evolutionary ideas in some recent proposals indicates a recognition that any comprehensive, coherent theory of suicide needs to fit, alongside other domains of life science, within the modern Darwinian paradigm of evolutionary biology (Aubin et al., 2013; Gunn, 2017). Evolutionary issues in suicide became a point of discussion in the 1980s, led by the exploratory writings of deCatanzaro (1980, 1981, 1982, 1986), but his ideas have gained little traction. Working independently and building on the work of Paul Gilbert (Gilbert, Price, & Allan, 1995), Mark Williams (1997) incorporated into his "Cry of Pain" model of suicide two types of adaptive behaviours observed in non-human animals as possible pointers to the evolutionary origins of suicidogenic depression among humans. One is the attitude of pre-emptive defeat that animals often adopt to avoid conflict with more powerful conspecifics. The other is what Dixon, Fisch, Huber, and Walser (1989) label "arrested flight" – a defensive depressed-like behaviour exhibited by animals when trapped or unable to escape from threats. Most recently, Joiner et al. (2016, 2017), in papers that reference some of deCatanzaro's (1980) ideas, tentatively draw analogies with the sometimes self-sacrificial, yet evolutionarily explicable, behaviours of social insects and other animals, with a view to explaining maladaptive suicidality in humans. One strength of these publications is their agenda-setting acknowledgement that suicide and evolution theories should connect, an acceptance perhaps of geneticist Dobzhansky's (1973) axiom that "nothing in biology makes sense except in the light of evolution." The common weakness of these evolutionary hypotheses, it may be argued, lies in their reliance on putative animal analogues to this end: as already discussed, evidence of actual non-human suicide is signally missing. Biological processes that convincingly explain, say, insect behaviour may at best be only suggestive of hypotheses about human suicide: a distinctively human evolutionary account is required to explain what appears to be a uniquely human problem. Such a specifically human explanation of suicide has yet to be fully worked out.

Hence, the opportunity and need arise for a new model of suicide which integrates recent advances in the understanding of suicide's epidemiological correlates and which places suicide within an evolutionary paradigm specific to the human species. To meet this need is the hope and aim of this volume.

1.5 Aims of the Book

This book will attempt to formulate a coherent, evolutionary explanation for the emergence of suicide that may provide a tentative starting point for other researchers. There is no expectation of achieving a definitive account; rather, in a Lakatosian spirit, the aim is to offer a preliminary approximation (Ketelaar & Ellis, 2000; Lakatos, 1976). This being a scientific project, the hope is to arrive at a theoretical framework that fulfils traditionally accepted criteria by which scientific theories generally are assessed. Accepting that science has yet to agree on an exhaustive specification of these criteria, Kuhn (1977) selects five that, in his view, are sufficiently important and varied to cover the consensus view. First, accuracy: the consequences deducible from a good theory should agree with existing empirical findings. Second, consistency: a good theory should be integrated both within itself and externally with the accepted theories of other related domains. Third, breadth of scope: the deducible consequences of a good theory should reach far beyond the explananda the theory was formulated to target. Fourth, simplicity: a good theory should bring order to what would otherwise be viewed as unconnected phenomena and relationships. Fifth, fruitfulness: a good theory should lead the way to novel research findings, disclosing phenomena and relationships that were previously unknown or unrecognised. The outcome of this study will be assessed against these standards as part of the conclusions (Sect. 8.2 below), but the point can be made meanwhile that whatever conclusions are reached, there may well not be unanimity among readers about their worth. While his chosen criteria for preferring one theory over another may well constitute common ground across the sciences, Kuhn (1977) points out that their application by scientists as individuals is not entirely an objective matter. The need for value judgements arises from the imprecision and mutual conflicts inherent in the criteria themselves, opening the way to divergent views on their interpretation and their relative weights.

Different stances may be taken, for example, on the importance of the power of a theory to explain already known observations relative to its predictive fruitfulness. For example, a theory's predictiveness – its ability not only to generate novel empirical findings but also to predict them precisely *a priori* – features as one of four general principles selected by the entomologist Wilson (1998) as the main qualities he believes scientists look for (alongside, in his list, parsimony, generality, and