TRAFFIC INJURY PREVENTION
https://doi.org/10.1080/15389588.2020.1762871

Risk perception: A study using dashcam videos and participants from different world regions

P. Bazilinskyy[a], Y. B. Eisma[a], D. Dodou[b], and J. C. F. de Winter[a]

[a]Department of Cognitive Robotics, Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Delft, The Netherlands; [b]Department of Biomechanical Engineering, Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Delft, The Netherlands

ABSTRACT

Objective: Research has shown that perceived risk is a vital variable in the understanding of road traffic safety. Having experience in a particular traffic environment can be expected to affect perceived risk. More specifically, drivers may readily recognize traffic hazards when driving in their own world region, resulting in high perceived risk (the expertise hypothesis). Oppositely, drivers may be desensitized to traffic hazards that are common in their own world region, resulting in low perceived risk (the desensitization hypothesis). This study investigated whether participants experienced higher or lower perceived risk for traffic situations from their region compared to traffic situations from other regions. **Methods:** In a crowdsourcing experiment, participants viewed dashcam videos from four regions: India, Venezuela, United States, and Western Europe. Participants had to press a key when they felt the situation was risky. **Results:** Data were obtained from 800 participants, with 52 participants from India, 75 from Venezuela, 79 from the United States, 32 from Western Europe, and 562 from other countries. The results provide support for the desensitization hypothesis. For example, participants from India perceived low risk for hazards (e.g., a stationary car on the highway) that were perceived as risky by participants from other regions. At the same time, support for the expertise hypothesis was obtained, as participants in some cases detected hazards that were specific to their own region (e.g., participants from Venezuela detected inconspicuous roadworks in a Venezuelan city better than did participants from other regions). **Conclusion:** We found support for the desensitization hypothesis and the expertise hypothesis. These findings have implications for cross-cultural hazard perception research.

ARTICLE HISTORY
Received 15 January 2020
Accepted 26 April 2020

KEYWORDS
road safety; perceived risk; risk desensitization; hazard perception; crowdsourcing

Introduction

Objective risk and perceived risk

Each year, more than 1.35 million fatal accidents occur on the roads worldwide (World Health Organization 2018). An analysis of 65 countries showed that drivers from low-income countries have the highest probability of dying in traffic, with a correlation of -0.78 between road traffic death rate and gross domestic product (GDP) per capita (Bazilinskyy et al. 2019).

National differences in crash statistics may be attributable to national differences in driving behavior. A questionnaire study by Bazilinskyy et al. (2019), for example, found that respondents from countries with a lower GDP per capita report a higher number of violations such as tailgating, using a phone behind the wheel, or racing away from traffic lights. The underlying causes of national differences in driving behavior are unknown, however. In this paper, we attempt to examine the psychological mechanisms that may bring about cross-national differences in driving behavior and accident rates; such knowledge could prove useful in the development of crash countermeasures.

Various studies suggest that perceived risk is a promising psychological variable for explaining driving behavior and accident involvement. According to Wilde's (1998) risk homeostasis theory, if drivers perceive reduced risk (e.g., due to the introduction of a new safety measure), they may compensate by taking more risk. Similarly, according to Deery (1999), drivers who perceive a low level of risk in hazards would be likely to respond to those hazards less cautiously. Perceived risk has also been used to explain why drivers speed up as the lane becomes wider (Melman et al. 2018) or why drivers follow a lead vehicle at a particular distance (Heino et al. 1996; Saffarian et al. 2012). A study in Cameroon by Ngueutsa and Kouabenan (2017) found that drivers who reported having been involved in a severe accident or in more than three accidents, perceived road travel to be *less* risky compared to those involved in fewer accidents. Thus, the quantification of risk perception is relevant,

CONTACT Pavlo Bazilinskyy p.bazilinskyy@tudelft.nl; pavlo.bazilinskyy@gmail.com Department of Cognitive Robotics, Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Mekelweg 2, 2628 CD Delft, The Netherlands.
Associate Editor Douglas Gabauer oversaw the review of this article.

Supplemental data for this article is available online at https://doi.org/10.1080/15389588.2020.1762871

as perceived risk seems to have criterion validity with regard to dangerous driving behaviors and accident involvement.

National differences in perceived risk

National differences in perceived risk can be measured in various ways. One of the most commonly used methods is a questionnaire in which respondents are asked to estimate the riskiness of various types of driving scenarios or their personal probability of experiencing an accident/injury. Using such questionnaires, it has been found that Turkish respondents report a higher perceived risk than Norwegians (Şimşekoğlu et al. 2012), Sub-Saharan Africans have a higher perceived risk than Norwegians, Russians, and Indians (Nordfjaern et al. 2011), and Malaysians have a higher perceived/risk than Singaporeans (Khan et al. 2015).

Another method of measuring perceived risk is to let participants press a response button while watching traffic videos (e.g., Chapman and Underwood 1998; Borowsky et al. 2010; Wetton et al. 2010). A number of such video-based cross-cultural studies have been done before. Ventsislavova et al. (2019) showed video clips of hazardous traffic from China, Spain, and the UK and assessed the risk perception of drivers from these three countries. Using a hazard perception test which required timed hazard responses, they found that drivers from China recognized fewer hazards (70.1%) than drivers from Spain (80.3%) and the UK (85.4%). Based on the fact that drivers in China are exposed to dangerous traffic, Ventsislavova et al. stated that "this increased exposure to hazards presumably desensitises the Chinese drivers to the relative seriousness of some hazardous events, increasing their thresholds for reporting them" (p. 283). In a follow-up study using 'what happens next' queries, the authors found that drivers from all nationalities were equally skilled at predicting hazards, leading to the conclusion "that drivers' criterion level for responding to hazards is culturally sensitive, though their ability to predict hazards is not" (p. 268). Lim et al. (2013) and Lee et al. (2020) found that Malaysian drivers recognized fewer hazardous situations than UK drivers. However, in apparent contradiction with Ventsislavova et al., Lim et al. found that drivers detected more hazards from their own country.

Aim and hypotheses of the present study

In this study, we aimed to examine whether drivers perceive traffic situations from their region as relatively low-risk because they have gotten used to this type of traffic. The alternative hypothesis would be that drivers perceive high risk in traffic scenes from their region because these risks are readily identified due to the acquired expertise in detecting those hazards. We regarded the 'desensitization hypothesis' (i.e., an ego-region decrease in perceived risk) and the 'expertise hypothesis' (i.e., an ego-region increase in perceived risk) as equally plausible.

To test these hypotheses, we conducted a crowdsourcing study in which we let participants from different world regions press a response key to indicate perceived risk while viewing one-minute dashcam videos. We presented each participant with 16 dashcam videos recorded in Western Europe, India, Venezuela, and the United States.

Method

Videos

Sixteen dashcam YouTube videos were downloaded, a 1-min segment was extracted from each video, and audio was removed. The sixteen videos were a 4×4 combination of road type (busy city, non-busy city, secondary road, highway) and world region (India, United States, Venezuela, Western Europe). All videos featured scenarios of normal driving in good weather; we did not select these videos for specific events or incidents. The videos were shown in the participant's browser at a resolution of 854×480 pixels. The online supplement provides an overview of the 16 videos.

Crowdsourcing study

Participants performed the experiment via the crowdsourcing service Figure Eight (www.figure-eight.com). Participants became aware of this research by logging into a channel website (e.g., https://www.ysense.com), where they would see our study among other available projects. They would then self-enrol to the study. We allowed contributors from all countries to participate. A payment of USD 0.40 was offered for the completion of the experiment.

At the beginning of the questionnaire, the contact information of the researchers was provided, and the purpose of the study was described as "*to detect sources of danger in videos from dash cameras taken in four continents*". Participants were informed that the study would take approximately 25 minutes, that they could contact the investigators to ask questions about the study, and that they had to be at least 18 years old. Information about anonymity and voluntary participation was provided as well. Participants provided consent via a dedicated questionnaire item. The research was approved by the Human Research Ethics Committee of the Delft University of Technology.

The participants first completed questions about their demographic characteristics (age, gender, age of obtaining a driver's license, etc.), their primary mode of transportation, driving frequency and mileage in the last 12 months, and the number of accidents they were involved in during the last three years.

They were then asked to click on a link that opened a webpage with the videos, with the following instruction about how to complete the given task:

> You will view 16 videos from the perspective of a car driver. Each video lasts 1 minute. Press 'F' when you feel the situation becomes risky. Press 'F' for any type of risk, including very small risks. You can press the 'F' key as many times as you want per video. When you press 'F' no feedback will be given to you. After the first 8 videos you will be able to take a small break. Press 'C' to start with the first video.

The 16 videos were presented in random order in two batches of 8. After the first batch, participants were shown the

Table 1. Participant characteristics.

	United States	Venezuela	India	Western Europe[a]	Other[b]
Number of participants	79	75	52	32	562
Mean age (*SD*)	45.13 (13.75)	34.93 (12.20)	35.77 (11.92)	40.56 (12.31)	37.66 (11.09)
Percentage males (*n* males)	28% (22)	65% (49)	73% (38)	69% (22)	68% (381)
Mean age of first license (*SD*)	18.25 (4.02)	21.03 (4.93)	22.73 (4.90)	20.13 (3.64)	21.13 (4.81)
Private vehicle as primary mode of transportation	95%	53%	29%	69%	68%
Motorcycle as primary mode of transportation	1%	5%	44%	0%	6%
Mean driving frequency in last 12 months (*SD*)[c]	4.80 (1.13)	3.93 (1.77)	4.73 (1.21)	4.59 (1.21)	4.57 (1.44)
Mean mileage in last 12 months (*SD*)[d]	4.13 (1.79)	3.75 (2.26)	3.71 (1.55)	4.25 (1.50)	4.00 (1.80)
Mean number of accidents in last 3 years (*SD*)	0.15 (0.46)	0.36 (0.79)	0.79 (1.16)	0.31 (0.59)	0.40 (0.77)

[a]Combination of Austria, Belgium, Germany, Denmark, Finland, France, the Netherlands, and Sweden.
[b]The category 'Other' comprises of 60 countries. The ten most represented countries were: Turkey, Russia, Ukraine, Serbia, Canada, Spain, Egypt, United Kingdom, Brazil, and Portugal.
[c]1 = Never, 2 = Less than once a month, 3 = Once a month to once a week, 4 = 1 to 3 days a week, 5 = 4 to 6 days a week, 6 = every day.
[d]1 = 0 km, 2 = 1–1000 m, 3 = 1001–5000 km, 4 = 5001–15,000 km, 5 = 15,001–20,000 km, 6 = 20,001–25,000 km, 7 = 25,001–35,000 km, 8 = 35,001–50,000 km, 9 = 50,001–100,000 km, 10 = more than 100,000 km.
Note that non-responses are treated as missing values.

following text: "You have now completed 8 videos out of 16. When ready press 'C' to proceed to the next batch." At the end of the experiment, participants were shown a unique code and were asked to note down this code and return to the webpage of the questionnaire. They were required to enter the code on the questionnaire as proof that they completed the experiment in order to get their payment.

Statistical analysis

The mean number of response key presses per video was calculated to investigate differences between videos (regions and road types). Differences in perceived risk between pairs of videos were assessed using paired *t*-tests. Differences in perceived risk between participant groups (United States, Venezuela, India, Western Europe, and other countries) were assessed using Welch's *t*-tests. Moreover, the mean cumulative number of key presses as a function of time was calculated per video and per participant group, to investigate differences between participant groups. For each video, the percentage of participants who pressed the response key was calculated in 5-s wide bins. Chi-squared tests were then used to compare the five participant groups per bin. Fisher's exact test was used for pairwise comparisons between the five participant groups. For all analysis, we used a significance level (alpha) of 0.005 (Benjamin et al. 2018).

Results

Participants

A total of 1,237 persons participated between 28 June and 15 August 2019. The task received a satisfaction rating of 4.0 on a scale from 1 ('very dissatisfied') to 5 ('very satisfied'). Participants who indicated that they did not read the instructions, who indicated that they were under 18 years old, who did not complete the task, or who pressed the response key ('F') an anomalous number of times (more than 100 times in a video, or not at all in the first or second half of the experiment) were removed. If people completed the study more than once from the same IP address, only the first response was kept. In total, 437 participants were removed, leaving 800 participants from 71 countries for further analysis. From the total of 12,800 video responses (800 participants x 16 videos), a total of 307 video responses were removed because of a lagged video playback.

The 800 participants had a mean age of 38.1 years ($SD = 11.8$ years; one person did not indicate her age). Of the 800 participants, 286 were female, 512 were male, and 2 persons preferred not to respond. The participants obtained their driver's license at the age of 20.9 years on average ($SD = 4.8$ years); 77 participants provided no response or provided an invalid response to the question about the driver's license age. For the question 'What is your primary mode of transportation', 533 participants chose 'Private vehicle', 142 'Public transport', 60 'Motorcycle', 59 'Walking/cycling', 3 'Other', and 3 provided no response. The participants took, on average, 27.0 min to complete the study ($SD = 7.4$ min).

The three most highly represented countries were Venezuela ($n = 75$), United States ($n = 79$), and India ($n = 52$). Table 1 shows participant characteristics per world region. It can be seen that there were substantial differences between regions, with people from the United States more likely to be female and older, and more often using a car as the primary mode of transport. Participants from India, on the other hand, often reported a motorcycle as their primary mode of transportation. Moreover, participants from India were also involved in a high number of accidents compared to participants from other regions.

Differences in risk perception between videos

Figure 1 shows the mean number of response key presses per participant for all 16 videos and each of the five participant groups. The perceived risk differed between videos, with Indian roads generally regarded as the riskiest and Western European roads the least risky. An exception was the busy city video in the Netherlands; this was a video where the driver drove past various vulnerable road users (cyclists and pedestrians). From the 120 possible pairwise comparisons between the 16 videos (all five participant groups aggregated), a total of 106 comparisons were statistically significantly different from each other ($p < .005$).

A comparison of the perceived risk between participant groups (all 16 videos aggregated) showed that participants from the United States had a higher mean perceived risk

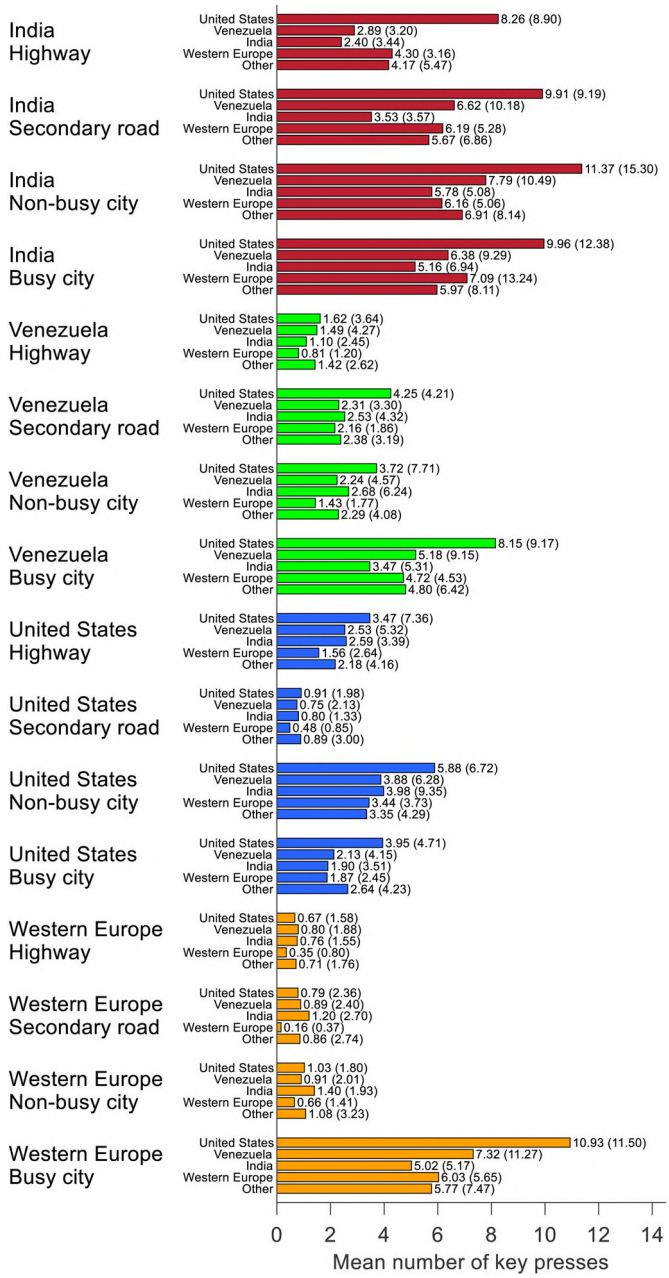


Figure 1. Mean number of response key presses for each of the 16 videos (4 world regions indicated in different colors x 4 road types) and for each of the five participant groups. The means and standard deviations (in parentheses) are shown next to each bar.

than participants from India ($t(128.9) = 3.86$, $p < .001$), Western Europe ($t(93.4) = 3.28$, $p = .001$), and participant from other countries ($t(90.5) = 3.95$, $p < .001$). There were no significant differences ($p > .005$) between the other paired comparisons between participant groups.

Ego-region effects of perceived risk

Participants from India viewing Indian roads: We examined whether participants showed ego-region risk effects by calculating the cumulative number of key presses per participants' world region per video. Figure 2 shows such a figure for one of the 16 videos: the Indian highway. The other 15 figures can be found in the online supplement.

Several noteworthy findings emerge from Figure 2, where a lower ego-region perceived risk compared to other participant groups supports the desensitization hypothesis, and a higher ego-region perceived risk compared to other participant groups provides support for the expertise hypothesis:

- Between 15 and 20 s, participants from India perceived significantly *lower* risk compared to participants from the groups United States, Western Europe, and other countries. During this time interval, the driver in the video overtook another vehicle that was driving in the left lane.
- Between 25 and 30 s, participants from India perceived significantly *higher* risk than participants from Western Europe. Here, the driver in the video overtook a vehicle that was driving in the right lane, see Figure 3. This result is consistent with the fact that participants from India had a high perceived risk when the driver in the video was overtaking other vehicles on the United States highway (see online supplement).
- Between 45 and 50 s, participants from India perceived significantly *lower* risk compared to participants from the United States, Venezuela, and other countries. During this time interval, the driver encountered a vehicle standing still on the highway, see Figure 4. Moreover, the driver in the video was not driving in the lane center but in two lanes simultaneously.

Also, we found that participants from India had low perceived risk when being overtaken by/encountering two-wheelers (secondary road, 55–60 s; non-busy city, 55–60 s; busy city, 25–30 s), see online supplement This finding is consistent with the low perceived risk of participants from India when interacting with two-wheelers in the Venezuelan busy-city video (45–60 s) and the United States busy-city video (40–45 s).

Participants from Venezuela viewing Venezuelan roads:

- Low perceived risk when driving past pedestrians standing next to the pavement (non-busy city, 30–35 s)
- High perceived risk when approaching inconspicuous roadworks and a narrowing of the street (non-busy city, 50–55 s)

Participants from the United States viewing United States roads:

- High perceived risk when driving past parked cars and when crossing an intersection (non-busy city, 25–35 s, busy city, 5–10 s, 30–35 s)
- High perceived risk when driving behind a cyclist (busy city, 40–45 s) or other vulnerable road users (busy city, 5–10 s). This finding is consistent with the high perceived risk of participants from the United States when interacting with two-wheelers in the Indian secondary-road video (55–60 s) and the Venezuelan secondary-road video (45–50 s).

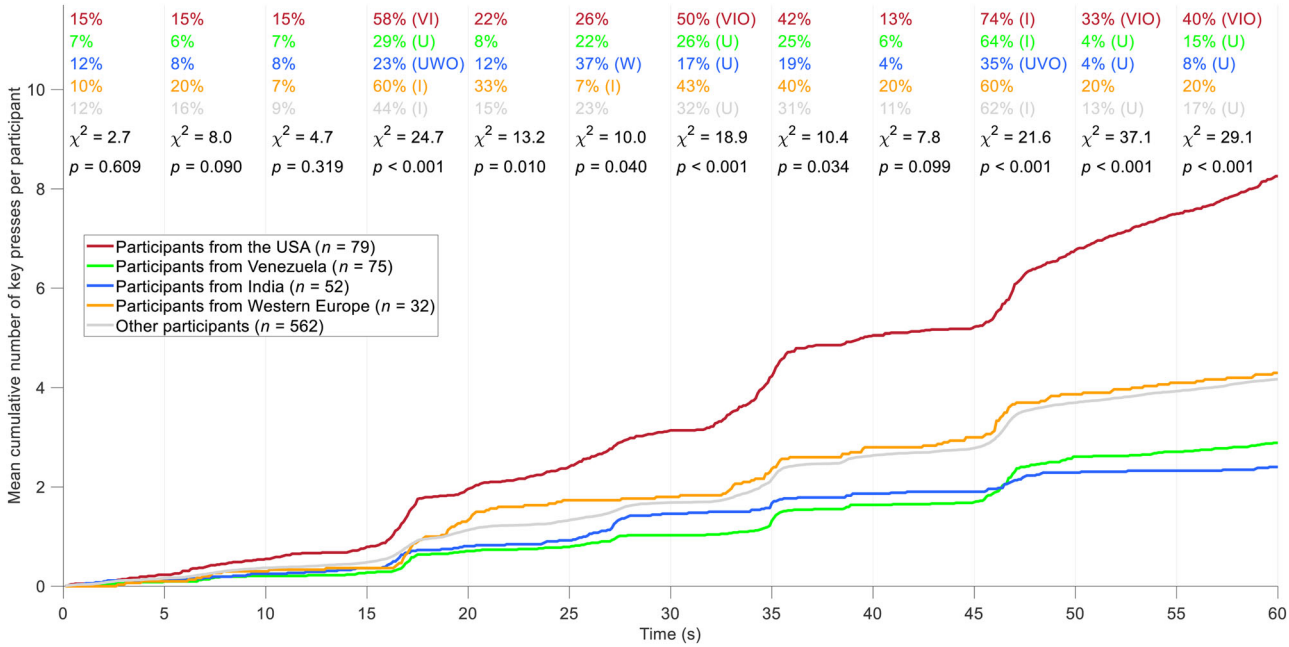


Figure 2. Mean cumulative number of key presses per participant group (United States, Venezuela, India, Western Europe, and other countries) as a function of elapsed time for the Indian highway video. A steep upward slope of the line means that many participants pressed the response key at that point in the video. Furthermore, the top of the figure shows, for each 5-s interval of the video clip, the percentage of participants per participant group who had pressed the response key at least once within those 5 s. Also shown is the result of a chi-squared test, comparing the five participant groups regarding the number of participants who pressed the response key at least once versus the number of participants who pressed the response key zero times. Between parentheses is shown whether the results for participants from that world region differ significantly from participants from the United States (U), Venezuela (V), India (I), Western Europe (W), or other countries (O), as calculated using Fisher's exact test. For example, "50% (VIO)" depicted in red between 30 and 35 s means that participants from the US were more likely to press the response key (50%) than participants from Venezuela (26%), India (17%), and other countries (32%) for that 5-s interval.

Figure 3. Screenshot from the video 'India, highway' (27 s), where participants from India perceived relatively high risk compared to participants from other regions.

Figure 4. Screenshot from the video 'India, highway' (47 s), where participants from India perceived relatively low risk compared to participants from other regions.

Participants from Western Europe driving on Western european roads:

- Low overall perceived risk on the highway and secondary road
- High perceived risk when encountering pedestrians and cyclists (busy city, 15–20 s)

Discussion

This study measured the perceived risk for participants who were asked to view dashcam videos. Our method, which required participants to press a key whenever they detected a risky event, allowed for examining how perceived risk varies as a function of elapsed time during the video (see also Chapman and Underwood 1998) and allowed for comparisons between videos and between the responses of participants from different countries. The results showed that dashcam videos from India were perceived as riskier than videos from other regions. This effect held for participants from all regions, a finding that is consistent with the fact that driving in India is objectively dangerous (World Health Organization 2018).

Overall, participants from the United States perceived high levels of risk; that is, participants from the United States pressed the response key more often than participants from India, Western Europe, and other countries. The differences in risk perception between participants from the different parts of the world could be due to the desensitization effect as detailed in the introduction; that is, it is

possible that participants from countries with a high actual traffic risk have gotten used to risk and therefore perceive low risk. An alternative explanation for the difference in perceived risk between participants from different world regions is the demographic make-up of the participant groups. More specifically, participants from the United States were mostly females (Table 1), and earlier research indicated that females are less likely to engage in risky behaviors than males (e.g., Zuckerman and Kuhlman 2000).

Ego-region effects of perceived risk

Even if the demographic make-up of the different participant groups differs, compelling evidence for ego-region differences in perceived risk is obtained if participants from a particular world region perceive high risk for some hazards and low risk for other hazards. Our analysis did find statistically significant support for such ego-region interactions. For example, we found that participants from India perceived high risk when the driver in the video overtook another vehicle on the inside (Figure 3); for drivers from other countries, where overtaking via the left lane is the norm, this maneuver was regarded as low-risk. Conversely, overtaking via the right lane was regarded as low-risk for drivers from India, but high-risk for participants from other world regions. These findings indicate that unfamiliarity with left-handed or right-handed traffic has important implications for perceived risk.

Additionally, it was found that participants from India perceived low risk when interacting with vulnerable road users, such as overtaking or being overtaken by two-wheelers. Also, strikingly, participants from India perceived only low risk when a vehicle was parked on the highway or when the driver was not driving in the lane center but in two lanes at the same time instead. These types of behaviors would be highly unusual in Western Europe or the United States, which can explain why participants from these regions perceived high risk during those moments. Participants from Western Europe, on the other hand, perceived low risk when driving on a relatively empty secondary road or highway, which may be because participants from Western Europe are used to structured roads. Finally, participants from Venezuela perceived relatively low risk when driving past pedestrians standing partially on the road (see online supplement). Again, this may be because this situation may be common in Venezuela but unusual in Western Europe or the United States, where pedestrians usually do not stand on the road while waiting.

The above results point to ego-region desensitization; that is, participants are less sensitive to hazards that are common to their own world region. These effects appear to be related to expectancies, where high perceived risk occurs for hazards that are unexpected and low perceived risk occurs for situations that are expected/common. For example, the stationary car on the Indian highway is not necessarily hazardous if one expects that such a situation might occur; it is, however, highly unexpected for people from foreign countries.

Apart from ego-region desensitization, we also found several apparent ego-region expertise effects. For example, participants from Venezuela were efficient at detecting inconspicuous roadworks on a Venezuelan road, participants from the United States found driving past double-parked cars relatively risky on United States roads, and participants from Western Europe recognized the high risk associated with cyclists. These findings may point to a trained eye for detecting or valuing ego-region-specific hazards.

Limitations and recommendations

Several limitations will have to be considered. First, using our present method, we cannot formally separate participants' response criteria from their ability to detect hazards. Ventsislavova et al. (2019) employed two types of tests: a traditional response method, similar to the one we used herein, and a hazard prediction test where the video was stopped, and participants had to predict what happens next. The latter approach is a test of ability, whereas the former conflates the 'ability to detect the hazard' with the participants' 'tendency to respond'. We recommend that future research uses both types of methods. Second, it is unknown whether participants' tendency to respond is due to risk perception/appreciation or due to methodological factors such as social desirability or task engagement. It is possible that participants from the United States, who on average were older and more likely to be female, took the task more seriously than people from other regions, hence yielding a high number of key presses. A third limitation is that we selected only four videos per region. Future research should use a larger number of videos and control for covariates, such as traffic density and time of day. If using videos from a larger number of countries, then it becomes possible to correlate national averages of perceived risk with national statistics such as accident rates and life expectancy. It should be noted that despite the small number of videos, our findings do have face validity. For example, we found that the videos from India were regarded as the riskiest overall, which corresponds to road traffic statistics indicating that Indian roads are dangerous (World Health Organization 2018). The videos from Western Europe were regarded as least dangerous, except for a video shot in Amsterdam, displaying narrow roads and multiple vulnerable road users. This finding also carries face validity, as car-bicycle accidents are a major concern in the Netherlands (Institute for Road Safety Research 2016).

Conclusions and implications

This article found evidence of ego-region desensitization, such as the fact that participants from India perceive low risk for hazards (e.g., stationary car on the highway) that are regarded as risky for participants from other countries. At the same time, we found ego-country expertise effects, such as regarding the detection of roadworks or parked cars. In conclusion, ego-region effects are probably a mix of desensitization and expertise effects.

The findings reported herein have important implications for hazard perception research; our study suggests that hazard perception tests developed in a particular country may not be valid for participants from other driving cultures. Furthermore, our findings point to difficulties of performing cross-national traffic psychology research. Even if age and gender could be controlled for, people in different countries inherently have different accident rates, driving laws and habits, and different modes of transportation, giving rise to idiosyncratic patterns in risk perception. Finally, our study indicated that drivers of a particular world region adapt to the specific hazards that may occur on their roads: road hazards may start to feel 'normal' to drivers (desensitization effects), or drivers may develop an intuition for avoiding them (expertise effects). These findings have various applications for road designers and policymakers. Our results serve as a reminder that even if perceived risk is low, objective accident risk may still be high.

Acknowledgement

This research is supported by grant 016.Vidi.178.047 (2018–2022; "How should automated vehicles communicate with other road users?"), which is financed by the Netherlands Organization for Scientific Research (NWO).

Data availability

Anonymised raw data and MATLAB code used for the analysis is available at https://doi.org/10.4121/uuid:cd649413-c707-4469-8c47-2e20a0ee1f87

ORCID

P. Bazilinskyy http://orcid.org/0000-0001-9565-8240
Y. B. Eisma http://orcid.org/0000-0003-3437-2761
D. Dodou http://orcid.org/0000-0002-9428-3261
J. C. F. de Winter http://orcid.org/0000-0002-1281-8200

References

Bazilinskyy P, Kyriakidis M, Dodou D, De Winter J. 2019. When will most cars be able to drive fully automatically? Projections of 18,970 survey respondents. Transp Res Part F: Traffic Psychol Behav. 64: 184–195. doi:10.1016/j.trf.2019.05.008

Benjamin DJ, Berger JO, Johannesson M, Nosek BA, Wagenmakers E-J, Berk R, Bollen KA, Brembs B, Brown L, Camerer C, et al. 2018. Redefine statistical significance. Nat Hum Behav. 2(1):6–10. doi:10.1038/s41562-017-0189-z

Borowsky A, Shinar D, Oron-Gilad T. 2010. Age, skill, and hazard perception in driving. Accid Anal Prev. 42(4):1240–1249. doi:10.1016/j.aap.2010.02.001

Chapman PR, Underwood G. 1998. Visual search of driving situations: danger and experience. Perception. 27(8):951–964. doi:10.1068/p270951

Deery HA. 1999. Hazard and risk perception among young novice drivers. J Safety Res. 30(4):225–236. doi:10.1016/S0022-4375(99)00018-3

Heino A, Van der Molen HH, Wilde GJ. 1996. Risk perception, risk taking, accident involvement and the need for stimulation. Saf Sci. 22(1-3):35–48. doi:10.1016/0925-7535(96)00004-5

Institute for Road Safety Research. 2016. Cyclists [factsheet]. SWOV, The Hague. https://www.swov.nl/en/facts-figures/factsheet/cyclists [accessed April 19, 2020].

Khan SUR, Khalifah ZB, Munir Y, Islam T, Nazir T, Khan H. 2015. Driving behaviours, traffic risk and road safety: comparative study between Malaysia and Singapore. Int J Inj Contr Saf Promot. 22(4): 359–367. doi:10.1080/17457300.2014.925938

Lee YM, Miller K, Crundall D, Sheppard E. 2020. Cross-cultural effects on detecting multiple sources of driving hazard: Evidence from the deceleration detection flicker test. Transp Res Part F: Traffic Psychol Behav. 69:222–234. doi:10.1016/j.trf.2020.01.013

Lim PC, Sheppard E, Crundall D. 2013. Cross-cultural effects on drivers' hazard perception. Transp Res Part F: Traffic Psychol Behav. 21: 194–206. doi:10.1016/j.trf.2013.09.016

Melman T, Abbink DA, Van Paassen MM, Boer ER, De Winter JCF. 2018. What determines drivers' speed? A replication of three behavioural adaptation experiments in a single driving simulator study. Ergonomics. 61(7):966–987. doi:10.1080/00140139.2018.1426790

Ngueutsa R, Kouabenan DR. 2017. Accident history, risk perception and traffic safe behaviour. Ergonomics. 60(9):1273–1282. doi:10.1080/00140139.2016.1259508

Nordfjaern T, Jørgensen S, Rundmo T. 2011. A cross-cultural comparison of road traffic risk perceptions, attitudes towards traffic safety and driver behaviour. J Risk Res. 14(6):657–684. doi:10.1080/13669877.2010.547259

Saffarian M, Happee R, De Winter JCF. 2012. Why do drivers maintain short headways in fog? A driving-simulator study evaluating feeling of risk and lateral control during automated and manual car following. Ergonomics. 55(9):971–985. doi:10.1080/00140139.2012.691993

Şimşekoğlu Ö, Nordfjaern T, Rundmo T. 2012. Traffic risk perception, road safety attitudes, and behaviors among road users: a comparison of Turkey and Norway. J Risk Res. 15(7):787–800. doi:10.1080/13669877.2012.657221

Ventsislavova P, Crundall D, Baguley T, Castro C, Gugliotta A, Garcia-Fernandez P, Zhang W, Ba Y, Li Q. 2019. A comparison of hazard perception and hazard prediction tests across China, Spain and the UK. Accid Anal Prev. 122:268–286. doi:10.1016/j.aap.2018.10.010

Wetton MA, Horswill MS, Hatherly C, Wood JM, Pachana NA, Anstey KJ. 2010. The development and validation of two complementary measures of drivers' hazard perception ability. Accid Anal Prev. 42(4):1232–1239. doi:10.1016/j.aap.2010.01.017

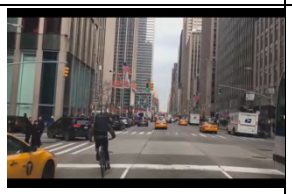
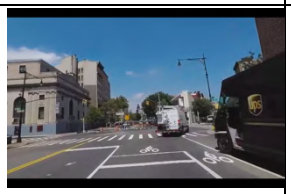
Wilde GJ. 1998. Risk homeostasis theory: an overview. Inj Prev. 4(2): 89–91. doi:10.1136/ip.4.2.89

World Health Organization. 2018. Global status report on road safety 2013 [report]. https://www.who.int/violence_injury_prevention/road_safety_status/2018/en [accessed April 19, 2020].

Zuckerman M, Kuhlman DM. 2000. Personality and risk-taking: common bisocial factors. J Pers. 68(6):999–1029. doi:10.1111/1467-6494.00124

Online Supplement

Table S1. Weblinks to the 16 videos and brief descriptions of the traffic environment.

	Busy city	Non-busy city	Secondary road	Highway
Europe	 https://youtu.be/CPWB9tZhT80?t=298 (04:58–05:58) Central Amsterdam, The Netherlands. Narrow streets with a high density of cyclists and pedestrians.	 https://youtu.be/SvFIU7ZZDIc?t=96 (01:36–02:36) Suburbs of The Hague, The Netherlands. One-way road with two lanes, separate bicycle path, and a signalized intersection.	 https://youtu.be/prlUz6V7ZUc?t=7804 (02:10:04–02:11:04) Goch, Germany, close to the Dutch border. Two-way road. Only cars from the opposite direction are encountered.	 https://youtu.be/K3vTVN7e5zY?t=47 (00:47–01:47) Dual carriageway A13 from Rotterdam to Delft, The Netherlands, with three lanes per direction, reduced to two for the last 10 s. The ego-vehicle drives at the rightmost lane.
India	 https://youtu.be/gjr4k0xJErw?t=58 (00:58–01:58) Rewari district, Haryana, India. Narrow streets with a high density of cars, tuk-tuks, motorcyclists, and pedestrians.	 https://youtu.be/iss5ULIt13E?t=390 (06:30–07:30) Bangalore, India. Very narrow street with traffic primarily in the direction of the ego-vehicle, with a few cars, motorcyclists, and pedestrians from the opposite direction.	 https://youtu.be/QXwr8IKp4nk?t=958 (15:58–16:58) Chandigarh, India. Single carriageway with cars and motorcycles in both directions.	 https://youtu.be/QXwr8IKp4nk?t=26 (00:26–01:26) Chandigarh, India. Dual carriageway with two lanes per direction. Cars and motorcycles present.
United States	 https://youtu.be/7HaJArMDKgI?t=4139 (01:08:59–01:09:59) Manhattan, New York. One-way four-lane road. Primarily cars and busses, with a few cyclists. Ego-vehicle drives in the middle lane.	 https://youtu.be/bQ7mI-ODxEE?t=2051 (34:11–35:11) Bronx, New York. One-way two-lane road, plus bicycle lane, and signalized intersections. Only cars, all at the direction of the ego-vehicle.	 https://youtu.be/6Y2hdqK1EnY?t=1281 (21:21–22:21) Angeles Crest Highway, Los Angeles. One-way two-lane road and signalized intersections. Ego-vehicle drives at the left lane.	 https://youtu.be/Hsr9U8obex0?t=1617 (26:57–27:57) Pomona Fwy (CA-60), CA. Dual carriageway with four lanes per direction. Ego-vehicle in the second rightmost lane. Traffic consists of cars and heavy vehicles.

Venezuela	 https://youtu.be/aMIlfYRhpO8?t=421 (07:01–08:01) Caracas, Venezuela. Very narrow street at the first half of the video, broader road (single lane & parking lane) for the remainder of the video. Cars and pedestrians present.	 https://youtu.be/HUtLMMim_V0?t=5242 (01:27:22–01:29:22 sped up by 2x to achieve normal speed) Caracas, Venezuela. One-direction broad road. Cars, buses, and pedestrians present.	 https://youtu.be/bTd6uHxW_Jc?t=507 (08:27–09:27) Caracas, Venezuela. One-direction road in the first part of the video, two-direction road at the remainder. Cars and motorcyclists present.	 https://youtu.be/h5foQ470048?t=1755 (29:15–31:15 sped up by 2x to achieve normal speed) Autopista Caracas – La Guaira, Caracas, Venezuela. Double carriageway with two lanes per direction. Ego-vehicle in the leftmost lane.

Figures S1–S15 show the mean cumulative number of key presses per participant group (United States, Venezuela, India, Western Europe, and other participants) as a function of elapsed time for the Indian highway video. A steep upward slope of the line means that many participants pressed the response key at that point in the video. Furthermore, the top of the figure shows, for each 5-s interval of the video clip, the percentage of participants per participant group who had pressed the response key at least once within those 5 s. Also shown is the result of a chi-squared test, comparing the five participant groups regarding the number of participants who pressed the response key at least once versus the number of participants who pressed the response key zero times. Between parentheses is shown whether the results for participants from that world region differ significantly from participants from the United States (U), Venezuela (V), India (I), Western Europe (W), or other countries (O), as calculated using Fisher's exact test. For example, "36% (O)" depicted in red between 25 and 30 s means that participants from the USA were more likely to press the response key (36%) than participants from other countries (16%) for that 5-s interval.

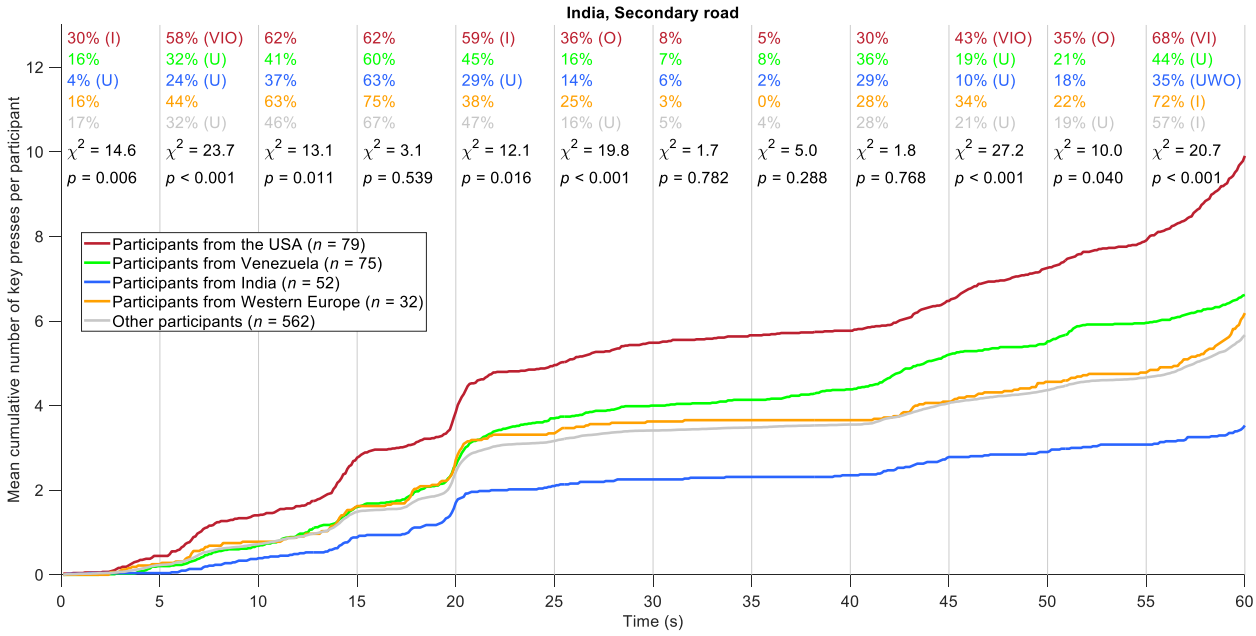


Figure S1. India, Secondary road. Screenshots: 19 s and 57 s.

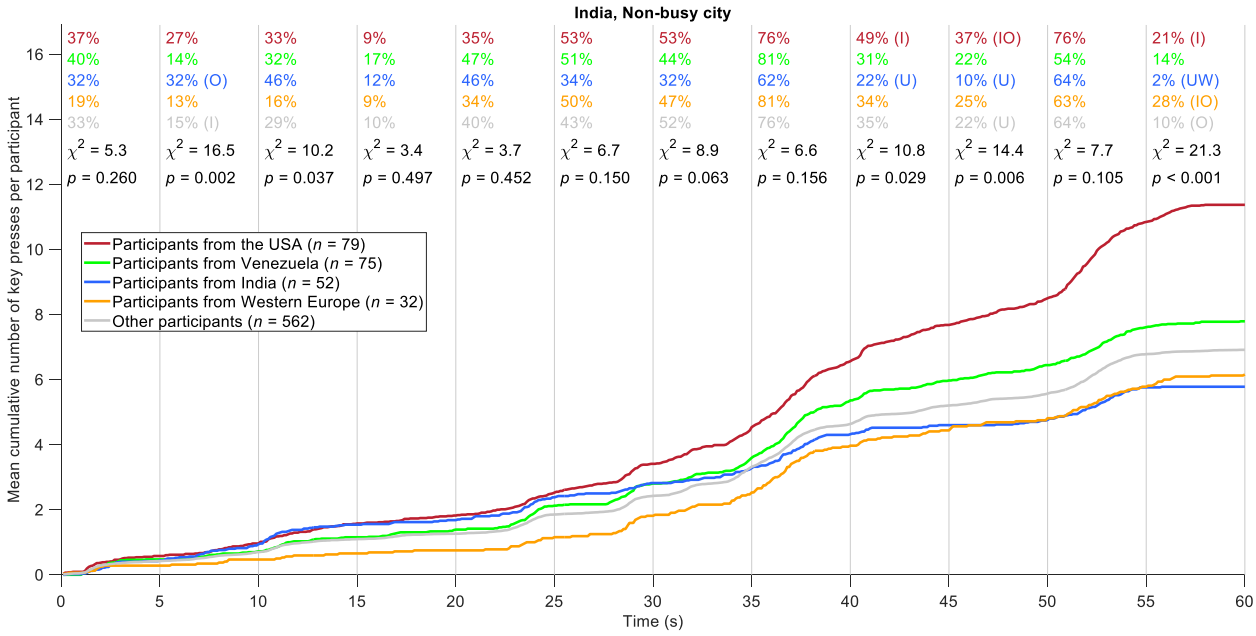


Figure S2. India, Non-busy city. Screenshots: 11 s and 56 s.

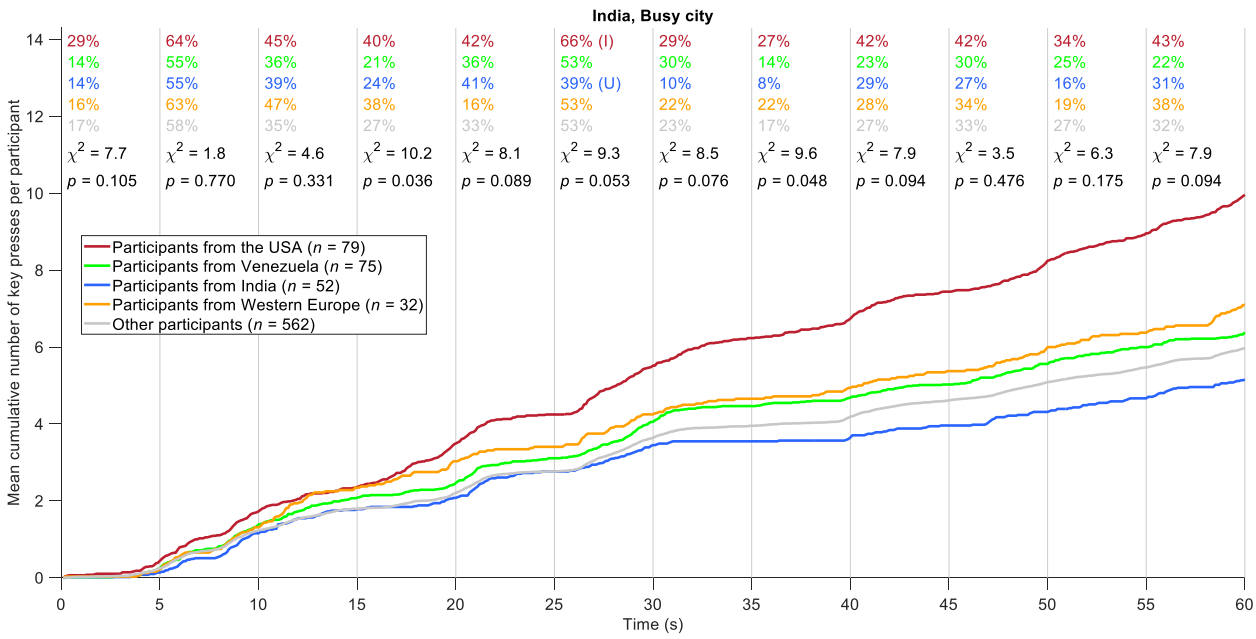


Figure S3. India, Busy city. Screenshot: 8 s and 27 s.

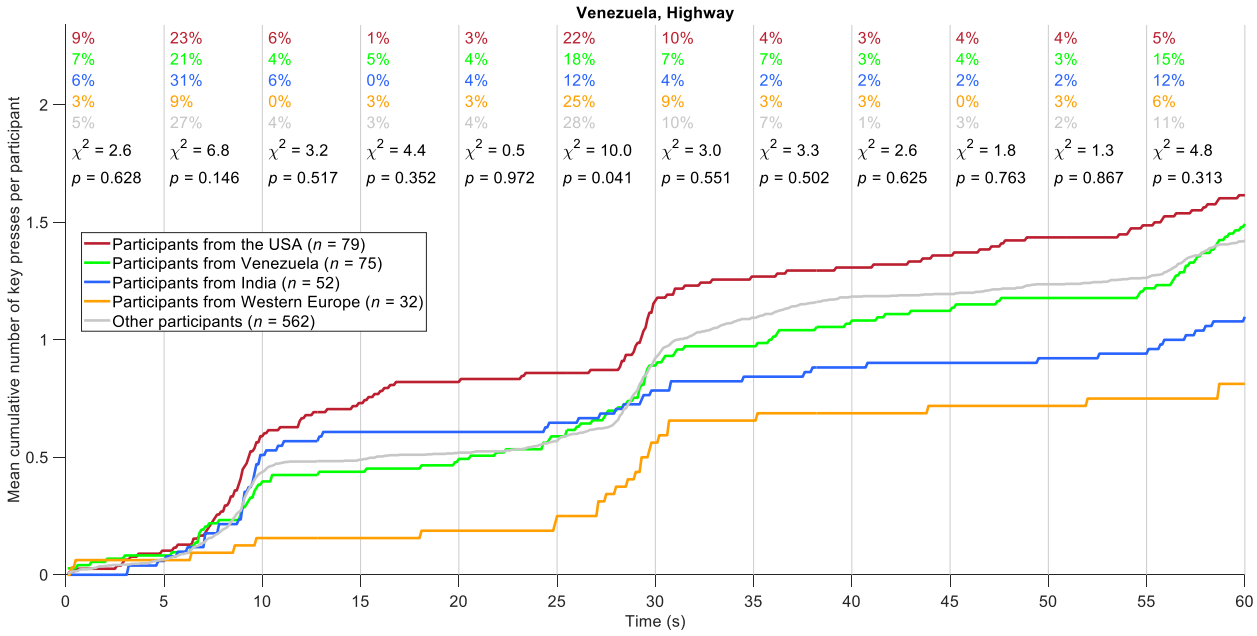


Figure S4. Venezuela, Highway. Screenshots: 9 s and 28 s.

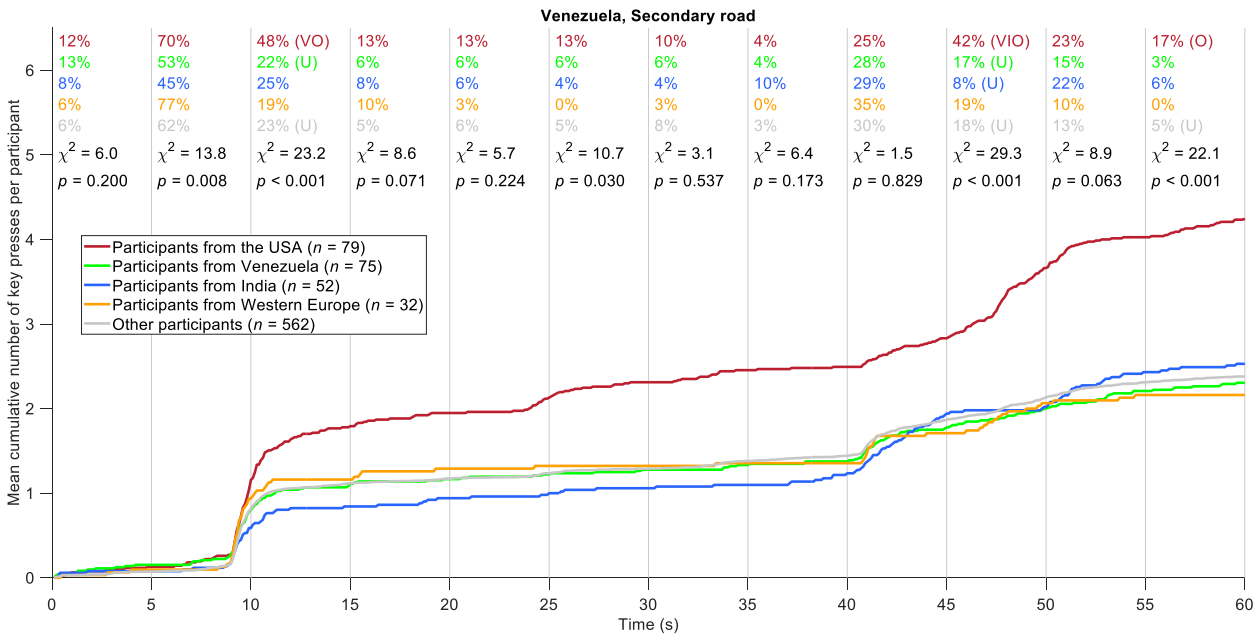


Figure S5. Venezuela, Secondary road. Screenshots: 9 s and 47 s.

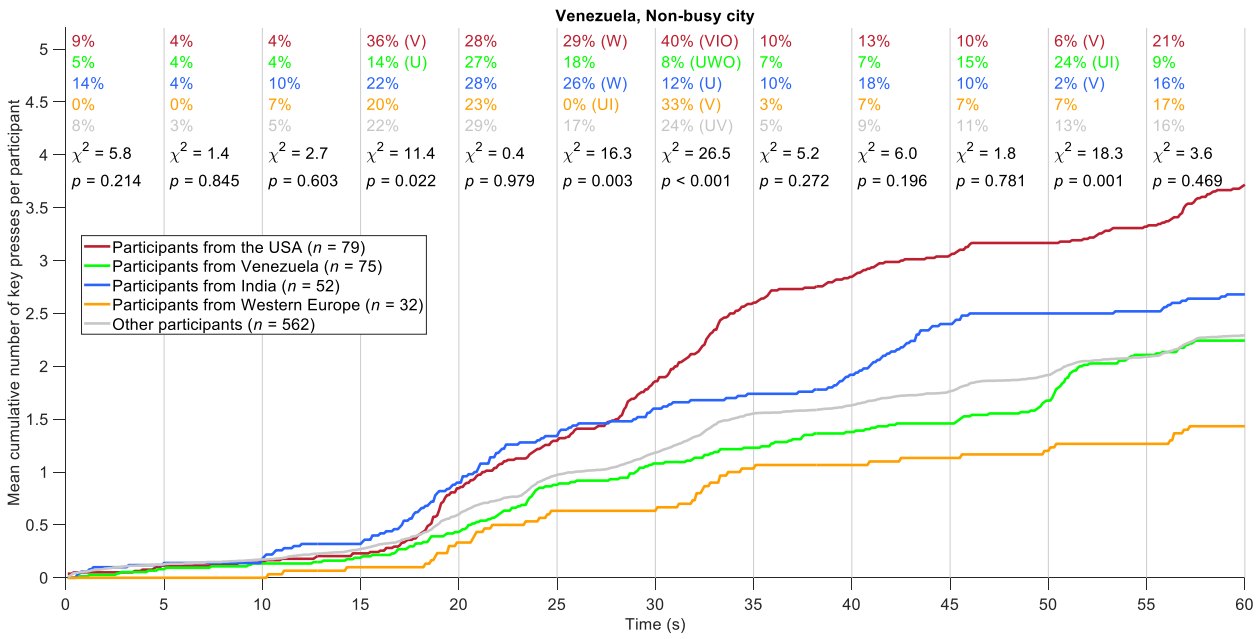


Figure S6. Venezuela, Non-busy city. Screenshots: 33 s and 50 s.

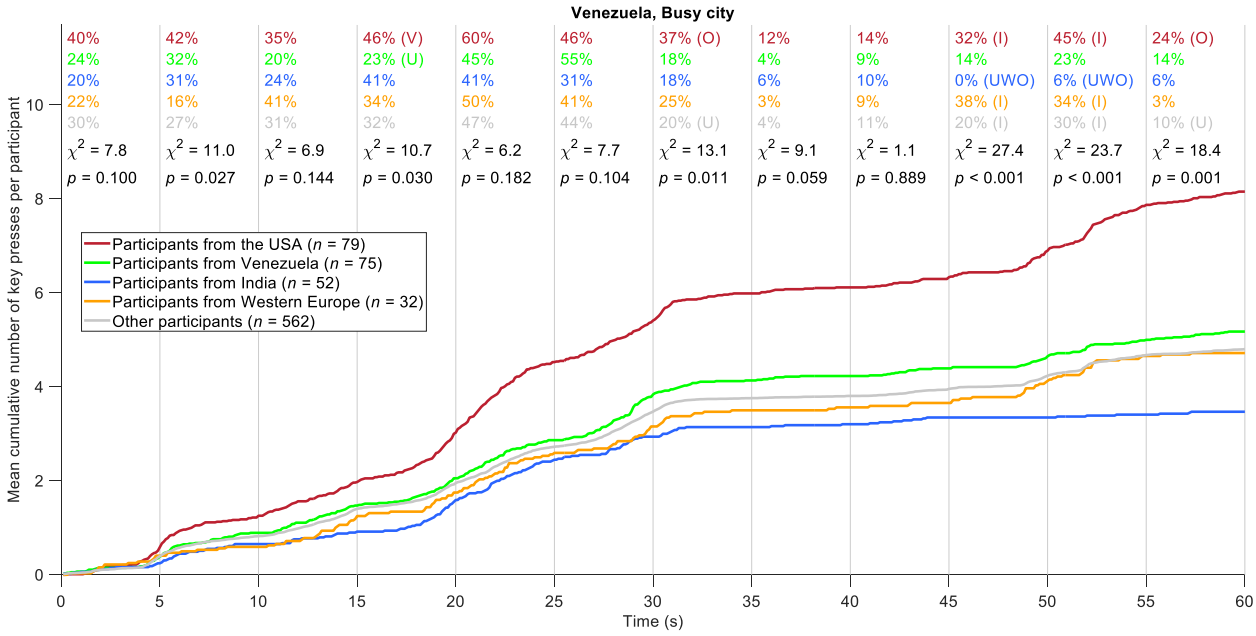


Figure S7. Venezuela, Busy city. Screenshots: 28 s and 49 s.

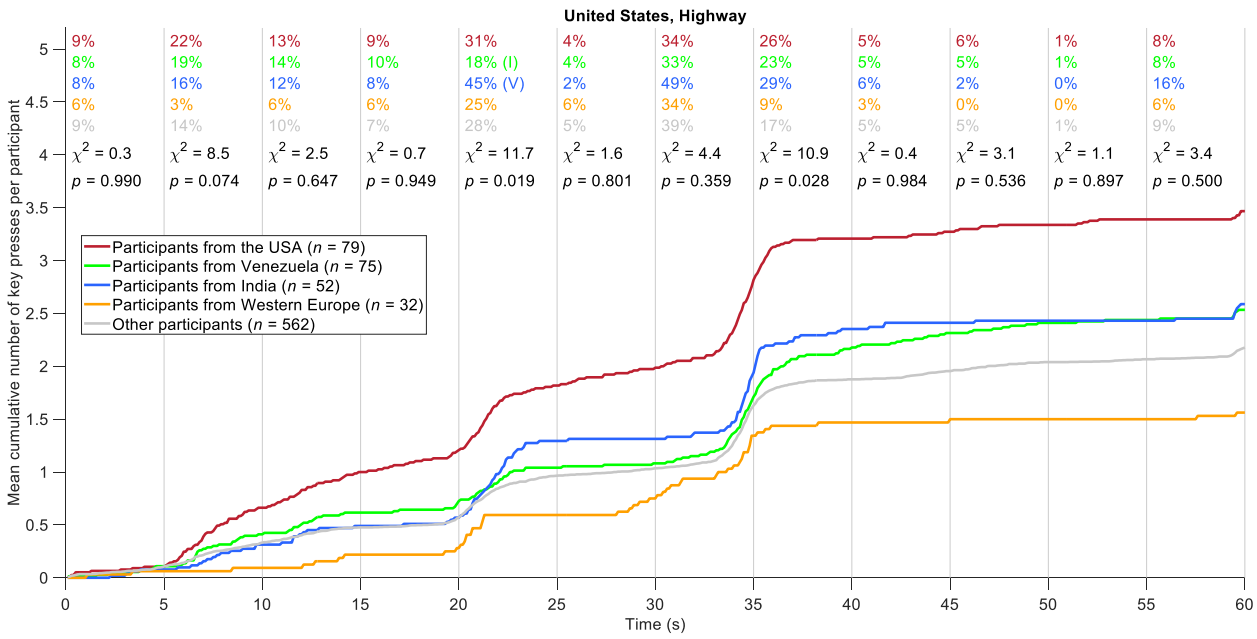


Figure S8. United States, Highway. Screenshots: 22 s and 36 s.

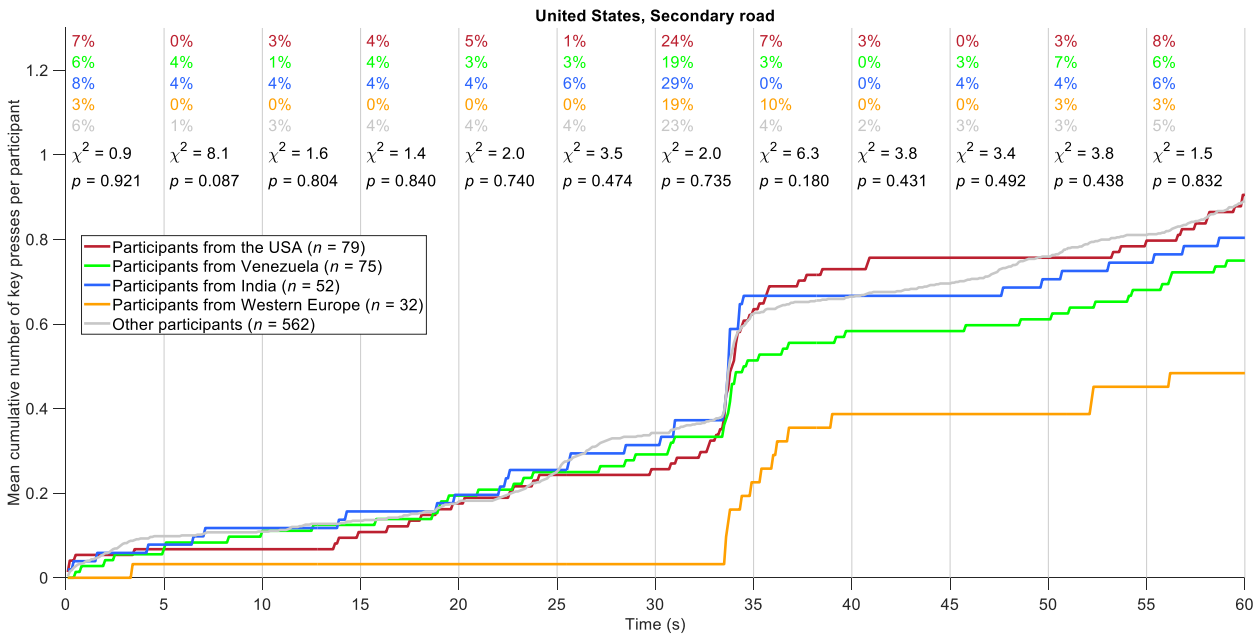


Figure S9. United States, Secondary road. Screenshots: 34 s and 59 s.

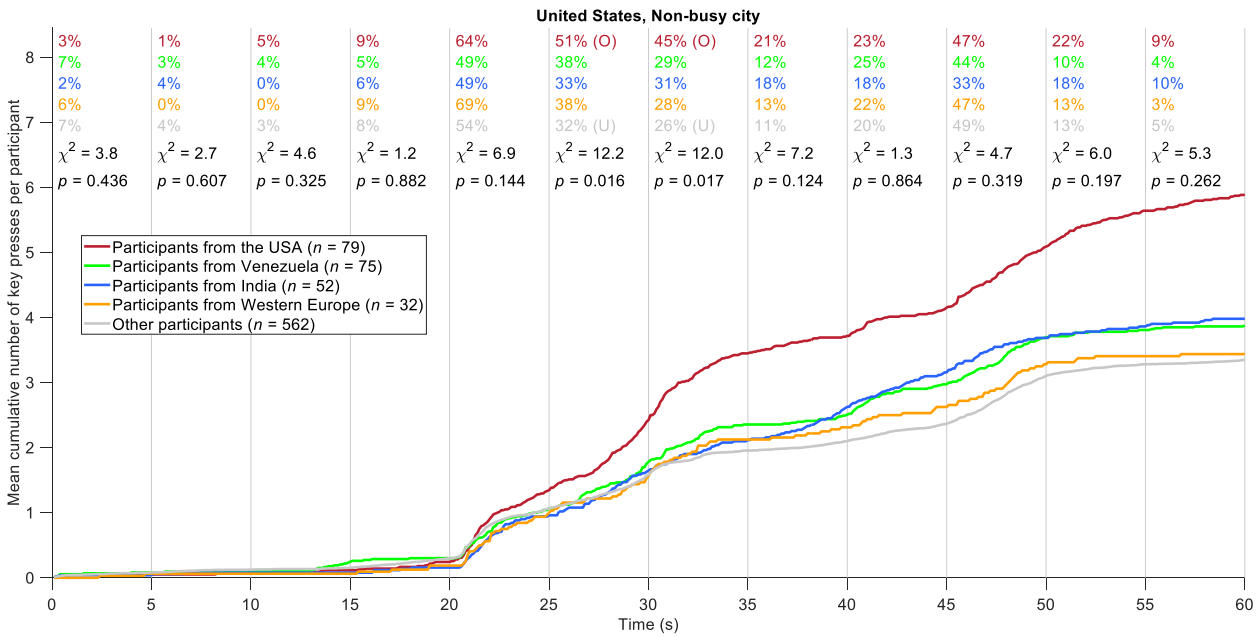


Figure S10. United States, Non-busy city. Screenshots: 27 s and 33 s.

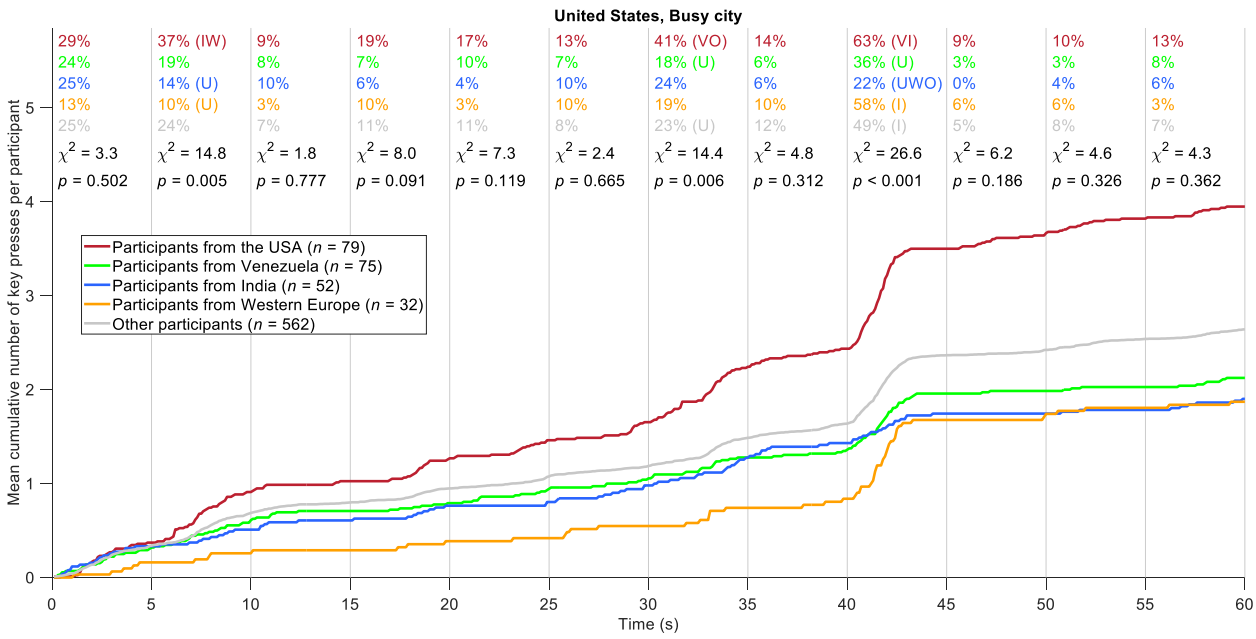


Figure S11. United States, Busy city. Screenshots: 8 s and 42 s.

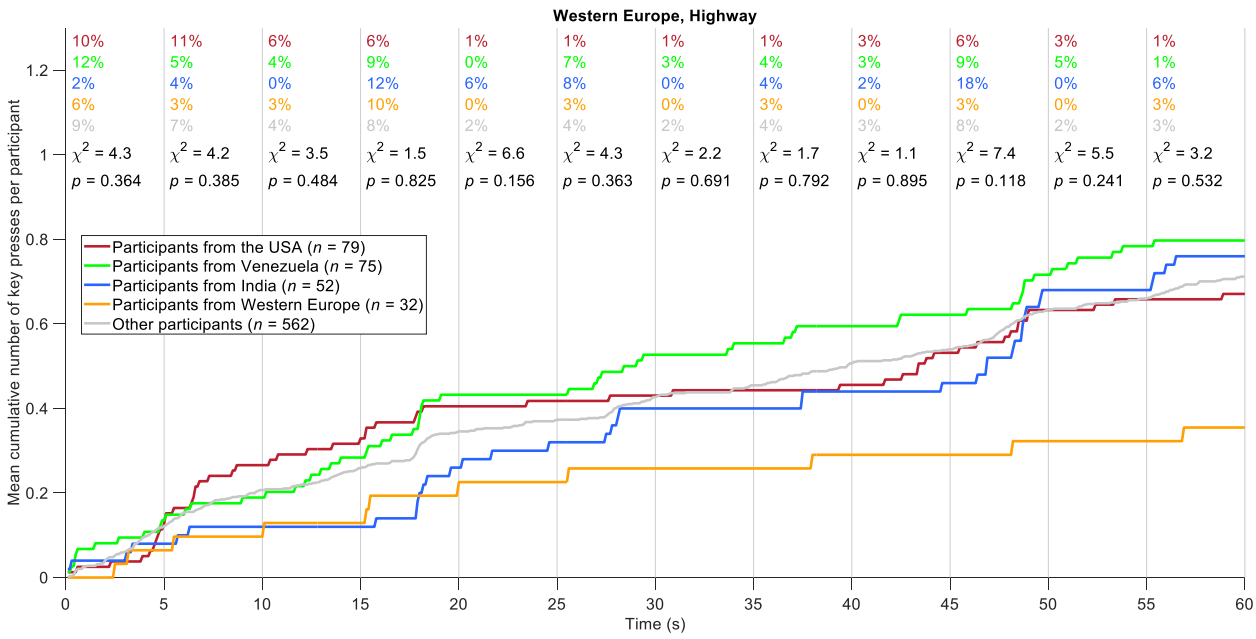


Figure S12. Western Europe, Highway. Screenshots: 18 s and 48 s.

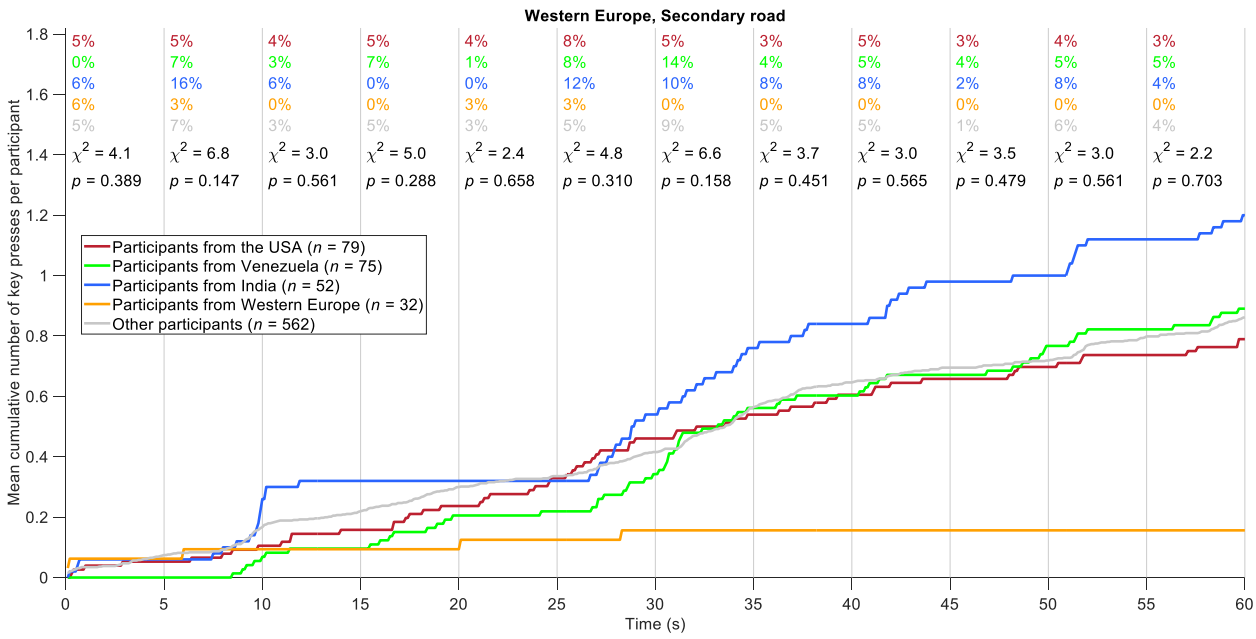


Figure S13. Western Europe, Secondary road. Screenshots: 10 s and 42 s.

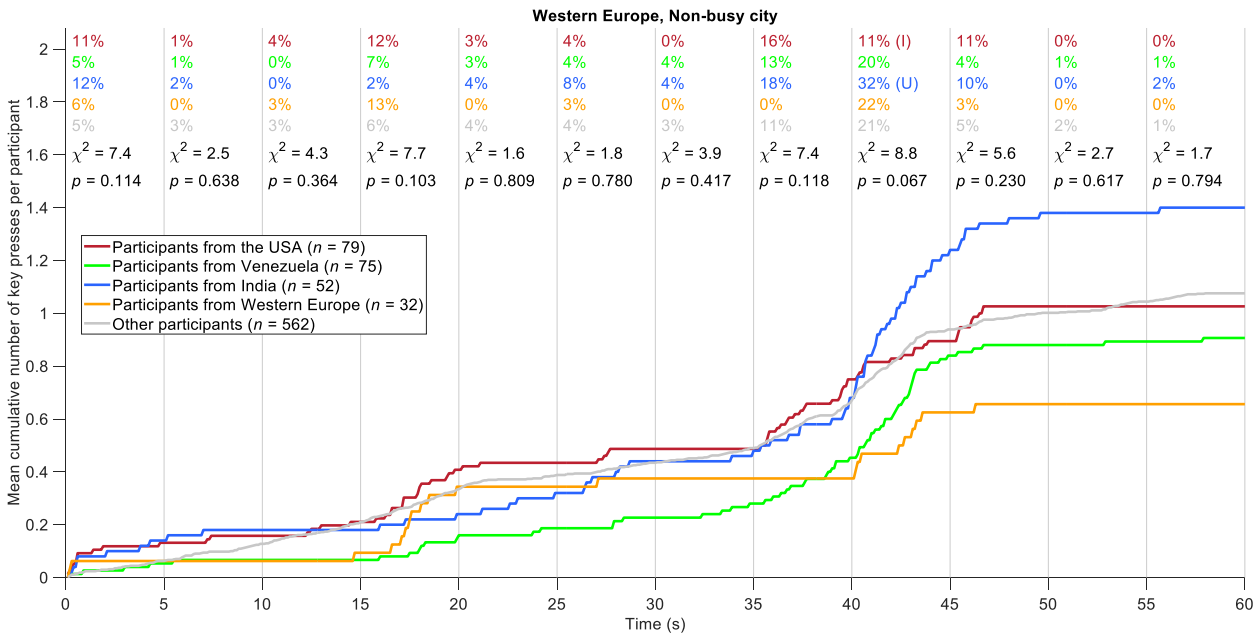


Figure S14. Western Europe, Non-busy city. Screenshots: 18 s and 43 s.

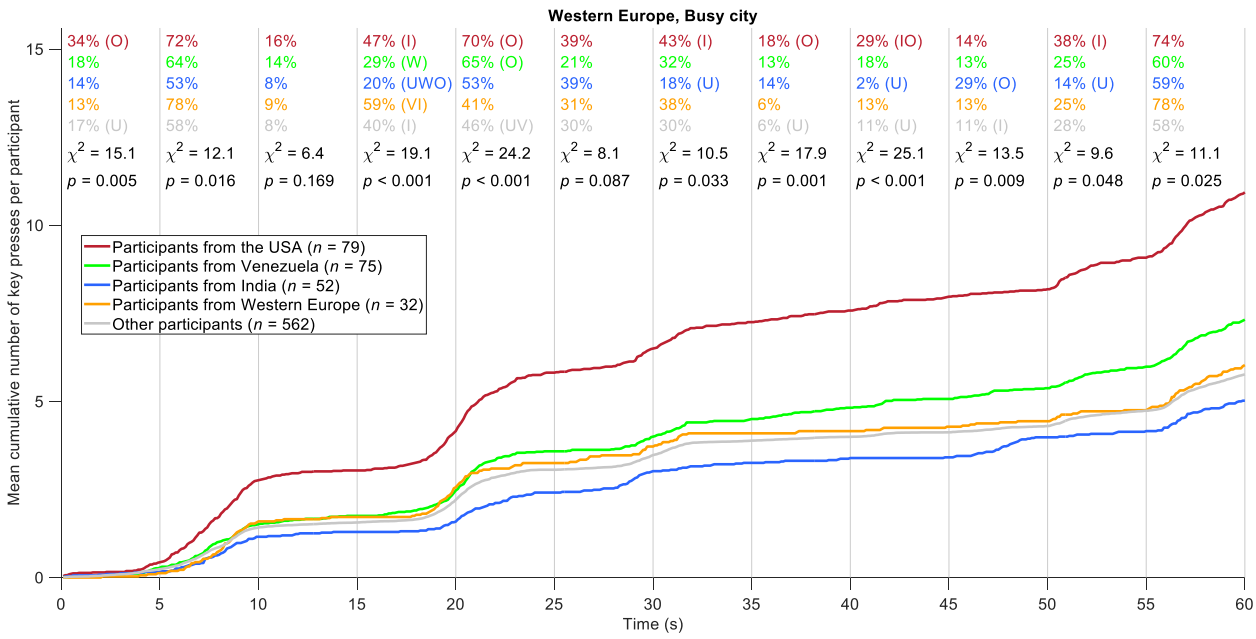


Figure S15. Western Europe, Busy city. Screenshots: 20 s and 58 s.