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The Education of Islamist Extremists

ON CHRISTMAS DAY 2009, UMAR FAROUK ABDULMUTALLAB, A TWENTY-three-year-old Nigerian man, arrived from Ghana into Amsterdam's Schiphol airport where he boarded Northwest Airlines Flight 253 to Detroit. As the airplane approached its destination, Abdulmutallab disappeared for twenty minutes into the lavatory. Back in his seat, he started fumbling around with his underwear. Neighboring passengers saw his trousers on fire and Jasper Schuringa, a Dutch film director, jumped on Abdulmutallab and subdued him, while flight attendants rushed to the scene with a fire extinguisher. The explosive device he had hidden in his pants failed to detonate and Abdulmutallab was arrested. Authorities discovered that he had been in contact with Al-Qaida elements in Yemen. Just a year earlier Abdulmutallab had received a degree in mechanical engineering from University College London.[1]

Two months before Abdulmutallab's attempt, on 13 October 2009, Mohamed Game, a thirty-seven-year-old Libyan living in Italy, blew himself up with two kilos of nitrate at the entrance of the Caserma Santa Barbara, an army barracks in Milan. This was the first and thus far only suicide attack attempted in Italy, and Game might have been a "lone wolf" operator, at most a member of a small local network. Game—who lost his right hand in the attack and is now serving a fourteen-year sentence—has a degree in electronic engineering.

Exactly three months before Game's failed attack, on 13 July 2009, a German court sentenced forty-seven-year-old German Pakistani Aleem Nasir to eight years in prison for his role as an Al-Qaida facilitator in Europe. Nasir had been traveling regularly to the tribal areas in Pakistan, supposedly to trade in semiprecious stones but apparently to transfer money to, and coordinate European recruitment for, Islamist militant groups. Nasir is said to have been enlisting a number of German Muslims for jihad, among them German Moroccan Bekkay Harrach, who would become infamous—also in 2009—for his videotaped threats of jihad against the German government, apparently recorded in a hideout in Pakistan. Nasir holds a degree in mechanical engineering while Harrach had

1 *BBC News*, 7 January 2010.

begun college studies of laser technology and mathematics before dropping out to take a part-time job in a mosque in Bonn.[2]

Apart from being male and of Islamic faith, these four men have little in common. They vary in terms of nationality, age, the Western country with which they had most contact, and even the extremist network they were part of. They also differ in marital status: Game, Nasir, and Harrach had wives and children; Abdulmutallab did not.

Their careers vary greatly, too. Nasir had worked at an energy research institute in Karlsruhe before being fired for supposed extremist statements, after which he worked as a gem trader. Game, despite his degree, had a history of underemployment and was in debt, while Harrach lived off odd jobs. Abdulmutallab never even began a career, jumping straight from his studies into extremist activities.

The only thing they have in common is having studied engineering.

As one would expect there are militant Islamist university or college graduates who have not had successful careers after graduation: Faisal Shahzad, the Pakistani man who left an SUV packed with explosives near Times Square in Manhattan on 1 May 2010, is said to have been "unemployed and bankrupt at the time of his arrest," though it is not clear whether his progressive radicalization was the effect or the cause of his unemployment.[3] Wadih El-Hage, a Lebanese man who is serving a life sentence in the United States for his involvement in the 1998 bombings of U.S. embassies in Africa, held minimum-wage jobs in the United States as a city custodian and auto mechanic, despite having university training as an urban planner.[4]

However, other extremists abandoned successful careers to devote themselves to the cause. Abdul Subhan Qureshi, leader of the Students Islamic Movement of India, who is wanted in India for various attacks, including the ones on the Mumbai trains on 11 July 2006, left his wife, three children, and a thriving occupation. Qureshi joined Radical Solutions, a computer firm in South Mumbai, in November 1996. According to his coworkers, Qureshi was an exceptional worker: "He handled several major independent projects, including an intranet for Bharat Petro-Chemicals carried out by Wipro in 1999, and then joined Datamatics." In just three years, his salary quadrupled. In a letter dated 26 March 2001 he resigned, stating, "I wish to inform you, that I have decided to devote

2 *New York Times*, 23 September 2007; *Der Spiegel*, 6 April 2009; *Frankfurter Allgemeine Zeitung*, 20 September 2009; Raffaello Pantucci, "Bekkay Harrach: The Face of German Terror," *Terrorism Monitor* (Jamestown Foundation), vol. 7, no. 30.

3 *New York Times*, 4 May 2010.

4 PBS *Frontline*, "A Portrait of Wadih El-Hage," www.pbs.org/wgbh/pages/frontline/shows/binladen/upclose/elhage.html.

one complete year to pursue religious and spiritual matters."[5] For other extremists their careers mattered less because they came from very privileged backgrounds: underpants bomber Abdulmutallab is the youngest of the sixteen children of Alhaji Umaru Mutallab, former chairman of First Bank of Nigeria and former Nigerian Federal Commissioner for Economic Development, and lived in a luxury apartment in Marylebone while studying for his engineering degree in London.[6]

And yet, despite their deeply dissimilar employment histories, Shahzad, El-Hage, and Qureshi all have engineering degrees, just like Abdulmutallab and the others. Shahzad "enrolled at the University of Bridgeport, where he received a bachelor's degree in computer science and engineering in 2000, followed by a master's in business administration in 2005."[7] El-Hage studied urban planning at the University of Southwestern Louisiana in the 1980s, interrupted by spells of jihadist training in Afghanistan.[8] Qureshi for his part "obtained a diploma in industrial electronics [in 1995], and landed a part-time job at String Computers in Mazgaon. Later, in 1996, he went on to earn a specialised software maintenance qualification from the CMS Institute in Marol."[9]

Socioeconomic background, age, country of origin or relocation, group of affiliation, employment and family situation—all these features vary among the men discussed thus far. The only feature they share is a degree in higher education, in particular a degree in engineering. This is doubly puzzling when set against commonsense expectations. While we readily accept that the dispossessed are natural candidates for extremism, we are at a loss to comprehend why well-off, educated men should join the ranks of jihad. And why would individuals with a technical mind and training in modern technology have a penchant for a movement at once violent, religious, and in many cases, as we will see in chapter 4, permeated by antiscientific beliefs?

At the Origins

Evidence of this link is not limited to recent cases. It spans three decades and three continents and appears in connection with notorious attacks. Mohamed Atta (Egyptian) and Khalid Sheik Mohammed (Kuwaiti), leading figures in the 9/11 plot, both studied technical subjects: one urban

5 Praveen Swami, "The Hunt for the Indian Mujahideen's 'al-Arbi,'" *The Hindu*, 13 September 2008, www.hindu.com/2008/09/13/stories/2008091355761100.htm.
6 *Wall Street Journal*, 29 December 2009.
7 *New York Times*, 4 May 2010.
8 "A Portrait of Wadih El-Hage."
9 *The Hindu*, 13 September 2008.

planning in Hamburg, the other mechanical engineering in the United States. In fact, of the twenty-five individuals directly involved in the 9/11 attacks, eight were engineers. Engineers are, moreover, found right at the beginning of modern Islamist militancy. In 1970s Egypt, three groups considered part of the beginning of modern jihadism had been started or were led by individuals who had a technical education. Al-Takfir wal-Hijra, which was involved in the assassination of a cabinet minister, was founded in 1969 by Shukri Mustafa, an agricultural engineer and former member of the Egyptian Muslim Brotherhood. Shukri was radicalized during his incarceration in the Tura prison and Abu Zabal concentration camp in Egypt. The second group—known as the Military Academy Group for its violent occupation of the Egyptian Technical Military Academy in April 1974, from where it launched a failed attempt to march on the ruling party's headquarters—was founded in the 1970s by Salih Siriyya, a Palestinian with a doctorate in the teaching of science (Ibrahim 1980; Kepel 1985). Siriyya, too, had been imprisoned. Finally, an electrical engineer, Muhammad Abd al-Salam Faraj, played a pivotal role in the group al-Jihad, which was responsible for the assassination of President Sadat in 1981 and became the most notorious successor to the earliest Egyptian groups (Nesser 2004; ICG 2004). Saad Eddin Ibrahim, an Egyptian sociologist who was the first to study the early violent Islamists, interviewed thirty-four members of two of these groups, the Military Academy Group and Al-Takfir, who were imprisoned in the late 1970s. Twenty-nine of them were either university graduates or students, and of the twenty-five for whom he reports their area of study, nine were engineers, seven were doctors, five were agronomists, two were pharmacists, two were studying technical military science, and one was studying literature (Ibrahim 1980, 1982).

Engineers were also members of radical student groups in Egypt in the 1970s called Gama'at Islamiyya. Ayman al-Zawahiri, who later gained worldwide notoriety as bin Laden's partner and successor at the helm of Al-Qaida, was a member of one of them. Abdallah Schleifer, an American Jew who is now a professor of media studies at the American University in Cairo and converted to Islam in the 1960s, made Zawahiri's acquaintance in 1974 when working for NCB news in Cairo. When they first met, Zawahiri, then at medical school, gave Schleifer a tour of the campus: "during the tour, Zawahiri proudly pointed out students who were painting posters for political demonstrations, and he boasted that the Islamist movement had found its greatest recruiting success in the university's two most élite faculties—the medical and engineering schools. 'Aren't you impressed by that?' he said" (Wright 2002).

Indications of the link between radical Islamism and engineering are also found beyond the Middle East. We have already mentioned Abdul Subhan Qureshi, the Indian computer engineer. Two of the three men

who in 1987 founded Lashkar-e-Taiba, a Sunni fundamentalist Pakistani group that fights against India's sovereignty over the State of Jammu and Kashmir, were professors at the University of Engineering and Technology of Lahore, albeit not engineers themselves.[10] While appealing to madrasa students and the disenfranchised, Jemaah Islamiya in Southeast Asia also recruited "many technical faculty members, including architects, engineers, geophysicists, chemists, and robotics engineers" (Abuza 2006: 78). The three leading suspects in the September 2004 bombing of the Australian Embassy in Jakarta had an engineering background. According to a Tunisian professor of the history of Islam, 60 percent of salafi-jihadists in his country are trained as engineers.[11]

While the groups mentioned thus far are made up of Sunnis, the phenomenon extends to Shiite Islamists too: engineers were prominently represented in Mahmoud Ahmadinejad's radical 2005 cabinet,[12] and the former Iranian president himself trained as a civil engineer. While he is not a militant, his rhetoric as well as his biography reflect radical leanings: he was among the many engineering students at the University of Science and Technology in Teheran who played a very active role in the 1979 Islamic revolution.[13]

Hezbollah, the Lebanese Shiite group, also has a strong link with engineers. Soon after it was founded in 1982, Hezbollah established Jihad al-Binaa ("construction jihad"), an organizational branch devoted to the reconstruction of civil infrastructure and private housing. According to Hezbollah expert Judith Palmer Harik, "this is an interesting organization because it is chock-full of professionals—contractors, engineers, architects, demographic experts."[14] Representatives for Jihad al-Binaa estimate that more than two thousand of their engineers and architects have been involved in the reconstruction of Lebanon since the war with Israel in August 2006, which, considering that the estimated total Shiite male labor force in Lebanon likely lies below three hundred thousand, is a large number indeed.[15]

10 Zafar Iqbal and Hafiz Mohammad Saeed founded Markaz Dawa Al Irshad, which is Lashkar-e-Taiba's political wing. The third founder was Abdullah Azam of the International Islamic University: http://en.wikipedia.org/wiki/Markaz_Dawa-Wal-Irshad; www.hinduonnet.com/businessline/2001/01/05/stories/040555ra.htm.

11 Mohamed Lahmar, "Tunis: Les djihadistes sont aux 2/3 des ingénieurs," *African Manager*, 24 May 2013, www.africanmanager.com/151248.html.

12 http://secularcaniranik.blogs.com/scaniranic/2005/08/whos_who_in_ahm.html.

13 Goudarz Eghtedari, personal communication with the authors, July 2006.

14 www.finalcall.com/artman/publish/article_2940.shtml.

15 This estimate is obtained considering that the total Lebanese male labor force is, according to the World Bank, about 700,000 (2004) and that Shiites are about 40 percent of the Lebanese population. See http://devdata.worldbank.org/genderstats/genderRpt.asp?rpt=profile&cty=LBN,Lebanon&hm=home.

A Systematic Test

Several scholars have mentioned the link between radical Islam and science and engineering[16] but more as an oddity than as anything that could help us understand the phenomenon. A few have speculated about what might explain it,[17] but no one has attempted to find a systematic confirmation of the phenomenon. In fact, no one since Russell and Miller (1977) has published any research on the type of higher education extremists, whether Islamist or otherwise, receive. The few studies that document levels of education are limited and include only small or partial samples.[18]

To discover whether the overrepresentation of graduates in general and engineers in particular can be confirmed by more than anecdotal evidence, we compiled a list of 497 members of violent Islamist groups in the Muslim world active since the 1970s. It includes almost exclusively men for the simple reason that they are the overwhelming majority of extremists.[19] We drew from a variety of sources. We took lists of names included in academic literature, we asked colleagues, we combed through government documents, and we visited websites of radical organizations themselves. Then we conducted research on each person to gather additional biographical data in news archives in several languages, online sources, and further official documentation.[20] We mainly sought data on each person's level and type of education but also gathered information on age, socioeconomic background, international mobility, function within groups, and other qualitative biographical information. We supplemented this data-gathering effort with a daily survey of major international and Middle Eastern newspapers from 2004 to early 2010 to record, verify, and research new names as they appeared.

16 Bergen and Pandey 2005; Hoffman 1995; Huntington 1996: 112; Sageman 2004: 76; Schulze 1990: 22; Wickham 2002: 1; Wright 2006: 301.

17 Abuza 2006; Bergen and Pandey 2005; Sageman 2004: 76; Schulze 1990: 22; Waltz 1986.

18 Bergen and Pandey 2006; Krueger 2007; Berrebi 2007; Hegghammer 2006. See also chapter 2.

19 We found two women: Aafia Siddiqi, an MIT-trained biochemist working as an Al-Qaida courier who was tried and convicted in the United States in early 2010 and sentenced to eighty-six years in prison, and Hila al-Qusair, an alleged fund-raiser for Al-Qaida in Yemen.

20 We searched for biographical information on these individuals in Lexis Nexis and Factiva news databases and on Google. We also searched many other news media in various languages, as well as a series of online databases, such as Global Jihad and Global Security. All websites were consulted between September 2009 and January 2011.

The list of names includes individuals who grew up in countries that have either a Muslim majority or an indigenous Muslim minority, all of which are non-Western.[21] The list does not include violent members of groups born or bred in a Western country, which we investigate in a separate sample in chapter 3.[22] The median year of birth of the three hundred cases whose ages we could establish is 1968. This implies that the median year in which those who went to university started their courses is 1986–87, with a spread ranging from the mid-1950s to the late 1990s.

Our sample consists of members of groups that manifest an Islamist ideology of some kind *and* that employ violence in pursuit of their aims. In cases in which the involvement of a given individual was not certain, we erred on the side of caution. For instance, we did not include prisoners at Guantanamo with the exception of the few among them whose involvement in violent groups was confirmed by other sources.[23]

Our list is not a random sample of the Muslim world's Islamist extremists, and it does not cover all areas with a presence of Islamist militancy. It leaves out or underrepresents groups in South Asia and North Africa, for instance. It also excludes larger insurgent groups like Boko Haram in Nigeria, the Shabab in Somalia, and the Taliban in Afghanistan, which operate in a different strategic context of less asymmetric conflict.

However, the sample spans three continents and three decades, allowing us to investigate how far the phenomenon reaches in both space and time. The list includes individuals from thirty-five nationalities from a dozen larger groups and almost twice as many smaller groups, which injects ideological and organizational variety. The sample includes locally oriented groups struggling against authoritarian regimes (such as Egyptian Takfir wal-Hijra) or foreign occupation (such as Hamas), as well as global jihadists pursuing a millenarian anti-Western struggle (such as Al-Qaida and its franchises).[24] The list includes members of both small cells

21 By Western we mean North American and Western European.

22 Group affiliation of radicals is the primary criterion we used for selecting individuals into the two samples, so as to avoid dividing cohesive groups into different subsamples. In some cases, group membership straddles the Islamic and Western worlds, yet all of these are still primarily anchored in one or the other.

23 We excluded individuals whose culpability remains unclear as well as individuals without educational information who are not clearly linked to any group. We also left out groups for which we failed to find educational information on any single member. The latter two categories amount to 124 cases; with the progressive widening of our search, we were increasingly focusing on badly documented groups. Including these cases in our estimations of education levels and engineers' overrepresentation in the sample would not materially change the results. As soon as educational information was found on at least one member, we included the whole group concerned, even if that meant adding many cases with missing data.

24 For a classification of different types of Islamist militancy, see Hegghammer 2009a.

(such as the October 2004 Sinai bombers in Egypt) and larger clandestine networks (such Jemaah Islamiya in Southeast Asia). Many of these groups are well-known in the West, but others, such as the Indian Mujahedeen, are known mostly to specialists. Variation in geography, group strategy, and ideology are important because they allow us to put the link between extremism and higher education in general and engineering in particular through a stricter test—to see whether it holds independently of the groups' specific makeup or whether it is more common in some types of groups than in others.[25]

Education Levels

Out of the 497 individuals in our sample, we found some biographical information for 436 and educational information for 335 (figure 1.1). Of these, only 28 had less than a secondary education and 76 had completed secondary education (including madrasas).[26] Two hundred thirty-one had undertaken higher education, whether finished or unfinished, and of these at least 40 studied in Western countries.

The share of individuals who undertook higher education is remarkable: 69 percent, if we consider only those in the sample whose education we know about (231/335). And even if we assume that *none* of the individuals whose education is unknown had higher education, the share of those with higher education would still be a hefty 46.5 percent (231/497).[27] The well-known cases of highly educated individuals who carried out violent acts—for example, the master bomber of the 2004 and 2005 Bali attacks, Azahari Husin, was an engineer with a PhD from the University of Reading and a lecturer at the Technical University of Malaysia, while Ramadan Abdullah Shallah, a leader of Palestinian Islamic Jihad, received his PhD in economics at the University of Durham—are just the tip of a well-educated iceberg.

We cannot, however, rule out the possibility that even the lower percentage is an overestimate because proportionally more graduates might have ended up in our sample. Who is included in our list *and* the information we found on these individuals are a function of the public avail-

25 Hezbollah is one important group where we found practically no individual-level data on the education of its members. Given the organization's size, this might seem odd, but the secrecy of its governance structures and leadership makeup is a well-known and frustrating fact among Lebanon specialists.

26 In cases in which only "secondary education" was mentioned in our sources, we assumed it had been completed.

27 If the denominator included members of all groups on which we found no information at all (see footnote 23), the share would still be 37.2 percent.

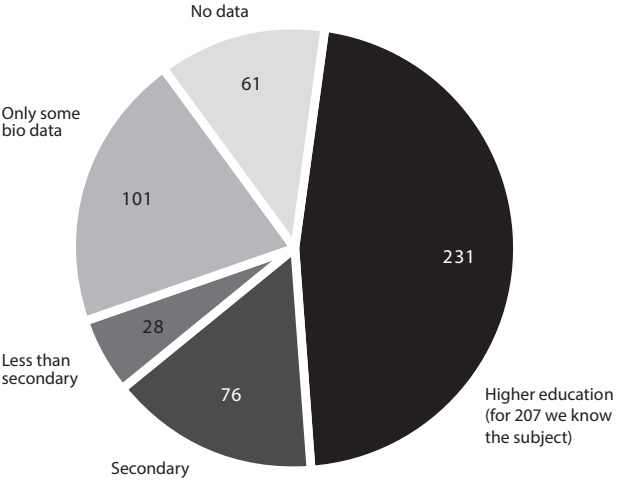

Figure 1.1: Levels of education in the Muslim world sample (497 individuals).
Source: Muslim world sample.

ability of data. This in turn depends largely on whether the individuals came to the attention of the authorities and media because they were killed, captured, or investigated. Since university graduates may hold positions that might expose them to a greater risk of detection than do nongraduates, they may also be more likely to enter the sample.

We were able to establish that at least 169 members of our sample exerted a leadership role in their organization or group—no less than 34 percent of the total sample, making this a plausible bias. It may obtain particularly among bigger groups in the sample, such as Jemaah Islamiya in Indonesia or Hamas in Palestine, whose total membership is much larger than the number of individuals in our records. In the case of smaller groups, however—such as the 1970s Egyptian groups and the international jihadi cells we have included—the majority of actual members *are* in our sample, somewhat mitigating the bias. If educational levels are broken down by group (see table 1.7), the members of the more exhaustively documented groups have similar levels of education as the members of the partially sampled ones.

The difference between the levels of education in the populations from which the sample is drawn and the levels of education in the sample itself is so dramatic that even a marked selection bias could not plausibly explain it: the rate of tertiary enrollment in all countries in the sample in 1987—

when the median case in our sample would have entered university—was 11.3 percent (weighted average).[28] The odds of being educated are thus, at the very least, more than six times higher in our sample than they are in the relevant population.

Although we cannot say by how much with precision, there is little doubt that violent Islamist radicals outside of mass insurgency and civil war settings are vastly more educated than their compatriots. Previous studies have highlighted the high levels of education among specific groups of Islamist militants.[29] The data presented here confirm the phenomenon in a much larger and diverse sample. Although in recent years radical Islamist movements seem to have undergone a process of "proletarization,"[30] looking at the last three decades one finds a strong overrepresentation of the highly educated almost wherever one chooses to look.

Considering the view often taken of such rebels—that they are poor, ignorant, or have nothing to lose—it is surprising to find that so many individuals with university degrees should join militant Islamist movements, given both the personal costs involved and the supposed backwardness of Islamist ideologies. We will come back to this in chapter 2.

Education Types

Of those who attended university, who studied what? Before revealing our results we need to mention that throughout this book we use the same *seven disciplinary groupings* when presenting the types of education for all extremists—Islamist extremists in this and the next chapters and left-wing extremists, anarchists, and right-wing extremists in chapter 5. Our categories include, first, the "big four" degrees, which rely on established knowledge and whose holders typically apply it to professional fields: engineering; medicine; law; and economics, business, and administration. We then further group other disciplines into three clusters. These disci-

28 UNESCO 1990, section 3-2. The rate of enrollment was calculated by weighing the national averages by the number of cases per country in our sample.

29 Ibrahim 1980; Krueger 2007; Krueger and Maleckova 2003; Bergen and Pandey 2005; Berrebi 2007; Benmelech and Berrebi 2007.

30 Ibrahim (1996) documents the declining share of the college educated among Egyptian violent Islamists. The tourist resort bombings in Egypt in 2005 and the subsequent jihadi campaign on the Sinai Peninsula were linked to radicalized Bedouins, a new phenomenon (*Christian Science Monitor*, 24 May 2006). In Morocco, Al-Qaida recruiters have focused on poor slum-dwellers (*International Herald Tribune*, 11 April 2007). Similarly, levels of education among broader-based and relatively recent Islamist groups like the Taliban in Afghanistan and Pakistan, the Shabab in Somalia, and Boko Haram in Nigeria appear to be quite low. On the intellectual shifts accompanying Islamist "lumpenization," see Roy 1994: 84ff.

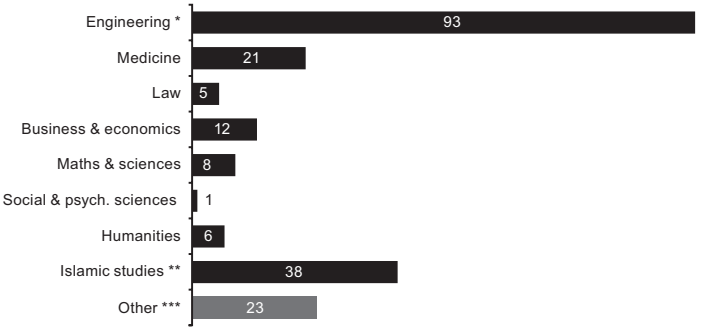

Figure 1.2: Islamist extremists by discipline of study (207 individuals).

* "Engineering" includes computer science and architecture. The latter was included because it is commonly part of engineering faculties in Middle Eastern countries, as it is in European countries.

** "Islamic studies" includes various Islamic subjects such as "Islamic law," "Quranic studies," and "religion."

*** "Other" includes agriculture, education, English, food sciences, pharmaceutical science, social services, and technical military science.

Source: Muslim world sample.

plines, while not having clearly corresponding professions, share methods and core concerns (and often buildings): math and science; social and psychological sciences; and humanities. Unlike the "big four," these disciplines, albeit with greater or lesser rigor, focus on creating knowledge rather than learning how to apply it. When relevant we provide information on additional specific subjects, such as Islamic studies for the sample discussed in this chapter or history for right-wing groups in chapter 5.

In the Islamist sample we were able to find the discipline of study for 207 of the 231 individuals who at some point had full or partial exposure to higher education (figure 1.2).[31] Unsurprisingly, the second most numerous group comprises 38 individuals who pursued Islamic studies. But the largest group among the Islamist extremists is that of the engineers: 93 out of 207 individuals, or 44.9 percent of those whose type of degree we know, studied this subject. The engineering group is followed at some distance by medicine (21 individuals), economics and business studies (12), and math and science (8). On the whole, the individuals who pursued what we might call "elite degrees"—engineering, medicine, and science—make up 58.9 percent of the total. The elite degrees are universally more demanding and have stricter admission criteria in the countries

31 For the few individuals who enrolled in more than one discipline, we registered the one first studied or, if that was not clear, the one first mentioned in order to avoid problems of double accounting.

in our sample than do the other degrees. If we add economics and business studies, which in some countries such as Egypt is also a selective degree (Moore 1994: 46), to the elite category, we reach 64.7 percent. Militant Islamists are not only highly educated but have some of the most prestigious degrees available in their societies. Zawahiri had good reason to feel proud.

The engineers' birthdates (based on the 65 cases for which we could determine them) range from the 1930s to the late 1970s, with the median date of birth in 1966—two years older than the overall median (based on the 300 cases for which we know the date of birth). The oldest, born in 1936, is Hamas spokesperson Ibrahim Ghousheh, who graduated with a degree in civil engineering from Cairo University. The youngest one is underpants bomber Umar Abdulmutallab, followed by Youssef Mohamad Al-Hajdeeb and Jihad Hamad, two Lebanese nationals born in 1985 who moved to Germany to pursue engineering degrees but were caught attempting to bomb German trains in 2006 before they finished their course of study.

With regard to specific fields of study, three types of engineering predominate for the 56 cases for which we have that information: civil, electrical, and computer-related (figure 1.3). We do not know whether the distribution across engineering fields means anything or simply faithfully reflects the distribution found in the population of the relevant countries; we could not find systematic data on this. What we do know is that several illustrious individuals are from these three subdisciplines. Dokka Umarov, the most prominent Chechen Islamist military commander and self-proclaimed emir of the unrecognized Islamic state of Caucasus Emirate from 2007 until his death in 2013, had a degree in construction engineering.[32] The one-eyed, hook-armed Abu Hamza Al-Masri, notorious for his firebrand preaching at London's Finsbury Park mosque and whom a UK court sentenced to life in prison without parole in January 2015, has a civil engineering degree. A particularly strong battalion of jihadi VIPs is made up of electrical engineers: Muhammad Abdul-Salam Faraj, prominently involved in the Sadat assassination; Pakistani Ramzi Yousef, a leading figure in the first attack on the World Trade Center in New York in 1993 who went on to concoct the "Bojinka Plot" with Khalid Sheikh Mohammed (himself a mechanical engineer) to simultaneously blow up twelve airplanes in midair between Asia and the United States in 1995; 9/11 support staff Said Bahaji and Mounir al-Motassadeq; and Yahya Ayyash, Hamas's master bomb-maker in the 1990s. Computer and electronic engineers include the above-mentioned Abdul Subhan Qureshi of Mumbai

32 www.chechenpress.co.uk/english/news/2006/06/23/01.shtml.

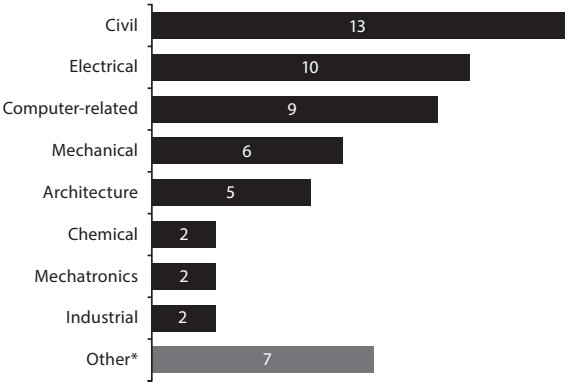

Figure 1.3: Types of engineering disciplines (56 individuals).
* "Other" includes urban planning, telecommunication electronics, industrial electronics, thermal energy engineering, medical technology, shipbuilding, and aeronautical engineering.
Source: Muslim world sample.

train-bombing fame, as well as Qatari national Ali Saleh Kahlah al-Marri, for many years the only foreign enemy combatant held on U.S. soil.

How Truly Overrepresented Are Engineers?

A bias in reporting the type of degree is implausible: we see no reason why the sources we used should be more inclined to report an engineering degree than any other degree. Still, the high proportion of engineers could be the result of "battlefield" selection: more engineers, we could conjecture, might have fallen into the investigative net, and hence ended up in our sample, because they took greater risks or had more visible leadership roles. This would be an important finding in its own right: even if engineers did not form a disproportionate share of jihadists as a whole, they would be the group that played the most significant role and paid the price for it.

However, this bias is unlikely. We were able to identify individuals who had held a leadership function within their militant group and had pursued higher education and found that the engineers were no more likely to be in a leadership role than were those who had studied other subjects at the university level (table 1.1). They were also no more likely to be bomb-makers, as we shall see shortly.[33] These data indicate that

33 Moreover, if there was a bias that makes engineers more visible whenever they engage in extremist activities then, all things being equal, they should be more visible in non-

Table 1.1
Leaders among Islamist extremists by discipline

Education	Leaders	Total in sample	%
Engineering	38	93	*40.9*
Medicine	5	8	*62.5*
Business & Economics	5	12	*41.7*
Math & Science	7	21	*33.3*
Islamic studies	19	38	*50.0*
Other degrees	15	36	*41.7*
Unknown degrees	5	23	*21.7*
Total	94	231	*40.7*

Source: Muslim world sample.

engineers are not taking on more exposed roles than are students of other disciplines.

The skeptical reader, however, might remain unconvinced for a different reason. Suppose the extremists come from countries in which scores of youngsters study engineering, a common career to aspire to in developing countries. This would then simply be reflected in the composition of the extremists. We would still have to explain why there are so many university graduates among the extremists, but the type of degree would simply follow from the distribution of graduates in the countries of origin. To see whether there is any truth in this, we looked at the number of engineers among the extremists relative to the number of engineers in the general population and then among the number of university graduates overall.

General Population

The share of engineers among the total male working population in the countries of origin of the individuals in our sample, weighted by the number of extremists we identified as coming from each country, is 1.3 percent. By contrast, even if we include all missing cases in the denominator,

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Islamist militant groups, too. And yet, as we shall see in chapter 5, very few engineers are found among many non-Islamist groups. In the most extreme case the few engineers found in non-Islamist groups might still be an overestimate of the actual share of militant engineers, but for this to be the case they ought to be drastically underrepresented relative to other graduates.

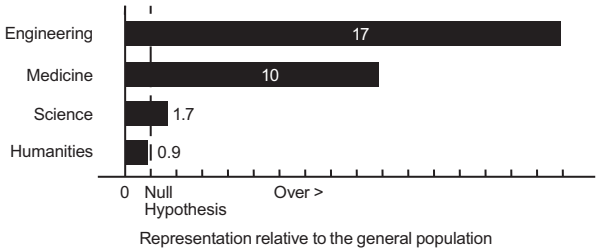

Figure 1.4: Representation of disciplines of study among Islamist extremists relative to presence of the same disciplines in the general population (odds ratio).
Source: Muslim world sample.

the share of engineers among our extremists is 18.7 percent (93/497). These figures allow us to calculate the ratio between the odds of being an engineer in the general population and the odds of being one in our sample of extremists. The odds of finding an engineer in the sample is *seventeen times greater* than what we would expect if engineers were as likely to radicalize as the male adult population in general.

Doctors, too, are overrepresented by ten times. The odds of finding scientists, by contrast, are only slightly higher than what the null hypothesis predicts, while humanities students appear slightly less frequently in our sample than they do in the general population.

Population with Higher Education

This massive overrepresentation of engineers among Islamist extremists does not tell us to what extent engineers are also overrepresented among the militants with higher education. How many engineers could we expect to become radical if they did so at the same rate as graduates in any other subject? To address this question we compare our results with enrollment rates in higher education. Again, the data are for *males*, since all the individuals with higher education in our sample are males with the exception of U.S. citizen Aafia Siddiqui. We were able to obtain higher education data for all of the countries with a substantial number of cases in our sample for 1987, the median year in which the men in our sample went to university.

As table 1.2 shows, the overrepresentation of engineers in our sample is very pronounced for all nationalities (Saudi Arabia is an exception, which we will explore in the next section). The average share of engineers among the total number of male students of the 19 countries in our sample is 11.6 percent (individual country averages are weighted by the

number of men per country in our sample who had pursued higher education). In our sample, by contrast, the share of engineers among those with known higher education is 44.9 percent.[34] The odds of being an engineer are more than *six times greater* than we would expect, a result that is highly statistically significant. For some of the countries in our sample the overrepresentation is even greater. In Egypt the proportion of engineers among male students was 10.9 percent in 1987 (dropping to 8.3 percent by 1995–96),[35] while among the 53 Egyptian cases in our sample whose subject of study we know 35.8 percent (19) are engineers. For Palestinians the enrollment rate was 5.9 percent, and out of 62 cases with known subject of study 35.5 percent (22) are engineers. (The differences between expected and actual ratios are highly significant for both countries in a chi-square test.)

To be accurate, we have to take into account 40 cases in our sample who studied in Western countries, 27 of whom (67.5 percent) studied engineering. To use the overall engineer ratio in the sample as the term of comparison, therefore, is not entirely correct, as Muslims studying in the West might have a higher propensity to choose an elite subject like engineering or medicine. But even if we remove this group we still have a ratio of 39.5 percent engineers (93–27/207–40), which makes the odds of being an engineer in our sample still five times larger than they would be if the likelihood of radicalization were the same across subjects. The difference remains highly statistically significant.

But what about the other disciplines? Table 1.3 compares weighted null hypotheses for four subjects with their actual presence in the sample. We find that there are more than twice as many doctors in the sample as we would expect—and out of 9 cases with known specialization, 5 are surgeons, arguably the most engineering-like type of medicine. Scientists, however, though they are often lumped together with engineers when scholars discuss the link between extremists and technical education, are in fact significantly *underrepresented*. More dramatic still, we find the almost total absence of humanities students. While we would expect on average 31 of them to appear in a randomly drawn sample of 207 male

34 The difference of the two ratios is significant in a chi-square test at $p < .001$. Engineering enrollment data were not available for a few countries, but these represent less than 5 percent of all cases with known higher education in the sample. We have detected some fluctuation over time in engineering enrollment relative to total tertiary enrollment in a few of the cases where more than one data point was available, but there appeared to be no systematic biases.

35 This share is estimated using aggregate enrollment figures (Arab Republic of Egypt 1996) and assuming the ratio of female students has remained constant.

TABLE 1.2
Islamist extremists with higher education, finished or unfinished, and share of engineers compared with the share of male students studying engineering, by country of origin

Country of origin	Total in sample	With higher education	% with higher education	Subject of higher education known	Engineers		
					In sample		% of male students in 1987
					N	% *	1987
Palestine	128	68	53.1	62	22	35.5	5.9
Egypt	88	59	67.0	53	19	35.8	10.9
Indonesia	53	12	22.6	7	1	12.5	15.3
India	36	10	27.8	9	7	77.8	14.4
Singapore	31	5	16.1	5	4	80.0	67.0
Saudi Arabia	33	14	42.4	12	2	16.7	10.2
Morocco	13	6	46.1	6	4	66.7	1.8
Yemen	12	3	25.0	2	0	0	4.1
Jordan	11	5	45.5	5	3	60.0	16.4
Malaysia	10	8	80.0	8	6	75.0	19.1
Pakistan	10	7	70.0	7	4	57.1	29.1
Algeria	9	3	33.3	3	1	33.3	14.3
Lebanon	7	6	85.7	6	4	66.7	11.0
Kuwait	4	3	75.0	1	0	0	10.1
Afghanistan	5	4	80.0	4	2	50.0	11.1
Syria	4	2	50.0	2	2	100.0	21.9
Sudan	4	2	50.0	2	1	50.0	11.1
Libya	4	0	0	0	0	0	–
U.S.	4	3	75.0	3	3	100.0	13.1
Canada	3	0	0	0	0	0	14.8
U.K.	2	2	100.0	1	0	0	30.2
Tanzania	2	0	0	0	0	0	12.1
Kenya	2	0	0	0	0	0	19.7
Philippines	2	0	0	0	0	–	31.8
Other**	12	8	66.7	8	7	87.5	–
Unknown	8	1	12.5	1	1	100.0	–
Totals	497	231	46.5	207	93	44.9	11.6 (weighted average)

* The share is calculated on the number of those whose degree we know.

** Belgium, Comoros, UAE, Germany, Guyana, Iraq, Ireland, Mauritania, Nigeria, Qatar, Somalia, Spain.

Sources: For the first 6 columns, Muslim world sample; for the last column, UNESCO 1990 (architecture counted as part of engineering); the figure for the United States is from 2005.

Table 1.3
Expected and actual shares of Islamist extremists in select disciplines (N in parentheses)

	Humanities		Science		Medicine		Engineering	
	yes	no	yes	no	yes	no	yes	no
Expected	14.9% (31)	85.1%	10.2% (21)	89.8%	4.8% (10)	95.2%	11.6% (24)	88.4%
Actual	2.9% (6)	97.1%	3.9% (8)	96.1%	10.1% (21)	89.9%	44.9% (93)	55.1%
Odds expected vs. actual	0.18 vs. 0.03		0.11 vs. 0.04		0.06 vs. 0.11		0.13 vs. 0.82	
Representation	5.9 times under		2.9 times under		2.0 times over		6.2 times over	

Source: Muslim world sample.

students from the countries in question, there are in fact only 6,[36] a finding almost as striking as that of the engineers' dominance.

Data on students in teaching colleges are not available for many of the countries in our sample. We know, however, that in Palestine and Egypt about 20 percent of all students are trained as teachers, while the share in our sample is only 2.8 percent: a mere 6 cases. Teachers have played only a marginal role in post-1970s Islamist militancy. This is true even though some of the highest-profile figures among the first generations of post–World War II militant Islamists were teachers, including Hassan Al-Banna and Sayyid Qutb of the Egyptian Muslim Brotherhood and Sheikh Yassin of Palestine's Hamas. But for some reason, the days of the schoolteacher-turned-revolutionary seem to have passed (see chapter 2).

The situation is similar for lawyers: constituting only 2.4 percent of the militant graduates in our sample, they are clearly underrepresented. Although no good data are available across all cases, in Egypt, for instance, we know that law students are about 15 percent of the total student body. Finally, in our sample we have only one individual trained in a social or psychological science, Ali Mohamed, an American of Egyptian origin who was involved in the bombings of U.S. embassies in Africa in 1998 and holds a BA in psychology (in chapter 5 we will show that left-wing extremists have studied social sciences and psychology much more frequently).[37]

36 Chi-square tests comparing actual and expected distributions were highly significant ($p < .01$).

37 UNESCO statistics unfortunately combine business, law, and social sciences into one category, preventing us from calculating precise null hypotheses.

If all university students were similarly likely to end up in radical groups, there *should* be many more scientists, teachers, and humanities students and graduates among Islamists and many fewer engineers. The data we've presented indeed show that the overrepresentation of the highly educated in the sample is largely driven by engineering and, to a lesser extent, medicine. It does not, however, disappear if we remove these two categories: we have at least 93 individuals in the sample known to have studied fields other than engineering and medicine. If we take out the special case of Islamic studies (38 cases), there are still at least 55 individuals with other types of university education, which is still at least three times as many as expected relative to the general population.[38]

The Saudi Exception

A closer inspection of the distribution of degrees by nationality (table 1.2) reveals that among the countries with a substantial number of graduates, Saudi Arabia does not have an engineering overrepresentation.[39] Scattered across several groups there is a contingent of 33 Saudis, 12 of whom have higher education, but only 2 are engineers. The paucity of Saudi engineers is also visible in the educational background of the extremists who perpetrated the 9/11 attacks: among the 25 individuals involved, there were 8 engineers and 15 Saudis. Seven of the 10 non-Saudis were engineers, but only 1 Saudi was an engineer—one of the two in our sample. These low numbers have increased significance when we consider two other sources. One is a sample of Saudi Islamist militants collected by Hegghammer. Out of a "core" of 70 violent Islamists active in the post-2003 domestic insurgency in Saudi Arabia (not overlapping

38 In our sample 104 individuals are known to have education that is less than tertiary. Given the levels of education and distribution of degrees in the relevant background populations, we would in fact only expect 9 individuals with "other degrees" in a randomly drawn sample of which we only know that it contains 104 cases without higher education. If we add to the 104 all 101 cases in our sample for which we have no information, and assume that they also have no higher education, we would still expect only 18 individuals with "other degrees" to complement them in a randomly drawn sample.

39 Indonesia might also appear as an exception with its small number of engineers. However, the numbers of graduates in our sample are small, and complementary research seems to show that they do, in fact, have a considerable presence of them: Noorhaidi Hasan, who interviewed 125 members of the militant Indonesian salafi group Laskar Jihad in various parts of the country, states that "almost half are students, dropouts and graduates from a dozen universities in Indonesia" and that "these students are generally enrolled in science and engineering departments" (2006: 159–60).

Table 1.4
Islamist extremists with higher education, finished or unfinished, and engineers in Saudi Arabia by source, compared to other countries of origin

		With higher education		Known discipline of higher education	Engineers	
	Total	N	%		N	%
Saudis in our sample	33	14	*42.4*	12	2	*16.7*
Saudis in Hegghammer's sample	36	17	*47.2*	11	1	*9.1*
All others in our sample	464	217	*46.8*	195	91	*46.7*

Sources: Muslim world sample; Hegghammer 2006.

with our sample), he found educational data on 36, 17 of whom had a degree or college exposure. Among the 11 of these for whom the subject of study is known, 5 pursued religious degrees but only 1 was an engineer (not the one in our sample).

The second source is a database of foreign Islamist militants who went to fight (and often died) in Iraq from all over the Arab world in the mid-2000s, put together by organizers affiliated with Al-Qaida. The U.S. military found it in a computer in a jihadi safe house in the border town of Sinjar, which they raided in October 2007, and declassified it in December of the same year. The Sinjar records include 590 short biographies of volunteers. The records are incomplete, providing educational information on only 88 individuals, and they represent a type of insurgency that is not part of our main sample. This, however, means that they constitute an "out of sample" check on our results that is independent of our other sources. As far as we know, the information has been released unfiltered.

According to the original Arabic records, 73 of the 88 militants were exposed to some kind of higher education, the subject of which is known for 46 cases (figure 1.5). Only 9, one-fifth of the total, are engineers. This is only somewhat higher than what we would expect given the distribution of disciplines among male Arab students. Ten individuals were trained as teachers—a marginal group in our main sample. Both facts, however, are only an apparent contradiction of the findings in our main sample—in fact the Sinjar data are much in line with our previous results: once we break the group of 10 teachers down by nationality, we find that 8 of the 10 are Saudis; the other 2 are from Libya, another oil-rich coun-

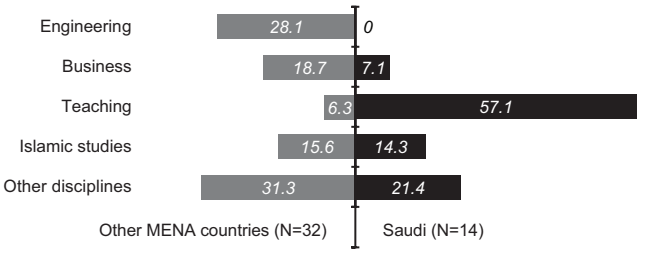

Figure 1.5: Distribution of nationalities and discipline of study among Sinjar individuals with higher education (%).
Note: MENA stands for Middle East and North Africa.
Source: Sinjar records (2007).

try. Among the 23 cases from Arab countries other than Saudi Arabia and Libya, 35 percent (8) are engineers, which is close to the proportion we have in our sample. The Sinjar data, however imperfect, match both the general finding of a surfeit of engineers as well as the Saudi exception.

What we are to make of the Saudi exception is a question we address in chapter 2.

Selection Effects

The proportion of graduates in general and engineers in particular among Islamist extremists appears to be genuinely significant. It requires explanation—but what exactly is to be explained first needs to be established. There are two processes that could generate these findings: one is a greater propensity among graduates and engineers to become jihadi and the other is a selection mechanism by which more graduates and more engineers are admitted to the ranks of jihad, regardless of propensity. The two processes could of course also work in combination.

The first filter, in other words, is individuals' willingness to join jihad, and to determine the extent to which the *over*representation of graduates and engineers is a reflection of an extra willingness on their part, the explanation must address the substantive question of why graduates are more willing than nongraduates to join and why engineers are the most willing graduates of all. But how faithful a reflection it is depends on the force of the second filter.

The second filter (which does not apply to founders and first movers) is extremist organizations' recruitment of certain types of militants rather than others. In so far as they exercise a choice rather than simply going after anyone available, they might prefer more able and hence more educated

people—especially those with technical skills—because such individuals would be better able to fulfill the organization's goals.[40] If the supply of militants is larger than the demand, organizations could fill their ranks to capacity by first choosing highly qualified people even though these are not necessarily more frequently available, that is, more willing, than the lesser qualified people among the supply. So, in an extreme case, the composition would seem to reflect a greater willingness on the part of the highly educated or of engineers to join, while in reality it merely reflects the fact that as members of the most desirable group they were being recruited in larger numbers, while all others, though equally willing, were being recruited in smaller numbers.

A number of reasons, some of which we will discuss at length in chapter 3, incline us to think that selection on the basis of educational level cannot explain away the high proportion of university graduates in our sample. We believe that the high number raises substantive questions concerning the motivations of graduates who join jihad. We do know that there is selection: for instance, Sageman (2004: 121) reports that only 10–30 percent of trainees in Al-Qaida camps in Afghanistan were formally accepted into jihad, although we do not know whether these trainees were accepted because their level of education correlated with the skills the organization sought. Moreover, Al-Qaida is perhaps the organization that faced the starkest trade-off between quality and quantity, and for which an upper limit of membership size is plausible. But it is not clear whether all groups systematically privilege quality over quantity—in some strategic contexts, it may be useful to simply maximize membership. Next, we know from historical sources (see chapter 2) that radicalization in places like Iran, Egypt, Palestine, and Indonesia was student driven or initiated by educated elites. Also, even if there was a general bias toward recruiting the better educated, there are large differences between the education levels of extremists in different regions that require an explanation (see table 1.2 as well as our data on the West in chapter 3).

In this chapter, we can use our existing sample to test for selection based on technical skills such as bomb-making or communication management. This allows us to evaluate whether engineers rather than graduates in other disciplines are overrepresented because they are overrecruited for their technical abilities. Below we will also test for a kind of selection that can affect both the university-educated in general and engineers in particular: this is the case in which organizations happen to be formed in

40 For conjectures along these lines, see Bueno de Mesquita 2005 and Benmelech, Berrebi, and Klor 2010. Note, however, that even these authors include the supply of would-be militants in their argument: while groups select their operatives among a larger pool, the quality of the larger pool shifts as a function of economic development, resulting in a shifting of the quality of the operatives over time.

certain domains, as for instance a university, and this original "accident" influences the "types" of people who are subsequently recruited through local social networks.

Bomb-making Skills

If attendance at a man's funeral is a measure of his success in life, few Arabs have been more successful than Yahya Ayyash. Tens of thousands of angry Hamas supporters showed up at his funeral in January 1996 in the Gaza Strip (Kahana 2007: 69)—two days after Israeli Intelligence had assassinated him.[41] Among his admirers, Ayyash was known as "the Engineer," an honorific that had more to do with his fabled skill at bomb-making than with his degree in electrical engineering from Bir Zeit University. Ayyash had orchestrated a lethal campaign of suicide bombing, taking the lives of no fewer than ninety Israelis and making him Shin Bet's most wanted target. He was killed by another feat of engineering: a modified mobile phone, given to him by way of a mole, blew away most of his head.

In December of the same year, Samar Alami, a Lebanese banker's daughter of Palestinian extraction, and Jawad Botmeh, a Palestinian Jordanian businessman, avoided a funeral but were still sentenced by a British court to twenty years in jail for the bombings of the Israeli embassy and of a Jewish charity in London in the summer of 1994. Alami held a BS in chemical engineering from University College London—the same school that underpants bomber and fellow engineer Umar Abdulmutallab attended two decades later—and an MS in chemical engineering from Imperial College. Botmeh had electrical engineering degrees from the University of Leicester and King's College London.[42]

Azahari Husin, the Indonesian "master bomb-maker" of the 2004 and 2005 Bali bombings, was killed in 2005 in Batu, near Malang in East Java, during a protracted shoot-out with the police who had surrounded his hideout. Nicknamed "demolition man" by Malaysian newspapers, he trained as a mechanical engineer in Australia in the 1980s before taking a doctorate at the University of Reading in 1990.[43]

Different in social background, biography, and theater of activity, Ayyash, Husin, and the imprisoned pair had two things in common: their training as engineers and their bomb-making skills. This may lead us to conclude that violent groups deliberately recruit individuals with a technical

41 *New York Times*, 7 January 1996, www.nytimes.com/1996/01/07/world/palestinians-vow-vengeance-at-gaza-funeral-of-terrorist.html?src=pm.
42 www.freesaj.org.uk/.
43 *The Scotsman*, 3 October 2005, http://thescotsman.scotsman.com/world/Demolition-Man-and-Money-Man.2666376.jp; *International Herald Tribune*, 2 July 2006.

education to make bombs or to maintain clandestine communications, or that individuals with those skills might be more inclined to form or join radical groups. This explanation for the strong presence of engineers among violent Islamist radicals[44] appears further corroborated by the fact that some groups overtly value technical skills: on Hamas websites, admiring references to bomb-building and technical skills of activists abound, and "engineer" is used as a general honorific title (although only Ayyash was "*the* Engineer"). The technical skills hypothesis is intuitively appealing—it is the immediate explanation proffered by most colleagues when we first tell them about the overrepresentation of engineers among extremists. It is also the explanation offered with some degree of professional pride on many of the engineers' blogs in which our puzzle has been discussed: they claim that it is obvious that only engineers have the necessary skills to carry out a technically sophisticated insurgency. And yet there is compelling evidence to suggest that technical ability does not really account for this phenomenon.

The first piece of evidence is found in a British intelligence dossier, which reports that "a network of 'extremist recruiters' is circulating on campuses targeting people with 'technical and professional qualifications', particularly engineering and IT degrees."[45] Abuza reports a similar recruitment practice for Indonesia's Jemaah Islamiyah (2006: 78).[46] But it does not appear to be technical skills that recruiters are after. The dossier states that Islamist "extremists are known to target schools and colleges where young people may be very *inquisitive* but *less challenging* and more susceptible to extremist reasoning/arguments" (emphasis added). The choice of adjectives is interesting: we can find people who are inquisitive and challenging or supine and unchallenging, but the combination of a sharp mind with a loyal acceptance of authority may be rare, especially among those ready to choose extreme paths. A training manual for jihadists lists the traits to look for in potential recruits: "discipline and obedience, patience, intelligence" (p. 18), "caution and prudence" (p. 19), and the ability "to observe and analyze" (p. 20).[47] These traits could be

44 For instance, Bergen and Pandey (2006) refer to this hypothesis to explain the strong presence of technically educated in their sample.

45 *Sunday Times*, 10 July 2005.

46 In July 2014, Abu Bakr al-Baghdadi, the Islamic State's self-styled caliph, called for "judges, doctors, engineers and people with military and administrative expertise" to migrate to ISIS territory (www.bbc.com/news/world-middle-east-28116846). At the time, however, ISIS was engaged in a broader project of state-building rather than just small-scale insurgency.

47 "Military Studies in the Jihad against the Tyrants," used in court in the trial, held in New York from January to May 2001, against four men charged in the 1998 embassy bombings in East Africa. Identified in the trial files as "Government Exhibit 1677." Date and author are unknown.

more likely to be found among engineers, and recruiters might be aware of this. In years of research we have never encountered any evidence of recruits being selected because of their *technical* skills. Personal trust and dedication seem a far more important criteria (Sageman 2004: 107–12).

Second, bomb-making is the task of a few specialists in a group, a fact that makes the high proportion of engineers among many organizations, especially larger ones, puzzling. In Hamas, many engineers hold prominent positions in senior management that have no technical component (while among Hamas suicide bombers, the majority pursued religious degrees; Berrebi 2007: 28n51). If Hamas leaders are selected based on their skills, they are not technical ones.

Third, the technology involved in carrying out most of the violent attacks by Islamist extremists does not require great expertise. It is harder to obtain good-quality explosives than it is to put them to use. And electricians, mechanics, and ex-army officers have shown themselves to be just as good at making bombs as (if not better than) engineers. Dulmatin, the other mastermind of the Bali bombings—nicknamed "the Genius" for his prowess with explosives and who was killed in a shootout in March 2010—was an auto mechanic.[48] His bomb-making colleague Noordin Mohammad Top, who was killed in 2009 in a police raid, had a degree in accounting.[49] In the UK-based plot to blow up transatlantic jets in 2006, the quartermaster in charge of explosives and logistics, Assad Sarwar, had studied sports science. The one engineer in the group, Ahmed Abdullah Ali, who had a computer systems engineering degree, was the leader of the cell rather than its bomb-maker.[50] Fathur Rahman al-Ghozi, key operative and bomb-maker of the Islamist militant Jemaah Islamiya group in Southeast Asia, had trained at Abu Bakar Bashir's religious school. Ahmed Ghailani, bomb-maker for the devastating 1998 bombings of the U.S. embassies in Tanzania and Kenya, had taken electronics courses in vocational school.[51]

Fourth, the destructive capacity of these violent groups does not seem to increase with the proportion of engineers among their members. Consider, for instance, the Saudi insurgency, which, with almost no engineers in its ranks, still mounted devastating bomb attacks in 2003 and 2004;

48 *The Times*, 9 March 2010, www.timesonline.co.uk/tol/news/world/asia/article7054952.ece.

49 *Sydney Morning Herald*, 18 September 2009, www.smh.com.au/world/terror-kingpin-dies-in-siege-20090917-fttc.html.

50 *The Telegraph*, 7 September 2009, www.telegraph.co.uk/news/uknews/terrorism-in-the-uk/6024777/Airlines-bomb-plot-profiles.html.

51 *Financial Times*, 26 January 2002, www.singapore-window.org/sw02/020126ft.htm; *New York Times*, 24 January 201, www.nytimes.com/2011/01/24/nyregion/24ghailani.html?pagewanted=all.

or, for non-Islamist cases, consider the LTTE in Sri Lanka, or the IRA and ETA separatist movements, whose members were largely poorly educated and working class (Hudson 1999: 47, 50; Iribarren 1998: 47).

Fifth, "hands-on" knowledge is not always acquired in engineering classes. Being an engineer may make someone more likely to try their hand at bomb-making than it would someone with a nontechnical degree, but this may be the result of unwarranted self-confidence: in recent years a string of five attempted attacks, all aimed at Western targets, involved engineers *and* failed. It is not surprising that the likes of Richard Reid, an uneducated man with a troubled past of abuse and petty crime who went from convict to convert, should have failed to carry out even his technically unsophisticated plot. In December 2001, he was overpowered by other passengers and crew while trying to detonate with a match his shoe laced with explosives during American Airlines Flight 63 from Paris to Miami. It *is* surprising, however, to go through a list of abysmal failures at the hands of technically educated extremists that came to our attention within just a few years. Their exploits are summarized in table 1.5 (some of them were carried out by militants who grew up in the West who are part of a second sample we present in chapter 3).

For instance, Times Square bomber Faisal Shahzad, whose explosive contraption of firecrackers, a pressure cooker, fertilizer, gasoline, and gunpowder fizzled out without doing any damage, holds a BA in computer science and engineering. Kafeel Ahmed, one of the two jihadists who tried to drive a Jeep Cherokee loaded with propane canisters into a Glasgow Airport terminal in June 2007 but got stuck on security bollards, was studying for a PhD in computational fluid dynamics and held degrees in mechanical and aeronautical engineering.[52] While five bystanders were slightly injured, he and his partner in the attack, Bilal Abdullah, a medical doctor, sustained severe injuries and Ahmed died a month later (in that he was more successful than Abdullah, if belatedly so: a joint suicide note showed that the two had actually intended to die in the attack).[53] The duo had previously deposited two bombs in London, which were defused by the police, one of which could not have exploded because it lacked an oxidizer.[54]

52 *Wall Street Journal*, 4 May 2010, http://blogs.wsj.com/dispatch/2010/05/04/faisal-shahzads-life-in-america-and-path-to-citizenship/; *Hindustan Times*, 6 October 2007, www.hindustantimes.com/Bangalore-cleric-tells-how-Kafeel-Sabeel-changed/Article1-235277.aspx; BBC News, 6 July 2007, http://news.bbc.co.uk/1/hi/northern_ireland/6278858.stm; www.timesonline.co.uk/tol/news/uk/crime/article5352923.ece.

53 *The Australian*, 6 July 2007, www.theaustralian.com.au/news/world/glasgow-suspects-left-suicide-note/story-e6frg6so-1111113898104.

54 *The Register*, 29 June 2006, www.theregister.co.uk/2007/06/29/more_fear_biscuits_please/.

Table 1.5
Failed engineer-led attacks against Western targets, 2007–10

Name	Degree	Year	Location	Attempted attack
Kafeel Ahmed	Mechanical and aeronautical engineering	2007	Glasgow Airport, UK	Drove a Cherokee SUV loaded with gas canisters into a terminal but got stuck on security bollards, slightly injured five innocent people, and died of his wounds.
Hicham Doukkali	Civil engineering	2007	Meknes, Morocco	Blew himself up near a tourist bus armed with a butane canister; killed no one but lost an arm.
Mohamed Game	Electronic engineering	2009	Milan, Italy	Blew himself up with two kilos of nitrate near Caserma Santa Barbara; killed no one while barely surviving his injuries.
Umar Abdulmutallab	Mechanical engineering	2009	Northwest Airlines Flight 253 Amsterdam to Detroit	Tried to detonate explosive he had hidden in his underwear but was overpowered by other passengers.
Faisal Shahzad	Computer science and engineering	2010	New York City	Left an SUV packed with a homemade cocktail of explosives in Times Square. It failed to explode, but he was identified and arrested.

Sources: Press archives.

To test the bomb-making skills hypothesis systematically, we were able to identify the functions that individuals performed within their militant group for 228 of the 497 cases in the sample (table 1.6). Two results stand out. First, bomb-makers are a minority among the overall staff (15 percent); many more individuals seem to be tasked with organizational and

TABLE 1.6
Functions within groups by discipline (individuals can have more than one function)

	Founder		Leader		Bomb-Maker		Media and outreach		Total functions (individuals)	
Education	N	%	N	%	N	%	N	%	N	%
Engineering	*5*	*9*	38	*72*	8	*15*	14	*26*	*65* (53)	*100*
Medicine	0	*0*	*5*	*63*	3	*38*	3	*38*	11 (8)	*100*
Business & Economics	2	*33*	*5*	*83*	1	*17*	3	*50*	11 (6)	*100*
Math & Science	4	*40*	*7*	*70*	0	*0*	*6*	*60*	17 (10)	*100*
Islamic studies	*5*	*21*	19	*79*	2	*8*	*6*	*25*	32 (24)	*100*
Other degrees	3	*13*	20	*83*	2	*8*	2	*8*	27 (24)	*100*
No higher ed. or unknown ed.	4	*4*	*75*	*73*	19	*18*	16	*16*	114 (103)	*100*
Total	23	*10*	169	*74*	*35*	*15*	*50*	*22*	277 (228)	*100*

Source: Muslim world sample.

propaganda duties. Second, of those with engineering degrees, only 15 percent were bomb-makers, which is no more than the average share across all types of disciplines.[55]

A Random Event Amplified through Networks?

Could our findings be explained by a different kind of selection process, one that is essentially accidental? Illegal groups are set up in clandestine fashion, and to diminish the chances of detection their existence is advertised along networks of preexisting social bonds. Their opportunities for expansion are constrained within circles of friends, colleagues, and kin.

55 Among the Western-based groups we investigate in chapter 3, engineers appear more frequently among the groups that are formed independently of larger organizations (table 2.6). This indicates that if skills matter, they matter for self-recruitment at least as much as they matter for recruitment.

If the prime movers were, even accidentally, engineers or engineering students, their network would be more likely to expand within the faculty in which they work and socialize, among like-minded people with whom they interact on a daily basis. Whether for recruits or recruiters, the opportunities would follow network lines. Observations in our sample would hence not be "independent" from each other with regard to education; a combination of historical accident and network-based selection with no deeper meaning could thus explain the engineers' overrepresentation. A similar reasoning could be extended to the overrepresentation of graduates in general.

This might indeed be true for the early Egyptian groups in which, as Ibrahim has written, "three recruitment mechanisms were employed: kinship, friendship and worship" (1980: 437ff.). However, the more we find graduates in general and engineers in particular to be overrepresented in extremist groups in different countries and in different networks, the less likely it is that their dominance is due to a historical contingency and its network effects.

To test this hypothesis, consider the distribution of degrees both by country of origin and by group. As we have already seen (table 1.2), university graduates in general and those with engineering degrees in particular are not clustered in any one country of origin but spread across most of them—with the exception of Saudi Arabia, which we have just discussed. The same obtains when we consider the distribution across groups (table 1.7). Strikingly, the proportion of engineers is even more evenly distributed across groups than is the proportion of individuals with higher education, especially among the groups with more cases in the sample, giving further support to our finding that engineers are overrepresented.

Our sample of jihadists contains at least four clusters that grew independently of each other—North Africans, Southeast Asians, Palestinians, and core Arabs—and both graduates in general and engineers in particular are strongly represented in all of them. The idea that the technically educated were able to connect with each other via the Internet and thus likely to form a virtual network—as suggested, for instance, by Abuza (2006: 79–80)—does not apply to the individuals in our sample, most of whom radicalized before the Internet became available. (For example, as late as 1998, even in a developed country like the UK only 4 percent of households had an Internet connection.)

Moreover, in broad-based movements such as Hamas, network effects should become less important with the growing scale of mobilization. Also, mosques and radical preachers—often the focus of initial radicalization and recruitment—are loci where in principle students of different faculties can mix. In so far as places of worship functioned as recruitment

TABLE 1.7
Islamist extremists with higher education, finished or unfinished, and share of engineers, by militant group or attack

Group / Attack	Total in sample	Level of education known	With higher education	% with higher education over total cases	% with higher education over known cases	Discipline of higher education known	Engineers	
							N	% of known higher education
Hamas	92	73	55	60%	75%	50	19	38%
Core Arab cluster*	36	14	7	19%	50%	5	1	20%
Indian Mujahedeen	35	10	9	26%	90%	8	6	75%
Ibrahim sample	34	34	29	85%	85%	26	9	35%
Palestinian Islamic Jihad	32	11	9	28%	82%	9	1	11%
Jemaah Islamiyah Singapore	31	31	6	19%	19%	6	5	83%
Various Al-Qaida	30	17	14	47%	82%	14	6	43%
Central Qaida*	27	15	13	48%	87%	9	5	56%
11 September 2001	24	24	17	71%	71%	14	8	57%

Jemaah Islamiyah (Indonesia, Malaysia)	24	20	7	29%	35%	3	3	100%
Bali bombings	22	14	6	27%	43%	6	3	50%
African embassies	16	13	6	38%	46%	6	3	50%
Southeast Asian cluster*	12	4	2	17%	50%	1	0	0%
World Trade Center 93	12	12	12	50%	71%	11	5	60%
Islamic Jihad (Egypt)	10	7	5	25%	67%	5	3	50%
GSPC Algeria	8	3	2	71%	100%	2	1	20%
Al-Gama'a Al-Islamiya (Egypt)	7	5	5	60%	96%	5	1	52%
Sundry cases	45	28	27	60%	75%	27	14	38%
Totals	497	335	231	46%	69%	207	93	45%

* These groups are taken from Sageman 2004. If cases overlapped with the event-based categories of Bergen and Pandey (who kindly shared their data on individuals involved with several violent events), they are included in the Bergen groups; Sageman's categories hence are residual sets including individuals from the same network who were not directly implicated in the events.

Sources: Muslim world sample; Sageman 2004; Bergen and Pandey 2006.

vehicles, it must mean that graduates in general and engineers in particular were already attracted by them.

Network ties cannot explain why certain networks radicalize while others do not, or why certain individuals in a network radicalize first while others leave the network once it radicalizes. All that network effects can explain is why individuals who lacked the "right" network ties failed to radicalize even if they had a predisposition to do so. Sageman, who makes the strongest case for preexisting network ties to explain the expansion of salafi-jihadists, claims that "in-group love" more than "out-group hate" drove these movements and that "social bonds came first, and ideology followed" (Sageman 2004: 136, 133). To warrant such a conclusion, however, we would need a stringent test, namely to know how many of those who had network ties with individuals or groups that *subsequently* radicalized *failed* to radicalize and abandoned or remained at the margin of their groups. The fewer the people who left, the stronger the network effects would be. Conversely, the more the people who left, the more other traits and factors must have been involved in such decisions. But in the absence of this crucial data one cannot say.

This does not imply that the *size* of the engineering contingent within each independent cluster is unaffected by network effects—it very probably is. What we cannot explain by network effects is the greater propensity of engineers to become prime movers and their greater willingness to stay in or join a radical network. For an explanation of these factors we will need to look elsewhere. In chapter 2, we start by taking another look at their biographies for inspiration.

Conclusions

The puzzling phenomenon with which we started has been confirmed: engineers are indeed overrepresented among violent Islamist radicals. Relative to their presence in the male population in their countries of origin, the number of engineers among extremist groups is fourteen times what we would expect; and relative to graduates with other degrees they are four times more numerous than we would expect. Furthermore, the overrepresentation is evenly distributed across all groups and across all countries of origin, strongly suggesting that the correlation is not the result of a historical contingency amplified by network diffusion. The only notable exception to the engineering phenomenon is Saudi Arabia, where engineers are only weakly present among extremists. The findings are further confirmed by the Sinjar database of jihadists who went to fight in Iraq.

The hypothesis that the overrepresentation could be the result of selective recruitment based on technical skills in bomb-making and communi-

cations does not stand up to scrutiny for a host of different reasons, the most important of which is that the ratio of bomb-makers among engineers is identical to that among jihadists with other degrees.

Over and above the engineering puzzle, we found that university students and graduates generally are vastly overrepresented among Islamist radicals. Overall, our results suggest that the higher the level of education the greater the likelihood of joining a violent group, and furthermore that among those with higher education, students with more demanding professional degrees have a greater likelihood of joining. These results provide the first wide-ranging systematic confirmation that the core of the Islamist movement emerged from would-be elites, not from the poor and the dispossessed.

The factors that might explain our double finding—the overrepresentation of graduates in general and of engineers in particular—will be explored in the following chapters.