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1. Executive Summary

Four suicide bombers struck in central London on Thursday 7 July 2005, killing 52 people and injuring more than 770. Our investigation aims at describing Londoners’ transportation choice in response to the terrorist attacks, understanding reasons behind these choices and obtaining evidence for policy making.

The first stage of our investigation provided a descriptive account of Londoners’ commuting behaviour. Consistent with Gigerenzer (2006)’s dread hypothesis, the archival transportation data we obtained from the Department of Transport showed that, in the aftermath of the 7/7 attacks, Londoners (1) avoided the two attacked modes (tube and buses) for up to 6 months, (2) substituted the attacked modes by two non-attacked modes (powered two wheelers and bikes) and (3) as a result of this, the number of people who died on bikes increased by 150% in 2005 compared to 2004.

The second stage of this study aimed at understanding the reasons underlying the transportation choices as well as to obtain empirical evidence that can be used by policy makers to nudge people into choosing wisely, that is, by making choices based on long-run risks rather than rare events, such as terrorist attacks on public transport.

The archival data showed that among all the six transportation modes, i.e. car, taxi, tube, bus, bike and scooter, taxi has the lowest fatality, followed by tube, bus, bike, scooter, whereas car is the riskiest mode to use. The fact that people did not choose taxi to replace tube or bus suggested that perceived safety was probably not the only dimension that determined people’s transportation choices.

To explore this, we conducted a paper and pencil survey where we presented the 7/7 attack as a vignette, and asked participants to choose transportation mode and answer a number of questions, imagining the attack had just happened. The results from 21 students studying at London School of Economics (LSE) showed that

1. Tube was avoided more on the day immediately following the attack than in the week after the attack
2. Choice was based on factors other than perceived risk
3. Tube was avoided more when public transport was practically inconvenient
4. Practical convenience was mentioned as a reason for choice as frequently as safety and more than cost
5. Participants had a widely varied perception of risk: people who chose private transport after the attack thought they were choosing the “safer” transportation just as those who chose to stick to taking the tube after the attacks.

These findings, along with Gigerenzer’s dread hypothesis, made us realize that

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1. People’s transportation choices depend on perceived safety, costs, convenience, and possibly how people feel in using a particular transportation mode.

2. Terrorist attacks on public transport increase the relative “salience” or importance of safety compared to other criteria like convenience and make the attacked modes (tube and bus) be perceived as less safe than the non-attacked ones (car, taxi, bike, scooter).

We then turned to the difficult question of how to encourage the public to use public transportation modes after they have been the target of terrorists. We designed four possible “nudges” that we later tested in two online experiments.

1. **Risk nudge**: Presenting commuters with fatality statistics of public and private transportation mode such that they become aware of the additional amount of risk they undertake by replacing tube and bus by bike and scooter.

2. **Dread nudge**: Reminding commuters of governmental actions in dealing with terrorist attacks such that they feel less dread in using the attacked modes.

3. **Costs nudge**: Presenting commuters with the cost information of each transportation such that they understand the monetary implications of using the more expensive modes, i.e. travelling by car or taxi.

4. **Planning nudge**: Asking commuters to plan ahead and make choices for the entire week following the attacks instead of for the day to be able to anticipate the cumulative costs and inconvenience over a week.

We conducted two on-line surveys to test the relative impact of these nudges. The first on-line survey was conducted in July 2009 with 66 students attending a summer school course at LSE as the participants. The 7/7 London attacks were recreated by presenting video scripts hosted on the BBC (British Broadcasting Corporation) website. The videos effectively re-created in the laboratory the effect on the public’s transportation choices in real life: 91% of the participants chose the public modes before watching the video, but only 19% chose these same modes after watching the 7/7 video. The nudges on the other hand increased this percentage to 37%, providing evidence for their effectiveness. The most effective condition was the risk nudge. After being presented with the fatality statistics, 75% of the participants chose the attacked modes. The least effective was the dread nudge. After watching a video showing governmental actions cracking down on terrorists, 20% chose the attacked modes, that is, virtually no change at all compared to before nudging and after watching the 7/7 video. Planning ahead had little impact, leading to 25% of the participants choosing the attacked modes for the week following the attacks, whereas presenting people with the actual monetary costs of the six transportation modes led to as many as 54% of the participants choosing tube or bus for the day after the 7/7 attacks. The nudges decreased the weight assigned to safety issues and increased the perceived safety and convenience of the attacked modes relative to the non-attacked modes. It was also interesting to note that participants had accurate perceptions of the relative safety of public vs private before the attack, but erroneous perceptions after the attack, with tube and bus being perceived as less safe than before learning about the attacks, and than the private modes.

These results were encouraging, but had the limitations that the study population was mainly composed of overseas students and some conditions had a small sample size. To increase the external validity of our studies, we conducted a second large scale survey (via the Maximiles company) which involved 800 London commuters as the study participants.

This second study was conducted in October 2009. As in our first study, we observed a preference reversal confirming the effectiveness of watching video as the mechanism of recreating the 7/7 attacks scenario: 70% of the participants chose tube or bus prior to watching the video compared to 25% afterwards. The risk nudge again stood out as the most promising, recalibrating the perception of the relative safety of the modes, and making people realize that the private modes are no safer than the public modes.

As a whole however, the effect on the choices was not large, debiasing risks, costs, dread and asking people to plan ahead led only to a 10% increase in the number of participants choosing the two attacked modes from 25% to 35%. Different nudges had more or less the same impact on the choices.

We also collected information in terms of the level of numeracy, education, income, age and gender, in order to provide further insights. No difference was found between commuters younger and older than 45 years, or between those received up to high-school education versus those received more. By contrast, whether the commuter is male...
or female makes a difference. After watching 7/7 video, females are significantly less likely than males in choosing the attacked modes (tube or bus) in the debiasing costs and risk conditions. This difference due to gender appears similar to the gender difference in perception of risks due to terrorist attacks found in a general survey by Rosoff and John (Heather Rosoff & Richard John, presentation at the University of Southern California, January 9, 2009) There was also an interaction between gender and age. After watching the 7/7 video, young females are less likely than young males to choose the attacked modes (tube or bus), whereas the reverse holds for the above 45 age group.

2. Research Accomplishments

2.1 Archival data results

Following the 7/7 bombings, London commuters switched to pedal cycles and powered-2-wheelers. (see Figure 1) causing an increase in pedal cycles fatalities (see Figure 2)

Figure 1. Year-to-year change in the number of users of pedal cycle, powered-2-wheelers and car/taxi between 2002 and 2006
Figure 1. Year-to-year change in the number of fatalities of pedal cycle, powered-2-wheelers and car/taxi between 2002 and 2006

### 2.2 first on-line survey results

The first on-line survey found a preference for the non-attacked modes of transportation prior to watching 7/7 video but for the attacked modes after watching the video. The preference for the non-attacked modes is however reduced to a large extent after nudging (Fig.3). The salience/importance of perceived safety, convenience, feeling and costs change as a result of watching the video, and again following the nudges (Fig.4). The debiasing risk is the most effective nudging condition in which the attacked modes are perceived safer than the non-attacked modes (Fig. 5).

Figure 3. % choosing attacked and non-attacked modes before and after watching 7/7 video as well as after nudging
Figure 4. Change in the decision weights assigned to safety, cost, feeling and convenience before and after watching the 7/7 video and after nudging.

Figure 5. Ratings of perceived safety of the attacked and non-attacked modes in the four nudging conditions, i.e. debiasing cost, debiasing dread, planning and debiasing risk (the higher the rating, the safer the transportation mode is).
2.3 second large-scale on-line survey results

The second on-line survey involved 800 participants. We found a similar preference reversal between the attacked and the non-attacked modes of transportation as a result of watching the 7/7 video (Fig. 6). The effect of nudging is however much weaker compared to the one in the first on-line survey. The debiasing risk is the only condition in which we consistently found an effect and in which, as in the first survey, the attacked modes are perceived safer than the non-attacked modes (Fig. 7).

![Figure 6. % choosing the attacked and non-attacked modes before and after watching 7/7 video as well as after nudging in the first on-line survey](image)

![Figure 7. Ratings of perceived safety of the attacked and non-attacked modes in the four nudging conditions, i.e. debiasing cost, debiasing dread, planning and debiasing risk.](image)
3. Applied Relevance

The general reaction of members of the public to terrorist attacks on public transport are to:

- avoid public transit modes
- typically switch to deadlier modes of travel
- be more fearful, more alert to risk

As a result of this, policy makers make huge investments to increase security of attacked modes relative to the non-attacked modes. For instance, after 9/11, the US Government spent $9 per passenger ($22 Bn) for air travel security in US and 1¢ per passenger for railway and underground security in UK, when in fact air travel is safer than other modes of transportation (Source: Department of Transport, http://www.dft.gov.uk/pgr/statistics/datatablespublications/trends/current/section7safety.pdf)

This project tried to determine what are the ways in which policy makers could encourage the public to revert back to “business as usual” in the aftermath of a terrorist attack on public transport without actually making this spending. Based on our data, information campaigns that strive to make people feel safer by showing what actions are taken to counteract terrorist attacks on public transport, or to make people aware of the costs and inconvenience of substituting public transport with private modes are not as effective as directly reminding people of the long run risks of choosing private transport over public transport.

This ‘risk nudge’ was shown in one study to lead people to choose more often public transport in the aftermath of an attack, and in two studies to correct the public’s perception of the relative safety of public over private. While before an attack on public transport, private transport is rightly considered as less safe than public in the long run, the dread of an attack makes people change this perception swiftly. To correct for this dread risk effect, our studies show that it is important to remind people of the relative risk of all modes in normal conditions of travel as people elaborate this reminder. Future studies should elaborate on this insight further and measure the effect of this risk nudge on choice after elaboration of the risk statistics.

4. Collaborative Projects

n/a

3. ................................................................................................................................. Research Products

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<tr>
<td>5b # of outreach presentations (non-technical groups, general public)</td>
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3.1 Publications and Reports


3.2 Presentations

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3.3 Models, Databases, and Software Tools and Products

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4. Education and Outreach Products

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<td># of new degree programs developed</td>
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</table>

One student supported: Zhifang Ni, doing a PhD with the department of Management at LSE
One more student involved: Claudia Niza, doing a PhD at LSE

5. Additional Information for DHS Data Base

Did project involve human subjects? Yes

Please identify the academic disciplines involved in this effort: Management Sciences
Topic/Research Areas:

- Advanced Data Analysis and Visualization
- Biological Threats and Countermeasures
- Border Security
- Chemical Threats and Countermeasures
- Communications and Interoperability
- Emergency Preparedness and Response
- Explosives Detection, Mitigation and Response
- Food and Agriculture Security
- Human Factors Aspects of Technology
- Immigration Studies

(Control + click to select multiple)

Select Nature of Research:

- Hybrid Basic-Applied

Select data collection methods used in this project:

- Bench Tests
- Bioassay
- Compiling and Sorting Database
- Data Mining
- Expert Consultation

(Control + click to select multiple)

Select Analytic Methods used in project:

- Biometrics
- Case Studies
- Econometrics
- Genomic Testing
- Modeling

(Control + click to select multiple)

What is the research risk profile of this project?

- Applied Unknown

IMPORTANT: List a few bullet-examples of research and education outcomes important to DHS:

Select anticipated End Users (federal, state, local government agencies, industrial companies, etc.):

- Academic Community
- Agricultural Agencies
- CBP
- CDC
- Coast Guard

(Anticipated End Users: (Control + click to select multiple)

Identify three keywords or keyword phrases to describe this project for keyword searches:

Keyword 1:
Keyword 2:
Keyword 3: