Fyhri, A., Sundfør, H., Weber, C., & Phillips, R. (2018). Risk compensation theory and bicycle helmets–Results from an experiment of cycling speed and short-term effects of habituation. *Transportation Research Part F: Traffic Psychology and Behaviour, 58*, 329-338, ISSN 1369-8478.

The article has been published in final form by Elsevier at

https://doi.org/10.1016/j.trf.2018.06.025

Risk compensation theory and bicycle helmets – results from an experiment of cycling speed and short-term effects of habituation

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It has been suggested that the safety benefits of bicycle helmets are limited by risk compensation. The current study contributes to explaining whether the potential safety effects of bicycle helmets are reduced by cyclists' tendency to cycle faster when wearing them (as a result of risk compensation), and if this potential reduction can be associated with a change in perceived risk. A previous study (Fyhri & Phillips, 2013) showed that non-routine helmet users did not increase their speed immediately after being given a helmet to wear, while routine helmet users cycled more slowly. The current study tests whether the previously found reduction in speed in response to helmet removal – as an indirect indicator of risk compensation - could be established in non-routine helmet users, after a period of habituation while cycling with a helmet.

We did this by conducting a randomized crossover trial, in which we used GPS-derived speed calculations and self-reported risk perception. To test the effect of habituation, we used a design where each participant took part in two rounds with a break between and each round having two trips. We collected the data in June 2015. Non-routine helmet users (N=31) were recruited in the field (along cycle routes in Oslo), and through a sample drawn from the Falck National register of bicycle owners. In the first phase of the study, all participants were asked to complete a test route (2.4 kilometres downhill) with and without a helmet. In the second phase of the experiment, conducted after 1.5 -2 hours, the same participants again completed the test route with and without a helmet. In the time between the first and second phases of the experiment, all participants were given helmets, and told to use them on a predefined bicycle route.

Habituation to the helmet between the first and second phases of the experiment did not produce any decrease (with helmet removal) in speed, on top of the habituation that occurred while cycling down the hill (the order effect). Mean speed difference for cycling with/ without a helmet before the break was -0.76 km/h, after the break this difference was 0.32 km/h; 95% CIs [-0,5, 2.9] and [-0.9, 1.5]. We argue that risk compensation is an unlikely effect of using a bicycle helmet, and probably cannot explain any adverse effects related to helmet legislation.

Keywords: bicycle helmet, risk compensation, long-term effects, GPS, field experiment, habituation.

1 Introduction

Case-control studies have shown injury-reducing effects of bicycle helmets (Attewell, Glase, & McFadden, 2001; Olivier & Creighton, 2016). However, evidence from countries that have introduced helmet laws indicate no reductions in head injuries over and above those observed for other injuries (Robinson, 2006, 2007). Recent studies(Bonander, Nilson, & Andersson, 2014; Olivier, Walter, & Grzebieta, 2013; Walter, Olivier, Churches, & Grzebieta, 2011), and especially a Cochrane review from 2007 (Macpherson & Spinks, 2007) have disputed this finding. Nevertheless, it has been suggested that *risk compensation* reduces the effect of bicycle helmets, i.e., helmets make people take more risks (Robinson, 2006). Further, it has been suggested that this risk compensation is related to a change in perceptions about the consequences of a potential collision (Adams & Hillman, 2001), in other words to a change in *risk perception*, as defined in the psychometric model (Fischoff, Slovic, Lichtenstein, Read, & Combs, 2000).

Risk compensation has been used to describe how perceived risk influences driving behaviour among motorists, and is related to Wilde's (1994) *target risk theory* (risk homeostasis theory). Such models predict that driver behaviour is motivated by the goal of achieving a certain outcome related to risk level. According to the risk compensation theory people will become more careful when they sense increased risk and less careful when they feel more protected (OECD, 1990).

As part of the debate surrounding effectiveness of helmet laws, it has been claimed that a safety measure needs to be noticed if it is to be compensated for (Hedlund, 2000). This is in line with Adams and Hillman's (2001) claim that risk compensation is a result of changed assessments of consequences of behaviour. If one accepts this notion, it can been argued that studies should try to explain the components of risk perception *and* link those components to associated safety behaviours to provide convincing evidence for or against risk compensation (Phillips, Fyhri, & Sagberg, 2011). The studies should also account for findings that *discomfort* is a major barrier against bicycle helmet use (Bogerd, Walker, Bruhwiler, & Rossi, 2014; Finnoff, Laskowski, Altman, & Diehl, 2001). Since studies of risk perception have indicated that risk perception and comfort are conceptually close (Backer-Grøndahl & Fyhri, 2008; Lewis-Evans, De Waard, & Brookhuis, 2010), it is important to study perceived comfort in conjunction to perceived risk when looking at bicycle helmets.

Fyhri and Phillips (2013) found that after having removed the participants' helmets, routine helmet users cycled more slowly and demonstrated increased psychophysiological load. For cyclists who were not accustomed to helmets there was no significant change in either cycling behaviour or psychophysiological load. However, merely testing the *immediate* effect of a helmet is insufficient evidence against risk compensation. This is because the user might need to spend some time wearing the helmet while cycling to get used to the helmet and to sense the extra protection afforded. If this is true, risk compensation might take some time to emerge. Hence, there is a need for studies that look for changes in speed in response to wearing bicycle helmets after a certain time for habituation.

Our previously observed effect of a reduction in cycling speed in response to removing the helmet from routine helmet users (Fyhri & Phillips, 2013) could be seen as indicative of a risk compensation effect – after all, accustomed helmet-users cycled faster when wearing helmets than when not wearing them. But risk compensation is meant to predict what happens when a safety device is introduced, not when it is removed. It is important to note, therefore, that when wearing a helmet in our previous study, the routine helmet-users cycled no faster than non-routine users (whether the latter wore a helmet or not). Rather than an increase in speed in response to routine helmet use (direct risk compensation) our previous observations indicated some change in psychology and/or behaviour among cyclists as they become accustomed to using a helmet, which manifested itself, initially at least, as more careful cycling in response to helmet removal (reduced speed). This reduction in speed can be seen as indirect evidence of risk compensation.

In the current article, we wanted to test whether this reduction in speed in response to helmet removal – as an indirect indicator of risk compensation – could be established in non-routine helmet users, after a period of habituation while cycling with a helmet. More precisely, we hypothesised that the difference in cycling speed with/without helmet would increase after participants had time to get accustomed to the helmet.

Further, we wanted to explore if getting used to a helmet could influence participants' perceptions of risk and safety in the different conditions.

A natural implication of the theory of risk compensation is that a safety device leads to behavioural change via changes in experienced risk. In the case of cyclists and helmet use, it can be assumed that change in cycling speed is an important behavioural indicator, or a proxy, of risk compensation. Other behaviours that are likely to be outcomes of risk compensation are traffic violations, risky route choices, close overtakes etc. Such behaviours typically occur in natural cycling environments. The current study aims to observe the direct relationship between helmet use and risk compensation. Observing other types of behaviour calls for a very complex research design, to control for a range of potential confounds, and is not the subject of this study.

2 METHOD

2.1 Sample

An a priori power analysis using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was used to calculate the number of participants needed for identifying a significant change of 1.5 kilometres per hour (S.D 1 km/h) (found in Fyhri and Phillips (2013)). To reach this (power= 80 and alpha=0.05) 32 participants were needed.

Participants (non-routine helmet users) were recruited through a sample of bicycle owners drawn from the Falck National register of bicycle owners, through social media and along cycle routes in Oslo (a few days before the experiment). The participants were to answer a questionnaire about cycling and collisions in advance of the experiment.

Routine helmet users were filtered out using the question “How often do you use a bicycle helmet while cycling?” (always, often, sometimes, seldom, never). Only those who stated to “seldom” or “never” use a helmet were included. A total of 71 people met the criteria (non- routine helmet user) and received information about the experiment. The participants were not told the purpose of the study. After drop-out 31 cyclists showed up and completed the whole experiment. Data from one participant who completed the trip was excluded from further analysis, as it turned out that the participant had not followed the protocol (see section 2.3).

2.2 Sample description

Background variables (reported in the pre-trial questionnaire) are presented in Table 1. Three of the participants had not completed the first questionnaire, so the table only contains data for 27 participants.

Table 1. *Background variables. All values except age in percent.* N=27.

	Per cent
Cycled more than 50 days [this year]	56
Cycle all year	37
Bicycle collision last five years	15
Cycle often/always on red light	22
Mountain bike	30
Hybrid	37
Classic	30
Other type of bicycle	4
Female	32*
Mean age (years)	44.0
N	27

* From the total study, N=30.

Among the participants, there is an overrepresentation of males (68 percent). In a previous study recruiting participants with a roadside survey in Oslo, around 55 percent of the participants were male (Fyhri, Sundfør, Bjørnskau, & Laureshyn, 2015). The mean age, and the share who state to cycle on red light is comparable to what was obtained in the previous study (Fyhri & Phillips, 2013). All participants stated to never or seldom use their helmet when cycling, compared to national data indicating a helmet use rate of 51 per cent (Statens Vegvesen, 2014). There has been no implementation of mandatory helmet use in Norway. All in all, the sample seems to be representative of the Norwegian cycling population, with the one (important) exception that they rarely use helmets.

2.3 The experimental setup

The study was carried out as a randomized crossover trial at a site in Oslo. The test strip ran downhill (2.4 km) with mixed traffic, outside of the city centre (Figure 1). The site was chosen mainly for two reasons. (1) The steep slope (250 m elevation) would potentially induce a wider range of cycling speeds, thereby emphasizing any effect of the helmet on cycling speed. (2) Little traffic volume on the stretch made it unlikely that pedestrians or cars would affect cycling behaviour. The location is thus a somewhat “extreme condition”, it is not intended to be representative for a “typical everyday cycling- route”. The idea with this setup was to remove as many as possible factors that can influence cycling speed, other than the one issue we were interested in, i.e., risk compensation following from helmet use.

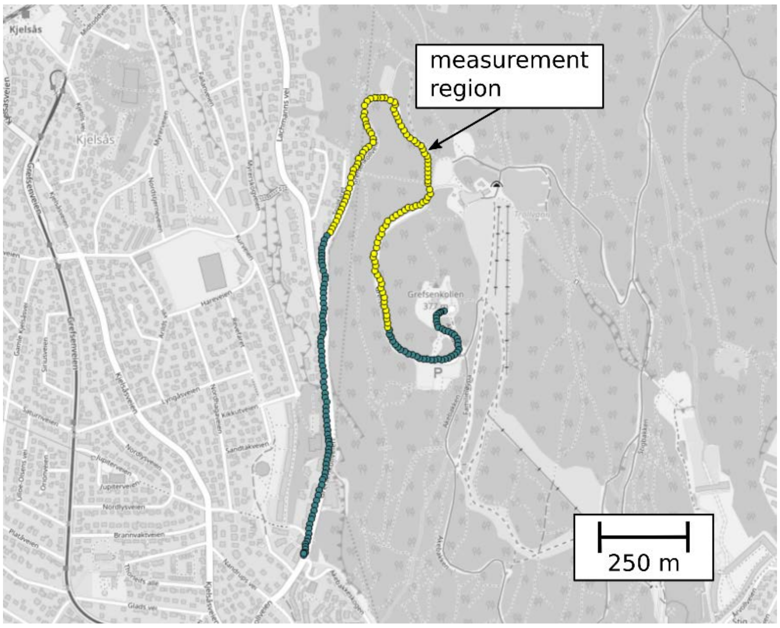

Figure 1. *The test route (in green), and the speed measurement region (in yellow). Map data from OpenStreetmap.*

Due to the unfamiliar setting, we wanted one of the elements to be familiar, hence all participants were told to bring their own bicycle. Participants were organized in small groups of 2- 4 cyclists. The group of participants were taken by car to the top of the hill they were to cycle down. A mobile phone was attached to their upper arm and the Strava-application (a mobile application that records GPS-coordinates) was activated. They were instructed to cycle down the hill at their “own speed”, individually. The point at which they had to stop cycling was marked with a person in a yellow waistcoat. After each trip, they were asked to respond to a questionnaire about obstacles they had encountered, and risk perception related to the trip. Questions about habit strength for helmet use were asked after the final trip. Each participant was asked to wear a helmet either in the first or second round (randomly assigned) of cycling (Table 2). The random assignment of conditions was aimed to counterbalance any order effect from getting used to ride the test strip.

We present the actual distribution of the different conditions in Table 2, indicating that counterbalancing had worked well.

*Table 2. Number of participants in each experimental condition. N=30**

		Pre-intervention		**Intervention**	**Post-intervention**	
		Test 1	Test 2	Habituation: all wearing helmets (duration 1-1.5h)	Test 3	Test 4
Group1	7 participants	Helmet	No helmet	helmet	Helmet	No helmet
Group2	7 participants	Helmet	No helmet	helmet	No helmet	Helmet
Group3	8 participants	No helmet	Helmet	helmet	Helmet	No helmet
Group4	8 participants	No helmet	Helmet	helmet	No helmet	Helmet

* In total, 31 participants completed the trial, but one participant had not followed the instructions, and was removed from the data set).

After the first two trips, the groups (2-4 in each group) cycled a distance of approximately 2.4 kilometres one way (total distance back and forth was 4.8 km) to a facility where they could try e-bikes. All participants were given helmets and told to use them as long as they were on the bicycle (and e-bike). The second phase of the experiment was conducted after 1.5 -2 hours. It was estimated that the participants wore their helmets for approximately 1-1.5 hour during the break. After the break, all participants completed the test route with and without a helmet (except for the one participant who cycled two times without a helmet and is not included in table 2). The design made sure that half of the participants changed the order in which they wore/did not wear a helmet, and half of them kept the same order as before the break. The ride to the facility during the break was deliberately planned to be along a safe and level route, and the cyclists did not have to ride uphill, so that also less experienced and less fit cyclists could take part.

The respondents were debriefed after the trial and explained about the purpose of the study. A few of the participants (no data were collected about this) indicated that they had second-guessed what the purpose was. When asked whether this had influenced their cycling they all claimed that the task itself was so demanding or that they had been so intent on performance that they had not been able to speculate much about how they were expected to behave.

The study was approved by the Norwegian Social Science Data Services. All participants signed an informed consent with the phrase "my participation is voluntary, and I understand that I can withdraw from the experiment at any time".

2.4 Instruments and measures

Data are available at the Norwegian Centre for Research Data (Fyhri & Sundfor, 2015).

2.4.1 Speed

GPS-coordinates were recorded for the whole distance using the mobile application "Strava". The data from GPS files is loaded via a Python script. Latitude and longitude coordinates are converted to the UTM (Universal Transverse Mercator) coordinate system to facilitate calculations: In UTM, the distance between two points can be found by calculating the Euclidian distance directly, without having to consider the curvature of Earth's surface. The rate for data acquisition was 1 Hz. The instantaneous speed is calculated by dividing the Euclidian distance between two consecutive data points by the difference in time between data acquisition.

2.4.2 Risk perception and helmet-use habits

All questions were originally asked in Norwegian, but are presented in English translation here. Risk perception was measured explicitly by two items: [On this trip…]

- "How high was the probability that a collision could happen, in your opinion?"
- "How large would the consequence of a collision have been, in your opinion?"

Responses were given on a 7- point scale where 1 indicated "very small" and 7 "very high/large".

Participants were also asked to what extent they felt unsafe, uncomfortable and excited: "When you cycled this trip, did you feel …"

- "unsafe?"
- "uncomfortable?"
- "excitement?"

Responses were given on a 7- point scale where 1 indicated "to a very small degree" and 7 "to a very large degree".

After the four trips, habits and helmet use were assessed by five items taken from the self-reported Habit Index (Verplanken & Orbell, 2003) “To wear a bicycle helmet is something that … “

- “I do automatically”
- “I would find hard not to do”
- “I do without thinking”
- “I do often”
- “Would feel strange not to do”

Respondents were to indicate level of agreement on a 7-point Likert scale (1= disagree 7=agree)

Being hindered was assessed by asking the respondents one question after each trip:

- Were you hindered by something on your way down the hill? (Yes/No).

Those who were hindered were to report what kind of obstacle they encountered. Typical examples were people walking by the road, other cyclists, cars entering from a parking lot etc.

2.5 Data preparation

Before analysis, we made a qualitative assessment of the responses about being hindered by obstacles or other road users. All in all, one third of the trips had contained some sort of obstacle or hinder (ranging from 8 out of 30 to 14 out of 30 participants per trip). Most of these were minor, such as some bus passengers waiting at a bus stop, or pedestrians walking along the road, and were evenly dispersed among conditions. We therefore did not take these into consideration for further analysis. Closer inspection of the more serious obstacles, showed that they all had happened at the beginning of the ride, or at a road junction 1.8 kilometres into the ride. From the complete data set, we therefore selected a region of interest (see figure 1). For each trip, an average speed is calculated as the arithmetic mean: sum_i(v_i) / n, where n is the number of measured values. Data were then imported to SPSS for analysis.

3 RESULTS

3.1 Assessment of the order effect

To explore adaption to the test route we looked at the speed for each trip (region 1 to 3), independently of condition. The results are presented in Figure 2.

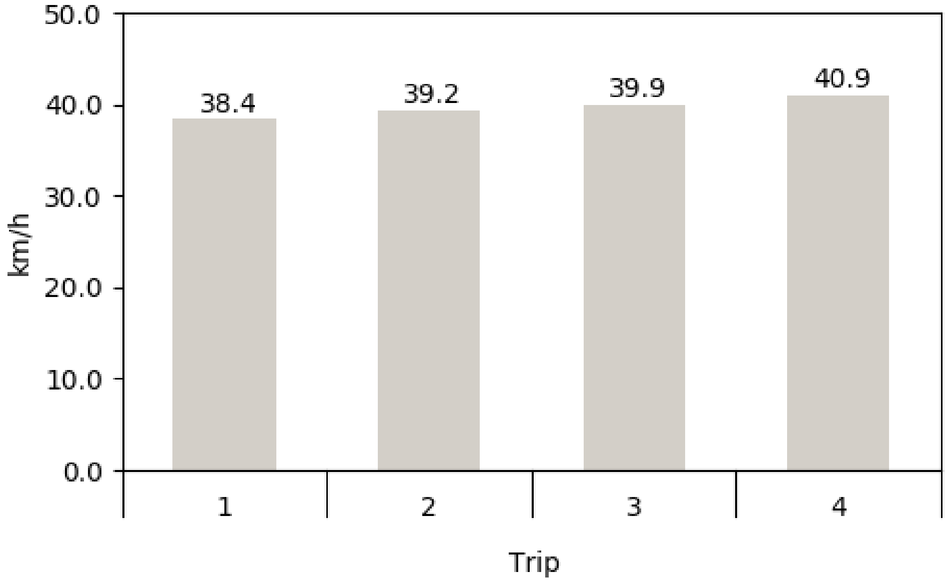

Figure 2. Speed on trips 1 to 4, regardless of condition. Mean (km/h). N=30.

As expected, there was a considerable order effect. The figure illustrates the changes in average speed for the different trips. The speed increased with the number of times cycling down the hill (change of 2.49 km per hour from trip 1 to trip 4). To test whether these changes were significant, a linear regression analysis was performed, with trip number as independent variable in the model (from 1st to 4th trip). The change in average speed was just significant, (B= 0.82; p=.08;, Adjusted R^2=.018) and therefore needs to be taken into account in the other analyses.

3.2 Effect of helmet on speed

To explore the difference between the behaviour (speed) when riding with or without a helmet we looked at the difference in average speed before and after the habituation period. The results are presented in Figure 3.

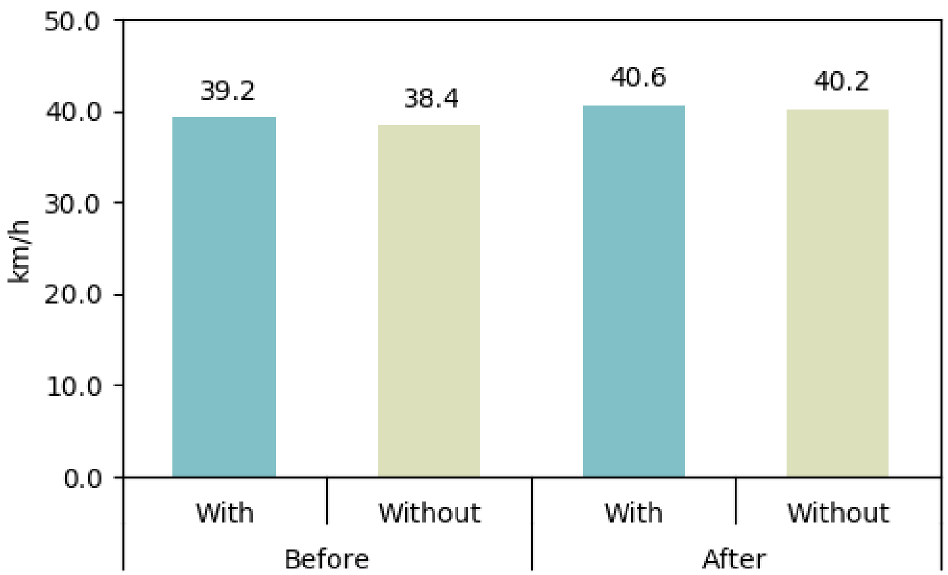

Figure 3. *Speed with and without helmet before the break, and after the break, regardless of trip number. Mean (km/h). N=30.*

Figure 3 shows that the speed is somewhat higher without the helmet before and after the break, but that the differences are small. To test whether the difference with and without helmet changed after the habituation period, a paired samples t-test was performed on the mean differences before the break (0.76) and after the break (0.32);

95% CIs for these means were [-0.5,2.0] and [-0.8,1.6]. The analysis showed that the difference between the trips with and without helmet had not changed significantly after the break (p=0.29). Giving the participants time to get used to a helmet during the break did not increase cycling speed while wearing a helmet relative to cycling speed without a helmet.

3.3 Effect of helmet on experience of the ride

To explore the effect of the helmet on the experience of the ride we calculated the mean difference for all four trips with and without helmet. Results are presented in Figure 4.

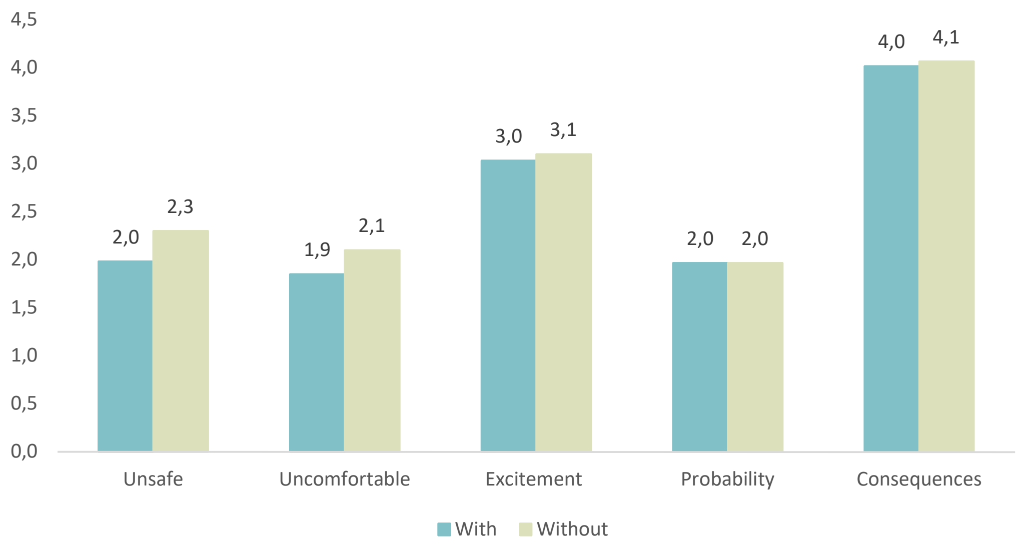

Figure 4. *Mean differences for measurements of experience of the ride (unsafe, uncomfortable, exited, probability of collision, consequences of collision). 1= very small degree 7=very high degree (aggregate measure of four trips).*

The figure illustrates the differences in ride experiences with and without helmet regardless of trip number. There are no differences in probability, consequences or excitement. Reports of feeling unsafe and uncomfortable in the helmet-on/ helmet-off condition appears to be different. To test whether these differences were significant, paired sample t-test was performed on the mean scores with (4.0) and without (4.7) a helmet. The difference in feeling unsafe was significant (p=.027). The differences in comfort, excitement, probability for collision and consequence of collision did not reach statistical significance.

Figure 5 shows how unsafe the participants felt before and after the break, with and without helmet. The figure indicates that feeling unsafe is reduced with increasing experience of the test course and confirms that the participants feel less safe when riding without a helmet.

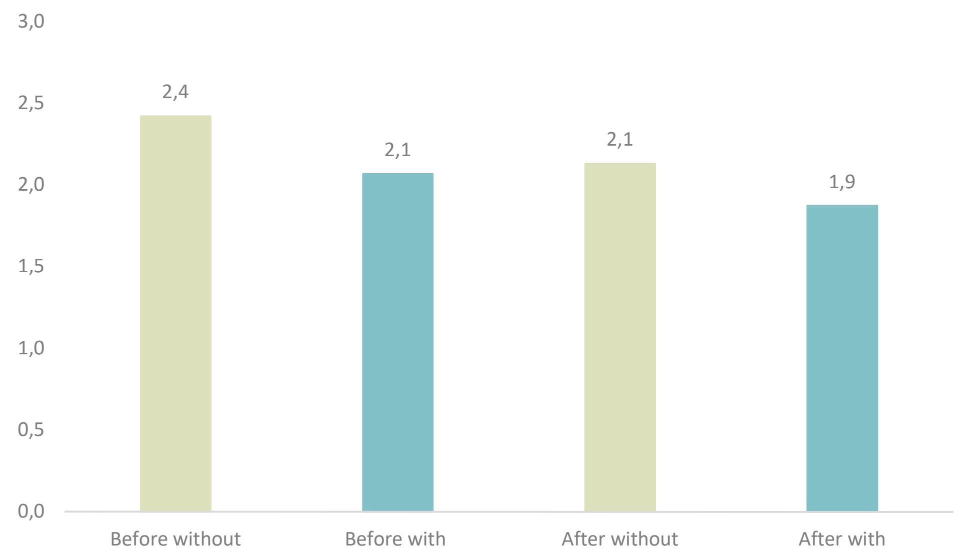

Figure 5. *Mean scores on feeling unsafe before and after break with and without helmets 1= low degree 7=high degree.*

To test whether the difference with and without helmet changed after the habituation period a paired samples t-test was performed, comparing the with/without helmet difference before the break (0.3) with the difference after the break (0.2). No significant effect of the break was found (p=0.86). If anything, the effect of the helmet on feeling unsafe was reduced after the break.

4 Discussion

The study tests whether cyclists adapt when cycling with a helmet, and if becoming accustomed to a helmet exacerbates any such effect. There was no difference in chosen speed between the helmet on or off conditions before the habituation period., which is in line with previous findings that using a helmet makes no immediate difference to cycling speed. There was also no difference in chosen speed between the helmet on or off conditions after two hours of habituation with the helmet. The participants reported feeling less safe when riding without a helmet but getting used to the helmet did not influence this feeling of safety. In other words, even after two hours of habituation with the helmet, removing the helmet did not affect chosen speed or perceptions of safety among these participants. Thus, we found no indirect evidence of risk compensation after habituation.

A strength of this study is that by using an experimental design, we could control for confounding conditions that might also have influenced speed and risk perception (pedestrians, cars, obstacles). Hence, we can assume that the largest change between phase one and two of the experiment is the condition (helmet off/on). As noted, there was a considerable order effect, participants got gradually more accustomed to the route and cycled faster for each trip. This highlights the importance of the randomised crossover design.

Still, we were not able to control the environment completely, and almost all participants reported they had been hindered by other road users on one or more of their trips. These situations were of rather small importance and more or less evenly dispersed among the conditions. Our interpretation is that they contributed with noise in the data, and that they did not produce any systematic differences that could influence our results. To further test the robustness of our findings, we also calculated the 85-percentile speed for each trip (as an expression of maximum speeds). This analysis did not differ from what we found using average speeds.

Our main aim has been to use speed reduction on removal of the helmet as a proxy for risk compensation, in order to see whether a limited time of familiarization is enough to produce a risk compensation effect. Related to this it can be argued that a weakness of the study is that the habituation period was too short to produce a potential adaptation behaviour. However, we saw no indications from self-reported measures that cyclists felt more comfortable while wearing the helmet, which may have indicated that a longer period would result in changes in cycling behaviour. Asking participants to wear the helmet for a longer period (say several weeks) and then to return to conduct the experiment would of course be ideal, but this was not practically feasible in this study. In fact, all participants were asked at recruitment (before the experiment) if they would volunteer to take part in such a follow-up experiment, and no-one accepted.

A potential limitation of the study is that the participants are placed in a somewhat unfamiliar situation, cycling down a rather steep hill. Hence, the ecological validity of the study can be questioned. Still, we argue that the internal validity (i.e. the control with confounding factors) afforded by the experimental design far outweighs this limitation and allows us to draw stronger causal conclusions than has been possible to do in previous research. We also believe that in everyday traffic (with more disturbing factors) the potential effects of the helmet on behaviour would be even more diluted than what we have been able to produce with the current design. To test this assumption, future studies should aim to explore the situation in more familiar settings (on their everyday cycling-routes).

As could be expected, some of the participants had second-guessed what the purpose of the study was. This is hard to avoid in a study such as this. In Norway, helmets are quite commonly used. It can be speculated that those who choose not to wear them do this from a certain conviction and therefore would be inclined to strategically change their behaviour in order to fit with their expectations (i.e. to cycle faster with a helmet). However, our results did not show any speed changes from helmet use, which does not support such a notion.

In the current study, we did find a main effect of the helmet on perceived safety, but this main effect did not change as a function of getting accustomed to the helmet. The fact that differences in risk perception did not change as a result of the intervention (time to get used to helmets), substantiates our lack of findings concerning speed changes. In the study, self-reported measurements for risk perception are used. It could be argued that more objective measures (such as heart rate variability) should have been utilized. Such measures have been attempted in previous studies, but Fyhri and Phillips (2013) concluded that their sensitivity was not good enough in a naturalistic setting, since differences in physical load induced substantial noise in the psychometric data. As noted, the subjective measure used here, seems to be sensitive enough, since it shows main differences between the helmet on/off condition.

The current study focused on cycling speed. As mentioned, there are other potential behavioural outcomes from risk compensation than increased speed. Future studies should aim to test if bicycle helmets influence risky behaviours such as red light running, route choice, lane placement etc. Further to this, the notion that cycling speed is linked with collision risk, deserves some comment. For motorised traffic, the relationship between speed and collision risk, as well as between speed and injury severity is well established (Elvik, 2013). Injury severity for cyclists in bicycle/motor vehicle collisions increases with increasing car speed (Kim, Kim, Ulfarsson, & Porrello, 2007). Also, cyclists who report to cycle fast also have a higher risk of self-reported collisions (Fyhri, Bjørnskau, & Backer-Grøndahl, 2012). Even if these relationships are not as well-studied as for car drivers, it is not unlikely that increased cycling speed is related to increased collision risk.

Using GPS-coordinates induces some uncertainty related to the speed measurements. Previous studies have used bicycle computers with calibration (they provide more accurate speed estimates). Since we wanted participants to use their own bicycle, bicycle computers were not an option: fitting and calibrating them would take up too much of the respondent's time. To compensate some of the inaccuracy of GPS measures the route was somewhat longer than in the previous study testing helmet effects (2.4 km versus 1.4 and 0.9 km) (see Fyhri & Phillips, 2013).

A limitation of the study is that the sample size is small (n = 30), even if such sample sizes are typical for experimental studies. To calculate the number of participants required, an a priori power calculation had been performed. Based on the effect sizes observed in a previous experiment (Fyhri & Phillips, 2013) (eta squared = 0.2) with a power of 80 per cent at an alpha level of 0.1, this was deemed to be sufficient. A posteriori calculations confirmed that given the standard deviations we have observed our sample size would have been able to detect a mean difference with and without helmets of approximately 1.5 km/h, as was observed in the previous study.

In this study, only those who were not already regular helmet users were to be included. We did not manage to meet that criterion to a full extent. To control for the fact that some of the participants where familiar with helmets, we also tested the models with statistical control for prior helmet use with the validated *self-reported Habit Index* (Verplanken & Orbell, 2003). The variable "habit strength for helmet use" did not influence speed or perceptions about cycling, and these models did not differ from those displayed.

In light of the above-mentioned limitations, our conclusions might seem unnecessary strong to some. However, our previous publications on the matter, where we did not find any risk compensation for cycle helmets, but were quite careful in our conclusion (Fyhri & Phillips, 2013; Phillips et al., 2011), have on a number of occasions wrongfully been cited as evidence *for* risk compensation (see e.g. Casanueva, 2014; Clarke, 2012; Goldacre & Spiegelhalter, 2013). Based on this we find it reasonable to come with the conditional conclusion that, until new research and even more convincing research is conducted, there is *still* no risk compensation for bicycle helmets.

5 Conclusions

The results from this study indicate that introducing a helmet to someone unfamiliar with one, does not lead to any risk adaptation, even after a short period of habituation (two hours). The results indicate that wearing a helmet makes the cyclists feel safer, but this change in feeling is not large enough to produce any speed changes. An important backdrop for this study is whether helmet use should be enforced as a law, or not. The current study does not give the full answer to that question, but it has important implications for one of the main arguments against helmet laws, namely that risk compensation can counteract the safety benefits of helmet use. The most likely remaining candidate for such a debate is now that helmet laws have the adverse effect of discouraging those who find helmets impractical for cycling.

Acknowledgements

The study was funded by the Norwegian Research Council as part of the programme Transport Safety (TRANSIKK).

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