

Is suicide terrorism part of human nature?

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Abstract

Suicide terrorism has increased rapidly over the past 15 years. The fact that such suicidal self-sacrificing behavior occurs both in humans and other species suggests that there are some evolutionary roots to this type of behavior, and thus might be the case in suicide terrorism. The aim of this thesis is to explore what evolutionary theories might play a role in explaining the underlying motives of suicide terrorism. To answer this, six theories will be reviewed: individual selection, kin selection, group selection, manipulation, cultural evolution and suicidal self-sacrifice as a non-adapted side effect.

The fact that suicide terrorists intend to die and often do not have direct offspring yet weakens the suggestion of involvement of individual selection. Kin selection might play a role if the benefits for kin outnumber the costs of a human life. Lastly, suicidal self-sacrificing behavior as a non-adaptive side effect might not be likely to contribute to the explanation of the underlying motives of suicide terrorism. Contrary, group selection seems to play a role; suicide attacks are mostly performed in an organizational context. Manipulation seems to be a strategy for recruiting individuals to complete the organization's plan of a suicide attack. Cultural evolution might be the main motive for individuals and organizations to commit suicide attacks, since it seems to be an effective way of spreading cultural traits.

According to my assessment, I consider a combination between group selection, manipulation and cultural evolution most likely as the main drive behind suicide terrorism.

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1. Introduction

The number of fatalities from terrorist attacks in 2015 was the highest since the 9/11 attacks in 2001 (Luxton, 2016). On average almost two attempted Islamic State attacks occurred in Europe every month in 2015 (Modderkolk, 2016). In particular suicide terrorism has increased rapidly over the past 15 years (Horowitz, 2015; Chicago Project on Security and Terrorism, 2016). In 2013, the number of suicide attacks with lethal casualties worldwide increased with 66% compared to 2012 (Sheehan, 2014). Suicide attacks differ from ‘regular’ attacks or conflicts in that surviving the conflict is no longer a goal; instead suicide terrorists are seeking their own death in the battle. Rationalizing suicide attacks is hard, since it is difficult to conceive why a person might be willing to make the biggest sacrifice possible: the person’s own life. Accordingly, suicide terrorists are viewed as enemies that are hard to understand and therefore hard to fight (Muller, 2004). Although suicide terrorism seems to gain ‘popularity’, it is important to realize that similar self-sacrificing behavior is of all times and occurs in different cultures, as exemplified by the volunteering victims of the sacrificial cults of the Aztecs (Silbermann, 2012), the suicide missions (e.g. by Japanese Kamikaze pilots) during the Second World War (Orbell and Morikawa, 2011), or the self-burning of humans (e.g. Jan Palach in 1969) as a form of ultimate protest (Trouw, 2000; “Zelfverbranding Jan Palach”, 2006).

In this essay, behavior like in the examples above is addressed as suicidal self-sacrificing behavior and is defined as the act of an individual intentionally sacrificing itself by exposing its life to large and often mortal risks, in an attempt to achieve some kind of goal. This kind of behavior is not just difficult to reconcile with ‘common sense’, it also seems surprising from an evolutionary view. Normally, behavior that has evolved by natural selection provides a high fitness to the acting individual (actor), while suicidal behavior decreases the individual’s future reproductive success to zero. Nevertheless, can suicidal self-sacrificing behavior still (partly) be reconciled with evolutionary principles?

To answer this, I will turn my attention to the animal kingdom to investigate if some evolutionary ‘evidence’ of this behavior is present in other species. In fact, there are some species that display *similar* behavior. In some spider species, including the Australian redback spider, the male sacrifices himself during mating by being cannibalized by the female (Gage, 2005; Andrade 1996). A less deadly but still similar behavior is found in migrating salmon, who take extreme risks while migrating back to their birth-river (The royal society for the protection of birds, 2005; Cooke et al., 2006). In some ant, wasp and bee species, individuals die when they sting or attack a predator. In other ant species, every night some individuals close the nest from the outside to protect the colony overnight, but as a result, these individuals cannot get back into the nest and die at night (Tofilski et al., 2008). A behavior that is sometimes displayed by grasshoppers is jumping into the water out of the blue, where they cannot survive (Biron et al., 2005). Such unpredictable behavior is also

seen in rats, where in normal situations rats avoid cats, some rats suddenly stop avoiding cats and get caught (House et al., 2011).

The fact that this suicidal self-sacrificing behavior occurs both in humans and other species suggests that there are some evolutionary roots to this behavior, and thus this might be the case in suicide terrorism. In addition, the fact that suicide terrorism happens with very different ideas, beliefs and backgrounds suggests that there is more to the decision of committing the act than only individual background factors (Orbell and Morikawa, 2011). Therefore, this review will seek the answer to the following question: what evolutionary theories might play a role in explaining the motives underlying suicide terrorism?

The existence of the behavior in the abovenamed examples cannot all be explained the same, hence there are probably more ways in which suicidal self-sacrificing behavior in animals might have been evolved. In this essay, I will systematically review six theories in an attempt to explain suicidal self-sacrificing behavior: individual selection, kin selection, group selection, manipulation, cultural evolution and suicidal self-sacrificing behavior as a non-adaptive side effect (Table 1). In chapter 3, I will discuss suicide terrorism in the light of the six theories. Finally, I will evaluate to what extent the various explanations may contribute to the understanding of suicide terrorism in humans.

2. Evolutionary explanations for suicidal self-sacrificing behavior

In the following sections, suicidal self-sacrificing behavior will be discussed in the light of the six explanations and several accompanying examples (Table 1). At the end of each section, a suggestion is made regarding the extent to which the theory might explain suicide terrorism in particular. These suggestions will be elaborated in chapter 3.

<i>Theory</i>	<i>Description</i>
Individual selection	Behavior is selected because it increases individual fitness (fitness (expected lifetime reproductive success of the actor)
Kin selection	Behavior is selected because it increases the actor's inclusive fitness.
Group selection	Behavior is selected because it increases the survival probability and/or the ability to spread of the actor's group.
Manipulation	Behavior is selected because it increases the individual fitness of another individual (manipulator).
Cultural evolution	Behavior is selected because it increases the spread of those ideas and beliefs of the actor that caused the actor's behavior.
Non-adapted side-effect	Behavior was not the target of selection and is actually reducing fitness: still kept in the population since it is a side-effect of other fitness-enhancing traits.

Table 1. Brief description of the six theories that will be discussed in this thesis

2.1 Individual selection

Individual selection is viewed as the 'default mode' for the evolution of behavior. Without special conditions, organisms are expected to evolve behavior that maximizes its own fitness, also at the cost of relatives or group members (Lankford, 2015). Individual fitness is the individual's expected lifetime reproductive success, which is the total number of surviving offspring an individual can expect to produce during its lifetime. Considering this explanation, suicidal self-sacrifice can only occur if the costs (reduction of individual's lifetime) are compensated by an increase in the number of surviving offspring of the individual.

Self-sacrificing behavior as a possible result of individual selection can be found in several species. For example, Australian redback spider males offer themselves to being cannibalized by the female while mating. By sacrificing its life, a male increases its lifetime reproductive success because

cannibalized males have two paternity advantages over surviving males: because the process of cannibalization takes some time, the male copulates longer and fertilizes more eggs than it would have if it survived the mating. In addition; females are more likely to reject a following copulation after it consumed the first male (Andrade, 1996). All in all, self-sacrifice seems the best strategy for the spider, since this act gives it the highest chance of reproduction (high benefits) and thereby increases its expected lifetime reproductive success. Another case of cannibalization as suicidal self-sacrifice occurs in crab spiders: towards the end of maternal care, the mother sacrifices herself by allowing her offspring to consume her. In this way, the survival probability of the offspring increases, and thereby also the mothers expected lifetime reproductive success (Evans, 1998).

Besides definite self-sacrifice, many species *risk* self-sacrifice in an attempt to achieve a goal. An example for the evolution of this high-risk (almost suicidal) behavior is the migrating of salmon to their spawning grounds. Adult salmon migrate back from the sea to the mouth of the river where they were born to spawn (Royal Society for the Protection of Birds, 2005). This journey is one of the most energy-demanding and challenging phases of a salmon's lifetime. Four major challenges are waiting for the salmon to pass; 1) the switch from salt- to freshwater, 2) finishing maturation during the migration on a tight energy budget, 3) the risk of parasite infections and 4) predation risk, because several species come to the river especially to catch the migrating salmon (Cooke et al., 2006). In this case, the salmon use a high-risk, high-gain strategy. The goal of the migration is to reproduce, so if a fish does not take the risk to migrate, this results in no contribution of their genes to the next generation (genetic suicide) and thus a very low lifetime fitness. If they do take the risk, they have a chance of reproduction which, if achieved, results in high lifetime fitness (high gain). In this case, taking the risk of self-sacrifice is actually the only strategy. But note; the salmon risk *possible* self-sacrifice; yet their goal is to survive, as was not the case with the redback spiders and neither is the case in suicide terrorism.

A human example of a high-risk, high-gain strategy might be smoking and drinking in young men. Research has found that young men who smoke and drink alcohol are found more attractive by women. This might result in a higher reproductive success, but at the same time in a higher risk of dying due to health problems (Vincke, 2016). Another example of this high-risk, high-gain behavior might be participating in extreme sports. However, these two examples are slightly different than the abovenamed, because here it is about individual differences in strategy *within* a species, also known as pace-of-life syndrome. Some individuals aim for short-term benefits to gain high expected lifetime reproductive success, while others gain their fitness throughout a longer lifetime (Hall et al., 2015). Nevertheless, it is still an example where an individual takes high risks to gain some kind of benefits, in this case; higher reproductive success.

In all the abovenamed examples, the individual tries to achieve reproductive success through suicidal or high-risk behavior. In suicide-terrorism this might be the case as well, but only when the behavior results in high expected lifetime reproductive success for the terrorist or its direct offspring.

2.2 Kin selection

In general, an individual attempts to maximize its own reproduction (individual selection), but in some cases, one achieves reproductive success through genetically related kin. Since relatives like siblings and cousins partly share genes with the individual, passing on genes is also possible through the survival and reproduction of these relatives (kin). Kin selection can occur if certain behavior also effects survival and reproduction of the actor's relatives; it is possible that the actor most efficiently spreads its genes by sacrificing its own fitness while enhancing that of its relatives. In this case, behavior that disadvantages the actor can evolve if it benefits relatives, following the Hamilton's rule (1964); $b > c/r$, where benefits (b) for the kin should be higher than the costs (c) for the actor divided by the relatedness (r) between the two (Lankford, 2015).

Kin selection can be found in several bee, ant, termite and wasp species and other social insects where genetic relatedness within colonies is high. Individuals of these species often display defensive self-sacrificing behavior. For instance in bees and ants, when attacking a predator, mechanisms are triggered that are fatal for the attacker. However, these forms of self-sacrificing defense are only deployed when the nest is under attack and thus in acute danger. Contrary, the Brazilian ant species *Forelius pusillus* shows pre-emptive defensive self-sacrifice. Here, worker ants sacrifice their lives every night. At sunset, the entrance to the nest is closed and one to eight worker ants finish the closure from outside and thereby trap themselves outside. Hence, these worker ants do not survive the night and have thus sacrificed their lives in pre-emptive defense of the nest (Tofilski et al., 2008).

Since relatedness in social insects between members of a colony is very high, the behavior in the abovementioned cases might be the result of kin selection; by sacrificing their own lives, their kin's fitness increases. This *extreme* kind of self-sacrifice for kin is rarely found in mammals. This can be explained using the Hamilton's rule. It is expected that self-sacrificing behavior is selected for if the benefits are far higher than the minimum threshold, or if the costs are low. Organisms with high numbers of related kin will have the greatest advantages of the self-sacrifice. Organisms with short lifespans will have the least to lose by dying, so the lowest costs. Most mammals and especially humans have low numbers of closely related kin, long lifespans and high potential for future investment (Lankford, 2015), suggesting self-sacrifice for kin might not be an optimal strategy for humans. Therefore, it might be questionable whether suicide-terrorism is actually due to kin selection. This will be further discussed in section 3.2.

2.3 Group selection

Group selection might be a possible explanation for suicidal self-sacrificing behavior as well. It acts on the level of the group, not the individual or the genetically related kin. Group selection can occur if a trait results in a higher overall group fitness than the average individual fitness of the

separate group members. According to this, behavior that is not necessarily beneficial for the individual might be selected for if it benefits the group (Rogers, 2016). A situation in which group selection can work is as follows; if a population consists of several groups, which have war regularly, between-group selection will favor groups that have the best defense, while within-group selection favors individuals that invest the most in offspring (individual fitness). This results in a selection conflict, because individuals that invest in defense, have less time and energy to invest in offspring. An ideal model for such situations is one where the minority of the group invests in defense (or whatever altruistic act), while the rest invests in offspring (individual fitness). The individuals that invest in helping (defense), do so by sacrificing their reproductive success for the group. Consequently; most individuals in the group have high reproductive success, while in times of war the group has enough ‘soldier individuals’ to make sure the group survives.

This kind of cooperative behavior occurs, for instance, in lions. When an intruder approaches, lions form a territorial defense coalition. In this coalition, some individuals approach the intruder while others lag behind. It is shown that the lions that walk consistently up front and approach the intruder (‘defenders’) have lower fitness than the ones that lag behind. Therefore, the costs for the ‘defenders’ (altruists) are high, but the benefits for the group are presumed to be higher. Overall, groups with a good balance of altruists and non-altruists (that focus on individual fitness) are more likely to survive (Bradley, 1999).

Group selection might also apply for human suicidal self-sacrificing behavior. This will be further discussed in section 3.3.

2.4 Manipulation

Manipulation of host behavior by parasites is a widespread phenomenon. A manipulated actor (host) changes its behavior in a way that does not benefit (and often disadvantages) its own fitness. This happens as a result of manipulation by another individual (parasite) trying to benefit itself. The manipulated behavior sometimes results in suicidal self-sacrifice of the host to improve the parasite’s chances of completing its life cycle (Biron et al., 2005; Eberhard, 2001).

An example of manipulation resulting in self-sacrificing behavior can be found in the hairworm *Nematomorpha* that parasitizes insects of the Order Orthoptera, like grasshoppers and crickets. The mature hairworms live inside the insect. To complete maturation and to reproduce, the hairworm needs an aquatic environment. To achieve this, the hairworm manipulates the host into jumping in water, where the host cannot survive. In the water, the hairworm leaves the dying host and begins its search for a sexual partner (Biron et al., 2005).

Changed behavior after parasitization was already found in several insects and crustacean hosts, but not much in mammals (Biron et al., 2005; Eberhard, 2001). This is probably because the mammalian blood-brain-barrier denies access to pathogens to the central nervous system.

However, in 2011, House showed behavioral manipulation in rats. The single-cell parasite *Toxoplasma gondii* is able to cross the blood-brain-barrier in warm-blooded mammals. *T. gondii* reproduces in a cat's intestine. To get there, *T. gondii* infects rats, which results in the rat preferring cat urine odor. This behavioral change increases the chance of predation by cats and so *T. gondii* can transmit to the cat where it sexually reproduces (House et al., 2011).

Behavioral manipulation does not only occur between species, but within species as well, even within one colony. Social insect colonies often consist of two types of individuals; queens and workers. The queens are reproductive and the workers have reduced fertility and maintain the colony. In other words, the workers have a very low lifetime reproductive success: in a sense, they commit 'genetic suicide'. It is thought that this behavior occurs as a result of a phenomenon called 'queen control' (Keller and Nonacs, 1993). This might be due to physical intimidation, but lately it has become clear that queen control occurs via pheromones. In for instance honey bees, the queen produces a pheromone that inhibits ovary activation in worker bees, hence the queen is the only individual to reproduce (Peso et al., 2015).

As the examples describe, manipulation can occur between and within species. In humans, suicidal self-sacrificing behavior might be the result of within-species manipulation. However, it is most probably not the result of chemical or physiological changes, but more likely due to social or psychological manipulation: indoctrination and brainwashing. These types of manipulation focus on modifying an individual into accepting certain ideas, opinions and beliefs and to give up their own beliefs and perspectives, often in a forcible way. It is known that indoctrination is an often used strategy in religious groups, dictatorship, cults and military contexts (Baron, 2000). This might also be the case in terrorist organizations and suicide terrorism and will be discussed in section 3.4.

2.5 Cultural evolution

Up to now, the theories I have discussed involved genetic evolution in the explanation for suicidal self-sacrificing behavior. In contrast to genetic evolution, cultural evolution focusses on transmission of cultural traits like ideas, skills, values, practices, mental models and strategies. This transmission of traits occurs via social learning, instead of sexual reproduction as is the case in genetic evolution. Boyd and Richerson (2005) define culture as "information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation, and other forms of social transmission". Cultural evolution can happen within an individual's lifetime, from individuals outside the group as well as the genetic family, and can also occur horizontally within a generation. As a result, cultural inheritable traits spread faster than genetic traits and cultural relatedness is achieved rapidly; most individuals in one group display the same cultural traits (Lehmann et al., 2008).

Research has shown that cultural evolution occurs in several species; for instance, birds learn songs from neighbors and chimpanzees imitate a groupmate's "termiting" skills (Lehmann et al., 2008). However, no other species depends on cultural information as much as humans do (Henrich, 2011). Already in 1918, Ellwood stated that "culture is a distinguishing mark of human social groups and so far we know, there have never been any human groups without culture".

The spreading of a cultural trait depends on the ability of the trait to stick with an individual and "its inherent power to spread between human minds" (Strimling et al., 2009). Therefore, the idea arises that traits are transferred more effectively when the individual makes it memorable through for instance public self-sacrifice. An example that strengthens this suggestion might be the suicide of Jan Palach in 1969 as a statement against communist Czechoslovakia. Not much later, some of his fellow students did the same, and many Czechs have been inspired a lot by these acts in their opposition against the Soviet Union. That the ideas of Jan Palach and his followers are still alive today is evidenced by the fact that they are still considered national heroes and that several memorials were placed after the fall of the Soviet Union (Trouw, 2000; "Zelfverbranding Jan Palach", 2006).

An example where cultural evolution has led to a situation that would not have occurred as a result of genetic evolution is clerical celibacy. This is the requirement that priests of the Catholic Church have to remain unmarried and abstain from sexual interaction. By accepting this, they sacrifice their own reproductive success. But in return, they have more time and energy to spread the catholic beliefs, which increases their cultural fitness (Qirko, 2004).

As we have seen, humans are highly dependent on culture, cultural traits might be spread more effectively by making it memorable and cases are known where cultural evolution leads to situations that genetic evolution would not have resulted in. Taking into account that cultural evolution can easily be intertwined with other explanations, I suggest that suicide terrorism might be an effective way to spread cultural traits like beliefs and ideas and thus increase cultural fitness. This will be further discussed in section 3.5.

2.6 Non-adaptive side effect

The abovementioned explanations for suicidal self-sacrificing behavior all assume that this behavior is the target of selection. An alternative might be that this kind of behavior is a non-adaptive side effect of a trait that is under positive selection.

An example of this phenomenon might be schizophrenia (including psychosis). Individuals suffering from schizophrenia have lower reproductive success; yet, this condition still exists in the population. A potential explanation for this is that schizophrenia might be associated with a very low degree of lateralization; hand-preferences close to zero are observed more in individuals with predispositions for schizophrenia; they are able to perform equally well with both their left and

their right hand. In situations where the absence of strong hand-preference provides a selective advantage, schizophrenia might spread as a side effect of selection against the lateralization of the brain (Crow, 2000).

It might be the case that suicidal self-sacrificing behavior is (part of) a side-effect of natural selection and is not specifically selected for. However, I think this might be unlikely, because the costs of this behavior are high (death), so the trait it is a side-effect of must have really high benefits for it to not be selected against. Nevertheless, it might be a possible explanation for suicidal self-sacrificing behavior. This will be discussed in section 3.6.

3. Contribution of discussed explanations to suicide terrorism

In this chapter, the contribution of each aforementioned theory to the underlying explanation of suicide terrorism will be discussed.

3.1 Individual selection

We have seen that in several situations, individuals act to improve their individual fitness. In most cases the individual tried to achieve reproduction or survival through (risking) self-sacrifice. This might be the case in suicide terrorism as well, but by committing suicide, an individual cannot pass on any more genes or invest in offspring *after* the act (Orbell and Morikawa, 2011). Hence, suicidal behavior can only be shaped by individual selection, if this loss of future reproductive success is overcompensated by an increase in current (or past) reproductive success, e.g. by enhancing future prospects of actor's offspring.

In suicide terrorism, it might be the case that the individual's fitness is increased if the act results in higher survival chances or reproductive success for direct offspring through, for instance financial support or higher social status (Lankford, 2015). However, suicide terrorists often are young men and women around their 20s, without children yet (Miller, 2006). For example, the average age of a Palestinian suicide terrorist is 21, of the 9/11 hijackers was 24 (Dickey, 2009) and the average age of suicide terrorists in Israel is 22 (Giese, 2016). In addition, from the 19 suicide terrorists responsible for the 9/11 attacks, 6 were married or engaged, several others were seeking for wives and only 2 already had a child (Lankford, 2015).

If individual selection is an active force behind suicide terrorism, it is unlikely that this behavior is displayed before the actor has a family on its own. Therefore, I think individual selection is not part of the evolutionary explanation behind suicide terrorism.

3.2 Kin selection

In the previous chapter, we have seen examples of kin selection in several species. Kin selection might also work in humans, but only if the benefits outweigh the relatively high costs of a (young) human life. Nevertheless, it is possible that in the case of suicide terrorism kin selection plays a role. It might be so that the terrorist (thinks he) is helping his or her family by committing the suicide attack. For instance, by trying to defeat the enemy through a suicide attack, the family could gain higher fitness as a result of better survival chances. It could also be the case that the family

gains fitness by a higher social status or financial support as a result of the suicide attack (Lankford, 2015).

There are indeed situations described where the family of a suicide terrorist received a sum of money. For instance, the families of Hamas/Palestinian Islamic Jihad suicide terrorists receive amounts of money varying from \$300 to \$15,000, where \$1600 is an average Palestinian annual income (Attkisson, 2014). The money is often accompanied by elevated social status. However, in some organizations, terrorists are separated from their family and thus a reward for the family is not applicable or rewards in general are not given by the organization (for instance, Chechen Rebels and Tamil Tigers). In addition, it is known that in some communities, suicide terrorism is not approved by the family (Qirko, 2009). Nevertheless, even without approval or a payment, the motive of the suicide terrorist might still be protecting and increasing the safety for their family. However, according to Orbell & Morikawa (2011), in most cases the attacker's family is not uniquely threatened and more likely to survive as a result of the suicide attack.

Considering the above, I think increasing the fitness of close relatives might play a role in some cases of suicide terrorism, but it is most likely not the explanation in all (or the majority of) the cases and therefore it is questionable whether kin selection is a driving force behind the maintenance of suicide terrorism.

3.3 Group selection

Following group selection, behavior that disadvantages the individual, but benefits the group can be selected for when this results in a high overall group fitness. According to this theory, an ideal group has a minority of individuals acting in favor of the group, while the majority acts to increase its individual fitness. Although present-day terrorist organizations cannot be viewed as a 'group', but more as a sub-culture, behavioral tendencies underlying present-day suicide terrorism may still have been shaped by group selection. Nowadays, role of the 'group' might have been taken over by (terrorist) organizations.

Even though many ideologies and religions can encourage the same behavior (suicide terrorism), it almost always occurs in organizational contexts (Qirko, 2009). This suggests the requirement of a group in order for this behavior to happen. In addition, most terrorists are not suicide terrorists, this is in consistency with the ideal model of group selection; a minority sacrifices themselves (Lankford, 2015). Even though the act might have disadvantages for the terrorist himself, the self-sacrifice is the ultimate gift that he can give for his cause and group. As Miller (2006) said: "The terrorist physically dies, but his group lives on, and in extend, so does he".

It is important to note that suicide attacks might be irrational or fanatical individual acts, but the organization that recruits and directs the attackers are definitely not. Terrorist organizations often

fight against governments or strong military armies with a discrepancy in resources. Therefore, recruiting and training suicide terrorists is important to organizations because a suicide terrorist is one of the most effective and reliable weapons possible and thus form an effective group defense (Qirko, 2009). Research has shown that terrorist organizations maximize the payoff; when the attacks do not reach sufficient kill ratios, the organization will eventually stop planning suicide attacks (Miller 2006). This suggests that suicide attacks are only used when they benefit the group. Apparently, suicide terrorism is a good group strategy and suicide attacks almost always appear in a bigger context or campaign (Pape, 2003).

All the above makes clear that suicide terrorists are part of a group and view ‘the others’ as an out-group. In addition, the main reason that suicide attacks are performed more and more is that it works (Pape, 2003). Apparently, suicide terrorism is a good strategy to achieve the main goals of the group (Miller, 2006) and therefore, sensitivity and willingness to perform this kind of behavior might be under frequency-dependent selection in a population. This makes it presumable that group selection plays a role in suicide terrorism

3.4 Manipulation

As we have seen in the previous chapter, manipulation can occur both between and within-species. This might also be the case in humans and especially suicide terrorism. Suicide may not at all be in the interest of the terrorist, but in the interest of others. Individual selection leading to manipulative behavior, inducing others to work on one’s own behalf, is very strong. Many forms of psychological pressure and emotional blackmail have probably evolved because of this. Manipulation in the form of indoctrination is known to be a frequently used tactic in terrorist organizations and military contexts (Miller, 2006; Security Service MI5, 2016).

Typically, indoctrination knows several phases, Baron (2000) names the softening-up, compliance, internalization and consolidation phase. In the softening-up phase, the individual is isolated from friends and family. The goal in this phase is to ‘break’ the individual by confusing, exciting, tiring, disorientating and sometimes abusing or frightening them. This phase can take hours to days or even weeks and can be subtle or more extreme. The point is that a period of stress increases the effectiveness of the further indoctrination; an assault on the individual’s attitude, beliefs and values. The second phase, compliance, is meant to see how the individual reacts on the group and the requested behaviors. In the internalization phase, the individual starts considering some of the group’s values and beliefs. This is also called the changing stage (Schein et al., 1961). The last phase is the consolidation. This is the phase where things become ‘final’ or ‘definite’. The individual isolates himself from out-group members and gets further indoctrinated by selective exposure to information. In this phase, the individual fully accepts the group’s doctrine and policy. The completed indoctrination process results in “an individual that is highly resistant to persuasion from those outside the group” (Baron, 2000). Such an indoctrination process clearly is a form of

psychological manipulation; because of this extreme and structured process, the individual changes its beliefs, morals and behavior.

When it comes to suicide terrorism, the organization wants to take as much uncertainty away as possible. The only thing the suicide terrorist has to do is show up and push the button, the rest is arranged for them. Before the suicide terrorist is even selected, the target is chosen and a complete plan is already developed. The terrorist is selected by recruitment and screening and is prepared for the mission by training and indoctrination. Leaving all the details and preparation to others is a way to make sure the terrorist follows through. The more one gets in touch with preoperational actions, the more moments of doubt one might have (Miller, 2006). In addition, the indoctrination process includes several “points-of-no-return” like writing last letters to loved ones, video-taping a goodbye message or saying final prayers. Some organizations reinforce the commitment by naming the terrorists “the living martyr” (Miller, 2006; De la Corte Ibáñez, 2014). The indoctrination, planning and rituals are ways in which the individual is manipulated into performing the suicide attack and to prevent him from quitting untimely.

Taking all the above into account, manipulation might be an effective way for organizations to get the picture complete; they have a plan and campaign that are part of a bigger context, all they need is an individual that is willing to sacrifice himself. It seems convincing that indoctrination is the method to achieve this. In addition, it is possible that the indoctrination process to become a suicide terrorist is not equally effective on anyone and that certain individuals are more sensitive to it.

3.5 Cultural evolution

The previous chapter showed that humans are highly dependent on culture, cultural traits might be spread more effectively by making it memorable and cases are known where cultural selection leads to situations that would not have resulted from genetic selection (Henrich, 2011; Strimling et al., 2009; Qirko, 2004). Since suicide terrorism is such a complex behavior, it is likely that this has not only been shaped by genetic evolution. Terrorism is strongly dependent on the social and political situation and almost always involves the urge of spreading some kind of political or religious message. This suggests that suicide terrorism most likely belongs for a large part to the realm of cultural evolution: the spread of cultural traits like ideas and beliefs through indoctrination and social learning.

First, the cultural embedding of suicide terrorism might play a role on the individual level. Several different individual motives can play a role in the decision to perform a suicide action; at least part of the decision comes from anger and resentment at the “out-group” (Miller, 2006). This shows that personal historical, cultural, political or religious perceptions might influence the individual. The way a culture and community view life, death and self-sacrifice for the community can influence individuals and their attitude regarding suicide terrorism (Qirko, 2009). For example in

the case of the Japanese Kamikaze pilots, it was expected by the military and it was culturally encouraged to sacrifice yourself for the country (Orbell and Morikawa, 2011). In Palestinian communities, suicide terrorists are often celebrated and recognized as heroes and freedom fighters by their family and community (Qirko, 2009). In addition, Miller (2006) points out that in most religions and secular mass political movements some kind of afterlife is promised after self-sacrifice for the cause. This afterlife often includes ‘immortality power’ and ‘eternal existence’. It is possible that these religious and cultural aspects could play a role in the decision of an individual to commit a suicide attack or that these aspects are used during the indoctrination process to persuade the individual.

On the other side of the suicide attack is the effect it has on the cultural fitness of the terrorists’ ideas and beliefs. Terrorist organizations seek attention from their audiences and try to communicate with the target, promote a religious agenda or push for political goals through terrorist attacks (Jetter, 2014). Media attention is an important vehicle to achieve this and to influence the public opinion. Hence, getting media attention is one of the main goals of terrorist attacks (Walsch, 2010).

It is shown that attacks receive more media coverage when they involve many victims, the hijack of an aircraft, known perpetrators and Western targets (Walsch, 2010). In addition, suicide attacks receive significantly more media attention than non-suicide attacks (Jetter, 2014). Studies show that media coverage serves as an outlet for the terrorists to reach a larger audience, communicate their grievances and beliefs and that certain individuals are more likely to sympathize with the terrorist organizations as a result of media attention (Walsch, 2010).

Summarizing, suicide terrorism may be an effective way to spread the terrorists’ beliefs and ideas. Accordingly, I consider cultural evolution as a convincing and valuable explanation for suicide terrorism, possibly in combination with other theories.

3.6 Non-adaptive side effect

As we have seen in the previous chapter, some mental illnesses are thought to be a non-adaptive side-effect of an adaptive trait. In fact, it is conceivable that the majority of mental illnesses are such side effects. In the context of suicide, this is relevant, since more than 90% of the people committing suicide suffer from a diagnosable mental illness. The most common mental illnesses underlying suicide are depression, bipolar disorder, schizophrenia and substance abuse disorder (Screening for Mental Health, Inc, 2016; Washington State Coalition for Mental Health Reporting, 2016). Suicidal tendencies as a result of mental illness might be an alternative explanation for suicide terrorism.

Debate persists about the psychology of suicide-terrorists. Are they mentally 'healthy' and willingly sacrifice themselves or do they suffer from personal crisis and mental health problems which results in suicide (Lankford, 2015)? The general consensus is that suicide terrorists do not have significant psychopathology. Research suggests that suicide terrorists are not more likely to suffer mental illness or psychological trauma than 'an average person'. Furthermore, it is thought that 'suicidal tendencies' is not a selection criterion an organization uses for recruiting suicide terrorist, in fact; if an organization suspects such a tendency it is more likely that this individual is not recruited for the mission (Qirko, 2009). Despite this, several critical assessments do not fully agree with the fact that suicide terrorists are not mentally ill (Sheehan, 2014; Lankford, 2011). However, if suicide terrorists suffer in fact mental health problems leading to suicide, this does not explain why these individuals commit suicide in such a violent and harmful way. Nevertheless, it might still be possible that mental illness or psychological instability makes individuals more sensitive to suicide terrorism or manipulation.

It can also be the case that suicidal self-sacrificing behavior as a whole is a non-adaptive side effect, of for instance 'mildly radical behavior', which may be adaptive under several circumstances. However, this is just speculation and without further research I cannot draw valuable conclusions based on this suggestion.

4. Conclusions

The aim of this thesis was to evaluate which evolutionary theories might play a role in explaining suicide terrorism. The fact that suicide terrorism happens with very different ideas, beliefs and backgrounds suggests that there is more to the decision of committing the act than only individual background factors (Orbell and Morikawa, 2011). To evaluate what might be the underlying motives of suicide terrorism, I considered six different types of explanations. My evaluation is summarized in Table 2.

In principle, the behavioral tendencies underlying suicide terrorism might have been shaped by individual selection. However, I consider this explanation unlikely, because suicide terrorism is typically committed at an age when the terrorist has no children yet. Accordingly, his death cannot be compensated by a higher probability of survival and reproduction of his children. Kin selection might explain self-sacrificial human behavior under some circumstances, but I do not consider it likely as a general explanation for suicide terrorism, because the benefits should be really high to outnumber the relative high costs of a human life. In addition, the fact that some families do not receive benefits makes kin selection less likely to be a driving selection force behind suicide terrorism. Lastly, I think mental illnesses or suicidal tendencies do not influence the decision to commit a suicide attack. A large body of literature shows that suicide terrorists are not more or less likely to suffer mental illness than ‘an average person’. An alternative explanation might be that suicidal self-sacrificing behavior is a non-adaptive side effect of for instance mildly radical behavior. However, this is not established yet and future research might be valuable.

In contrast, I consider group selection plausible as a part of the underlying explanation of suicide terrorism, because a suicide attack is almost always performed in the context of a group or organization. Group selection only selects for behavior that benefits the group and as this thesis showed, suicide terrorism does. Therefore I concluded that sensitivity and willingness to display suicide terroristic behavior might be selected for in a group. However, I think these individuals need some kind of encouragement to actually perform the act. This encouragement can be provided by manipulation of the individual, since it is an effective way to recruit soldiers for the cause and manipulate individuals into actually committing the suicide attack. In the process of manipulation, I think cultural aspects and differences between the group and the ‘out-group’ are exploited to rationalize the act and persuade the terrorist.

Furthermore, I think cultural evolution plays an overarching role in suicide terrorism. As I argued before, terrorism is strongly dependent on the social and political situation and almost always involves the urge of spreading some kind of political or religious message. On the individual level, culture and accordingly cultural encouragement can make an individual feel important, which can be part of the decision, or at least make an individual more vulnerable and sensitive for manipulation. Also, cultural beliefs and the important feeling this mission may give the terrorist can be ways to rationalize what he is about to do; killing himself and as much others as possible in

a terrorist attack. On group-level, suicide attacks result in a fast cultural evolution. Suicide terrorism turns out to be a great way to effectively spread ideas and gain support as is also showed by the amount of media coverage. As result, the terrorist's cultural fitness increases rapidly. And that is, in the end, what terrorists want; to propagate their cause and hopefully get more sympathizing soldiers to join the organization and thus.

According to my assessment, I consider it most likely that the main drive behind suicide terrorism is a combination between the willingness of some individuals to commit a suicide attack resulting from group selection, reinforced and exploited by manipulation, with the overarching goal of spreading the terrorist's (or its manipulator's) ideas and beliefs and thus increasing cultural fitness.

The outcome of this thesis can be important for counterterrorism. As I showed, suicide terrorism might be a good strategic choice for groups to overcome a discrepancy in military resources and therefore is maintained. Counterterrorism might want to reconsider the military force as a reaction to terrorist attacks, as it is possible that this reaction causes an opposite effect. In addition, this thesis showed that media attention is a main goal for terrorist organizations and suicide attacks gain more media coverage than 'normal' attacks, which makes suicide attacks a better strategy for the organization. Media companies might want to reconsider the time and attention they give terrorism as it is possible that this reinforces the organization's strategy (suicide attacks) and therefore this strategy might be maintained.

<i>Theory</i>	<i>Description</i>	<i>Who benefits?</i>	<i>Examples</i>	<i>Can it explain suicide terrorism?</i>
Individual selection	Behavior is selected because it increases individual fitness (fitness (expected lifetime reproductive success of the actor))	Actor's genes (actor = executor of the behavior)	Cannibalized Redback spider, Migrating salmon, high-risk behavior humans	Only in exceptional cases
Kin selection	Behavior is selected because it increases the actor's inclusive fitness.	Copies of actor's genes that are present in the actor's relatives	Defense in social insects	Possibly partly In a restricted number of cases
Group selection	Behavior is selected because it increases the survival probability and/or the ability to spread of the actor's group.	The copies of the actor's genes that are present in the other group members	Coalition defending in lions	Likely
Manipulation	Behavior is selected because it increases the individual fitness of another individual (manipulator).	Genes of the manipulator	Hairworm-grasshopper, rat-cat, social insects: queen-worker	Likely
Cultural evolution	Behavior is selected because it increases the spread of those ideas and beliefs of the actor that caused the actor's behavior.	Actor's beliefs/ideas/cultural traits	Social learning in birds, apes and humans	Likely
Non-adapted side-effect	Behavior was not the target of selection and is actually reducing fitness: still kept in the population since it is a side-effect of other fitness-enhancing traits.	No one	Schizophrenia in humans	Probably not

Table 2. Overview of discussed theories with short description, who profits, examples and conclusion about the contribution to suicide terrorism.

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