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Faculteit Revalidatiewetenschappen

master in de revalidatiewetenschappen en de kinesitherapie

Masterthesis

The influence of a cognitive dual task on driving performance of young adults in a driving simulator

Arne Daniëls
Yves Poesmans

Scriptie ingediend tot het behalen van de graad van master in de revalidatiewetenschappen en de kinesitherapie, afstudeerrichting revalidatiewetenschappen en kinesitherapie bij musculoskeletale aandoeningen

PROMOTOR :

Prof. dr. Raf MEESEN

BEGELEIDER :

Mevrouw Siel DEPESTELE

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Context

Technology never stops growing. The rapid advancement of mobile phones and even cars are the subject of technology as more and more in-vehicle activities are added to their interior. Infotainment in cars is becoming more advanced and requires more knowledge and attention. These distractions require a certain amount of mental resources. When more mental resources are needed, concentration on the road diminishes, which is in line with safety concerns. Car crashes or other forms of accidents are the results of reduced awareness of the surroundings during driving. To mimic these conditions, technological simulations can be used to map the patient's awareness and attention, such as the system technology incorporated simulator (STISIM). In this research paper, we want to investigate the results of the STISIM conducted at the University of Hasselt. This paper is part of a research project led by the Institute of mobility (IMOB) and rehabilitation research center (REVAL). The authors of this master thesis are part of the University of Hasselt.

The authors of this paper had no part in the design and usage of the test. Our primary assignment was the statistical analysis and the reporting of the received data in a scientific paper format. This report was entirely written by ourselves, with feedback from our co-promotor, Siel Depestele, supervised by prof. Dr. Raf Meesen.

1. Abstract

Background: Inattention to the road is one of the main contributors to crash risk. A popular distraction nowadays is mobile phone use while driving. Also, the continuous addition of technology and infotainment in vehicles is a never-ending cycle. Despite being user-friendly, these innovations do bring some safety concerns with them and could contribute to inattention to the road.

Objective: The purpose of this study was to investigate the influence of a cognitive dual-task on the driving performance of young adults.

Participants: 12 young active drivers (25-35 years of age), in possession of a valid driver's license, enrolled in this study. Participants were recruited in collaboration with the Rehabilitation Research Centre (REVAL) and the Institute Of Mobility (IMOB) of Hasselt University.

Measurements: Outcome measures were the percentage of time spent out of lane (%OOL) and the Total Road Edge Excursions (TREE). The subjective workload after each task was also included.

Results: No significant difference was found in %OOL and TREE. Furthermore, age and driving frequency both had no significant effect either. Cognitive dual-tasking seems to have an impact on the subjective workload.

Conclusion: According to this study, no effects of a cognitive dual-task were found on the driving performance of young adults in a driving simulator. The study also indicated no influence of gender or frequency of driving on the outcome measures. However, these results should be interpreted with caution due to the small sample size and other limitations. Future research about this subject is required.

Keywords: Driving performance, cognitive dual-task, young adults, driving simulator

2. Introduction

Today, with the addition of more and more possible in-vehicle activities, such as embedded and portable devices and technologies, the driver's driving task might have become more difficult. While these devices could bring better productivity, they can also detract attention from the driver which can be a safety concern. Multiple previous studies suggest that driver distraction and inattention contribute to a significant percentage of crashes and near misses (Klauer et al., 2005, Ranney et al., 2000, Sussman et al., 1985). McEvoy et al. (2007), revealed that, according to estimates, over 30% of serious crashes are associated with the driver's engagement in some sort of secondary task (McEvoy et al., 2007). Some estimates say that drivers engage in potentially distracting secondary tasks approximately 30% of the time their vehicles are in motion. Conversation with passengers is the most frequent secondary task followed by eating, smoking, manipulating controls, reaching inside the car, and mobile phone use (Thomas AR, 2008). These non-driving secondary tasks cause extra load that delays the driver's responses (Lee et al., 2009).

Driver distraction is also increasing due to the fast improvement in mobile phone technology. The majority of them being smartphones, which incorporate a touch screen. In comparison to older phones, using smartphones while driving appears to further deteriorate performance due to an increasing need to look at the screen and the decreased tactile feedback (Crandall and Chaparro 2012, Reimer et al. 2012).

With multitasking being more embedded in driving these days, it is essential to understand how multitasking affects performance.

In-vehicle multitask performance depends on multiple factors: resource demands, task structure, and attention switching and allocation. These will influence time-sharing effectiveness for numerous tasks (Wickens & Hollands, 2000). To meet those task demands, a certain amount of mental resources are needed. The amount required for a given task depends on the difficulty of the task and the invested effort (Kahneman, 1973). Insufficient mental resources can result from multiple or complex tasks and can lead to performance loss because structural interferences impair the simultaneous handling of those tasks (Duncan et al., 1997). Driving is a highly demanding task structure that requires integrating sensory inputs, cognitive processing, and motor execution (Christou et al., 2017). Several studies have

shown that for task structure, more demanding in-vehicle non-visual tasks result in more significant performance reduction (Briem and Hedman, 1995, Irwin et al., 2000, McKnight and McKnight, 1993, Patten et al., 2004, Rakauskas et al., 2004).
Attention switching is also a contributing factor that includes both the switching requirement and the requirement to prepare and maintain two task sets. Besides that, the cost of task switching has relevant structural implications (Koch 2018).

Driving simulators and designed dual-task events are built to study human cognitions under a specific driving task. These simulators have been used since the beginning of the 1930s to aid researchers in observing driver behavior without endangering the driver. (Eriksson et al., 2018). In addition, they allow evaluation under well-controlled and repeatable conditions of a broader range of simulated driving situations, dangerous or physically threatening situations in particular, as well as defining the influence of alcohol, drugs, and fatigue on driving (Lew et al. 2005; Reed and Green 1999). The STISIM, a commercially available driving simulator from Systems Technology Inc., is a widely used platform for automated driving research. This simulator has been validated in the past and used in multiple other studies (Reimer et al., 2006; Shechtman et al., 2007).

Regarding age, young adult drivers' reliance on electronic devices could contribute to multitasks having increased involvement in crashes for this age group. According to Fitch et al. (2013), the usage of a mobile phone can take drivers' eyes off the road for up to 33.1–71.5% of the time (Fitch et al., 2013). Another study reported that both hands-free and handheld phone conversations are associated with about a 40% increase in reaction times of drivers to peripheral traffic events in a simulator (Haque and Washington, 2014).

In this study, we aim to determine the influence of a cognitive dual-task on the driving performance of young adults in a driving simulator.
Besides that, we will address three different hypotheses in this study. Firstly, we hypothesized that there is a reduction in driving performance when being subjected to a cognitive dual-task while driving. Secondly, we hypothesized that there is an influence of gender on driving performance when presented with a cognitive dual-task. In previous studies, they have looked at the effects of training on multitasking performance (Karbach, 2009; Berryhill, 2009;

Freydier, 2016). So lastly, we hypothesized that the frequency of driving might influence a cognitive dual-task. Expecting that the participants who drive more on a daily basis will present a better performance when being exposed to a cognitive dual-task.

3.Methods

3.1 Participants

This study includes 12 subjects. Recruitment of the participants was done by persons of the research group REVAL from the University of Hasselt through online and active oral recruitment.

Participants were included in the study when the following inclusion criteria were met: (1) between 25 and 35 years old, (2) achieve a score of more than 23 on the Montreal Cognitive Assessment questionnaire (MoCA) (Nasreddine et al. 2005), which indicates normal cognitive functioning, (3) have normal, or glasses/lenses corrected vision (confirmed by a Snellenkaart (Hetherington, 1954)), (4) have normal, or hearing aid corrected hearing, (5) own a valid driver's license, (6) be an active car driver (average 2x/week driving in the last three months) (7) do not meet any of the exclusion criteria.
Possible participants were excluded if they (a) had a neurological or psychiatric condition, (b) had a physical limitation that prevents execution of a driving simulator task, (c) had an alcohol or drug addiction, (d) were currently using medications that affect the central nervous system, (e) had metal implants in the head or neck, (f) had any brain damage or skull fracture in the past or (g) experienced simulator sickness.

3.2 Study design and procedure

In this observational study, all measurements were conducted by two assessors during two test sessions, each with a duration of approximately 120 minutes.

We used an adaptive driving scenario in a driving simulator to measure motor control while driving. The STISIM driving simulator used in this study consists of a steering wheel and the visuals' surroundings created by one screen. Subjects were placed within the simulator's driving seat (*Fig. 1*), which provided a view of the roadway and dashboard instruments, including a speedometer.

The first session consists of two parts. The subject goes over the informed consent and possible questions that can be answered in the first part, followed by a short routine

questionnaire about caffeine consumption, amount of sleep, and smoking. Next, the Edinburgh Handedness Questionnaire (EHQ) and the MoCA questionnaire are completed. Lastly, a brief questionnaire about driving behavior is filled in before the subject undergoes an eye test (Snellenkaart). To start part two, the subject gets familiarized with the driving task in a 5’ practice session. Then the basic driving task begins and consists of driving three times 5'. In the first 5', the speed at which the next two are driven is determined. Before and after the basic driving test, the subject fills in a subjective workload scale. A simulator sickness questionnaire is filled in after both the familiarisation and the basic driving task.

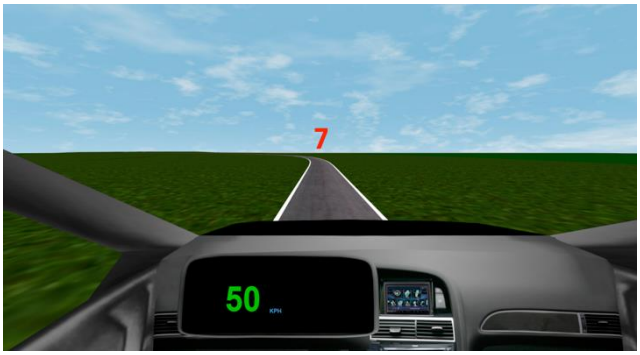
The second session takes place on another day. To begin the session, the subject must fill in the short routine questionnaire like session one. During this session, an EEG cap is placed on the head of the participant. This is beyond the scope of this study. Next, they run through a 5' basic driving task to determine the baseline speed as in session 1, which is followed by another 5’ basic driving task with a speed reduction of 20km/h to determine the baseline conditions for the dual-task. Hereafter, the subject practices the secondary cognitive task in a 5' trial without driving. After that, the cognitive dual-task is started, and the participant performs twice a 5' task. A simulator sickness questionnaire and a subjective workload scale are filled in after both the baseline and the cognitive dual-task.

During the adaptive driving scenario, a lane-keeping task is used where the subject has to keep the vehicle in the middle of the driving lane. The surroundings consist only of grass on both sides of the driving lane and blue sky. In this way, we have no interference of visual stimuli that might distract the driver. Two types of curves are used during the scenario, based on existing dangerous curves in Belgium, where there have been multiple accidents (Ariën et al., 2017). While driving, the gas and brake pedal are not used, and the vehicle operates on cruise control at a certain speed. The adaptive scenario manipulates this speed. The vehicle's speed is determined by how good the subject's performance is during the primary driving task. In case the car is kept ideally in the middle, the speed is increased. If not, the speed decreases. This assures that the performance of each subject on the motor steering task is equal between the subjects. Because each individual has a specific capacity and level at which they can perform a driving task as safely as possible. A specific speed might be an easy task for one person but quite challenging for another person.

The visual version of the Paced Auditory Serial Addition Task (PASAT) (Gronwall, 1977) is used as the cognitive dual-task. During this task, the subject has to add up the last two random numbers. The numbers are displayed on the middle screen, and the last digit displayed is added to the digit before it (*Fig. 2*). The oral answer of the subject is recorded and evaluated as correct, wrong, or no reaction.

Fig. 1 Driving simulator

Fig. 2 PASAT (cognitive dual-task)



3.3 Outcome measures

3.3.1 Primary outcome measure

During the two driving tasks (basic driving task and cognitive dual-task), we measure and compare the driving performance of each subject in between the two driving tasks by looking at the time of total excursions in percentage (percentage out of lane (%OOL)) and the amount of road edge excursions during both tasks (total road edge excursion (TREE)).

3.3.2 Secondary outcome measures

In addition, we will also look at the influence of gender and the frequency of driving on subjects driving performance. Another outcome that will be included in the study is the comparison of the subjective workload of the basic driving test and the cognitive dual-task. We look at subjective mental and physical workload and the subjective effort/exertion of each subject.

3.4 Data analysis

Data analysis was done on the 'SAS JMP' pro 15.2 software where we consider results with $\alpha<0.05$ as statistically significant. Statistical analyses were conducted to determine statistically significant differences and similarities for each outcome measure. Mixed models were used to investigate the influence of the variables, as fixed effects we used; moment (baseline and PASAT), gender (male and female), and frequency of driving (monthly, daily, and >3/week) on the percentage of driving out of line (%OOL) and the total road edge excursion (TREE) where each participant code is used as a random effect. The interaction of gender and driving frequency with the moment was also calculated. Therefore, we made multiple comparisons for each variable, and a student's t-test was used with a Bonferroni correction, where 0,05 was divided by every possible interaction (0,05/n-tests). This means the alpha for the interaction of gender and moment is 0,0083 (0,05/6) and the driving frequency and moment is 0,0033 (0,05/15). Paired t-test was used to determine the

difference of the subjective workload after the baseline compared to the subjective workload after the PASAT.

4. Results

4.1 Participants

Twelve participants were enrolled (5 women, 7 men). The mean age was 27,7 ± 2,5. Besides age and gender, we also looked at the participants' MoCa and Snellen score, the number of months they have their driver's licenses, and their driving frequency. All subject characteristics are presented in Table 1.

Table 1. Subject characteristics

Variable	Value
Gender (M*/F*)	7/5
Age ± SD (Y*)	27,7 ± 2,5
MoCa ± SD*	27,8 ± 1,6
Snelle ± SD	20 ± 0
Drivers license ± SD (month)	118,1 ± 36,4
Driving freq (month/day/ >3/week)	1/ 9/2
**M=Male, F=Female, Y=Year, SD= Standard deviation*	

4.2 Outcome measures

4.2.1 percentage out of lane

The average %OOL of all subjects during the baseline is 7.257% ± 1,787 and 6,916% ± 1.787 for the cognitive dual-task with an average difference of 0,340% ± 1,535. Our statistical analysis has shown that this is not a significant difference between the two driving tasks (p=0,8302) shown in table 2.

In terms of gender, neither male nor female subjects scored significantly better than the other on both baseline and the cognitive dual-task (p=0.4587). Male drivers averagely drove 1.852% ± 2.379 fewer times out of the lane during both tasks.

Furthermore, the driving frequency (p=0.2839) and the gender (p=0.4587) do not significantly influence the amount of time a subject is out of lane, according to the analysis.

Table 2. Outcome measures %OOL

Variable	Prob>F (0,05)
Moment (baseline/pasat)	0,8302
Gender (male/female)	0,4587
Driving freq (month, day, >3/week)	0,2839
Gender*moment	0,6546
Driving freq*moment	0,2098

4.2.2 Total road edge excursions

The average TREE of all subjects during the baseline is 21.022 ± 2.976 times and 19.428 ± 2.976 times for the cognitive dual-task, with an average difference of 1.594 ± 2.464 times. Our statistical analysis has shown that this is not a significant difference between both driving tasks (p=0.5357) shown in table 3.

Gender (p=0.7441) and the driving frequency (p=0.2314) do not significantly influence the number of times the subject leaves the road.

Table 3. Outcome measures TREE

Variable	Prob>F (0,05)
Moment (baseline/pasat)	0,5357
Gender (male/female)	0,7441
Driving freq (month, day, >3/week)	0,2314
Gender*moment	0,1981
Driving freq*moment	0,0835

4.2.3 Subjective workload

The subjective workload that each subject filled in after each driving session. It showed us that, on average, there was an increase of 3.725/10 on the subjective mental workload, an increase of just 0.042/10 on the subjective physical workload, and a rise of 2.716/10 on the effort the participant experienced after the cognitive dual-task. Both the mental workload and the effort showed a significant increase after driving with a cognitive dual-task compared to the baseline.

Table 4. Outcome measures

Subjective workload	Mean difference	Prob>F (0,05)
Mental workload	3,725	0,0005*
Physical workload	0,042	0,8576
Effort	2,717	0,0044*

*Values lower than P<0,05 are significant and are marked with **

5. Discussion

This study examines the effect of multitasking in simulated car driving on the driving performance of young adults.

Some studies have paid significant attention to the impact of cognitive load on driving performance. Primarily, these studies have sought to provide explanations for the impact of distraction while driving. According to Östlund et al. (2006), cognitive load resulted in reduced speed control. Most simulators used for these experiments have high validity and reflect the actual driving experiments on the road (Östlund et al., 2006). Briggs et al. (2018) provide the readers with several characteristics of the dual-task drivers and why they are more likely to cause accidents (Briggs et al., 2018). Such drivers are more likely to rely on their expectations rather than reality while on the road. Despite their ability to detect unexpected events on the road, their reaction time is generally lower. Research has also established that these individuals are less likely to detect peripheral events on the road (Briggs et al., 2018). Therefore, regardless of age, dual tasking increases an individual's risk of accidents on the road.

The research primarily focused on a narrow sample population consisting of younger adults aged between 25 and 35. This group already has quite the experience on the road and doesn’t suffer from the diminishing effects of aging. This would allow for a clear image of the effects of a cognitive dual-task on driving performance without the interference of aging or inexperienced driving. Therefore, we wanted to investigate the effects on this age group.

The test outcome could have been different had the study used an older or younger population. According to Merat et al. (2005), the elderly population is more likely to be at fault when engaged in collisions. As illustrated by the authors, "The cause of the accident is seldom due to careless or aggressive behavior but most of the time is due to their inability to handle complex traffic situations" (Merat et al., 2005, 4). Therefore, research to assess the influence of a cognitive dual-task on older adults' driving performance would show these inherent weaknesses and could be interesting for future studies.

Another variable of significant impact in the research is the influence of a demanding dual-task driving condition. In performing a study, Ebnali et al. (2016) established several

fundamental aspects. First, the mean driving speed decreased while the speed variability increased when the drivers engaged in an activity such as listening to the news. Second, the research also established that "age has a significant effect on speed variability and deep comprehension among drivers aged ≥75 during the secondary task" (Ebnali et al., 2016). Thus, non-visual distractions such as in-vehicle audio technologies could affect driving in the elderly.

Our work addresses three different hypotheses. According to one, driving performance diminishes when being subjected to dual-tasks while driving. The subject fails to perform during the driving simulator whenever the simulated car drives out of the driving lane. The program measured the number of times that the subject failed to drive straight, and the amount of time spent out of the lane. Our study, however, recorded no significant effect on driving out of lane and the amount of road edge excursions when implementing the PASAT-test.

On the contrary, their driving performance during the cognitive dual-task was even better than the baseline. This, however, was also not significantly demonstrated. According to Östlund et al. (2006), lateral variation decreased significantly when challenged with a cognitive dual-task due to increased steering activity (Östlund et al., 2006). This might have been a precautionary behavior and a compensation method for the reduced ability to react properly. The participants did report a significant increase in mental workload and perceived effort while driving with a dual-task. This was reflected in the self-reported subjective workload before and after each driving task. It could indicate that there might be significant differences when a more demanding dual-task is implemented. As said by Duncan et al. (1997) complex or multiple tasks can result in insufficient mental resources and can lead to performance loss because structural interferences impair the simultaneous handling of those tasks (Duncan et al., 1997). This is also in accordance with Ebnali et al. (2016), a study that found that drivers decrease their speed when engaging in a cognitive dual-task, such as listening to the news (Ebnali et al., 2016). In this case, the drivers could have compensated for their impaired handling of the dual-task by reducing their speed.

Another explanation for our findings might be the learning curve principle. Driving a simulator is a different experience, and the subjects could still be adjusting to it.

Secondly, we hypothesized the influence of gender on driving performance when presented with a cognitive dual-task. We found no significant effect of gender on the percentage out of the lane and the total amount of road edge excursions.
Lastly, we hypothesized that participants who drive more on a daily basis presented a better performance when being exposed to a cognitive dual-task. Like the gender, the driving frequency had no significant effect on percentage out of lane and total road edge excursions in both the cognitive dual-task and the basic driving task.

This research should be interpreted with caution, considering the small sample size. Future research should implement a lot more subjects and more types of cognitive dual-tasks instead of working memory, such as long-term memory, problem-solving, or auditory processing.

a. Strengths and limitations

This study has its limitations. Firstly, this study has a small sample size with only twelve participants. Another explicit limitation is sample bias. The participants are between the age of 25 and 35 years old. After recruitment, there has been an evaluation of when the participants obtained their driver's license, but this information was not used and is, therefore, an important criterium left out. Considering this, we do not know if some participants have an experience advantage over other participants. Another limitation is the use of using only one cognitive test to simulate a dual-task. A lot more different cognitive actions can be used to possibly induce cognitive impairment. The use of just one visual math task might not be challenging enough for some participants. The repetitiveness of this task could also allow for a strong learning curve towards the end of the sessions. Cognitive impairment on the road might be more unexpected and more variable than in simulated driving.
Next, our outcome measures, percentage out of lane, and total road edge excursions give us information about the number of errors but not the magnitude of the error. For example, participants crossing the edge by a small margin are not distinguishable from the ones crossing the edge by a far more considerable margin.
Lastly, we do not know how much time participants spend on the road during their daily lives. We included participants with a weekly cut-off, but we do not know their time spent on the

road in their lifetimes specifically. Therefore, some participants might have a more or less trained cognition whether they spend more or less time on the road. Theoretically, more limitations can be found regarding the personal traits of the participants because these personality traits have a much higher impact due to the small sample size. A larger sample size would reduce the influence of these personal traits and reflect a more generalizable outcome.

Strengths of this study included the use of validated tests and questionnaires such as the Montreal Cognitive Assessment questionnaire (MoCA) and the Snellenkaart to eliminate biases. Furthermore, the test was taken in a secure environment where all forms of external distractions were eliminated. Lastly, validated statistical software was used to evaluate the results.

This research should be interpreted with caution, considering the very small sample size. Future research should implement a lot more subjects and more types of cognitive dual-tasks instead of working memory, such as long-term memory, problem-solving, or auditory processing.

6. Conclusion

In conclusion, the main finding is that we found no significant difference in driving performance when driving with a cognitive dual-task in a driving simulator. Furthermore, we found no significant influence of age and driving frequency in this study. A significant increase in average subjective mental workload and perceived effort was found, but these findings should be interpreted with caution due to the small sample size.

Future research should include larger sample sizes with a heterogeneous population of young adults. This allows for a more detailed look at possible factors influencing driving performance. Moreover, adding more cognitive dual-tasks and incorporating different age groups should also be considered.

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UHASSELT
KNOWLEDGE IN ACTION

INVENTARISATIEFORMULIER WETENSCHAPPELIJKE STAGE DEEL 2

DATUM	INHOUD OVERLEG	HANDTEKENINGEN
13/10/2020	Start thesis deel 2. Inhoud en doelstellingen.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
04/01/2021	Overlopen en feedback introductie en methode.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
27/02/2021	Bespreken inhoud en verder verloop + vragen over proefpersonen in studie omv Covid-19.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
22/04/2021	Inhoudelijke vragen.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
21/05/2021	Bespreken statistiek en resultaten.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
27/05/2021	Inhoudelijke vragen.	Promotor: Copromotor/Begeleider: Student(e): Student(e):
		Promotor: Copromotor/Begeleider: Student(e): Student(e):
		Promotor: Copromotor/Begeleider: Student(e): Student(e):
		Promotor: Copromotor/Begeleider: Student(e): Student(e):
		Promotor: Copromotor/Begeleider: Student(e): Student(e):

In te vullen door de promotor(en) en eventuele copromotor aan het einde van MP2:

Naam Student(e): ..... **Datum:**.....

Titel Masterproef: .....

1) Geef aan in hoeverre de student(e) onderstaande competenties zelfstandig uitvoerde:
   - NVT: De student(e) leverde hierin geen bijdrage, aangezien hij/zij in een reeds lopende studie meewerkte.
   - 1: De student(e) was niet zelfstandig en sterk afhankelijk van medestudent(e) of promotor en teamleden bij de uitwerking en uitvoering.
   - 2: De student(e) had veel hulp en ondersteuning nodig bij de uitwerking en uitvoering.
   - 3: De student(e) was redelijk zelfstandig bij de uitwerking en uitvoering
   - 4: De student(e) had weinig tot geringe hulp nodig bij de uitwerking en uitvoering.
   - 5: De student(e) werkte zeer zelfstandig en had slechts zeer sporadisch hulp en bijsturing nodig van de promotor of zijn team bij de uitwerking en uitvoering.

Competenties	NVT	1	2	3	4	5
Opstelling onderzoeksvraag	O	O	O	O	O	O
Methodologische uitwerking	O	O	O	O	O	O
Data acquisitie	O	O	O	O	O	O
Data management	O	O	O	O	O	O
Dataverwerking/Statistiek	O	O	O	O	O	O
Rapportage	O	O	O	O	O	O

2) Niet-bindend advies: Student(e) krijgt toelating/geen toelating (schrappen wat niet past) om bovenvermelde Wetenschappelijke stage/masterproef deel 2 te verdedigen in bovenvermelde periode. Deze eventuele toelating houdt geen garantie in dat de student geslaagd is voor dit opleidingsonderdeel.

3) Deze wetenschappelijke stage/masterproef deel 2 mag wel/niet (schrappen wat niet past) openbaar verdedigd worden.

4) Deze wetenschappelijke stage/masterproef deel 2 mag wel/niet (schrappen wat niet past) opgenomen worden in de bibliotheek en docserver van de UHasselt.

Datum en handtekening Student(e)	Datum en handtekening promotor(en)	Datum en handtekening Co-promotor(en)
		

AFSPRAKENNOTA

1. Organisatie

Naam	Universiteit Hasselt/transnationale Universiteit Limburg (Hierna: UHasselt/tUL)
Adres	Martelarenlaan 42 3500 Hasselt
Sociale doelstelling	De UHasselt/tUL is een dynamisch kenniscentrum van onderwijs, onderzoek en dienstverlening.
Werking van de organisatie	**Faculteiten** De UHasselt telt zes faculteiten die het onderwijs en onderzoek aansturen: o { HYPERLINK "http://www.uhasselt.be/fac-architectuur-en-kunst" } o { HYPERLINK "http://www.uhasselt.be/fac-bedrijfseconomischewetenschappen" \t "_self" } o { HYPERLINK "http://www.uhasselt.be/fac-geneeskunde-en-levenswetenschappen" } o { HYPERLINK "http://www.uhasselt.be/fac-industriele-ingenieurswetenschappen" \t "_blank" } o { HYPERLINK "http://www.uhasselt.be/fac-rechten" \t "_self" } o { HYPERLINK "http://www.uhasselt.be/fac-wetenschappen" } Elke faculteit stelt per opleiding een { HYPERLINK "http://www.uhasselt.be/UH/Structuur-UHasselt/Onderwijsmanagementteams.html" } (OMT) en een { HYPERLINK "http://www.uhasselt.be/UH/Structuur-UHasselt/Examencommissies.html" } samen. **Vakgroepen** Binnen de faculteiten opereren diverse { HYPERLINK "http://www.uhasselt.be/Onderzoeksgroepen" \t "_self" }. Zij groeperen alle personeelsleden die onderzoek en onderwijs verrichten binnen eenzelfde discipline. Elke vakgroep bestaat vervolgens uit een of meerdere { HYPERLINK "http://www.uhasselt.be/Onderzoeksgroepen" \t "_self" }. Zij staan in voor de organisatie van het gespecialiseerd onderzoek. Deze klassieke boomstructuur van faculteiten, onderzoeksgroepen en vakgroepen wordt doorkruist door de { HYPERLINK "http://www.uhasselt.be/Onderzoeksinstituten" \t "_self" }. De instituten groeperen onderzoekers uit verschillende onderzoeksgroepen die in bepaalde speerpuntdomeinen onderzoek uitvoeren. Daarbij wordt het volledige onderzoekspectrum afgedekt, van fundamenteel over toegepast onderzoek tot concrete valorisatietoepassingen.

Juridisch statuut	Autonome openbare instelling

Verantwoordelijke van de organisatie, die moet verwittigd worden bij ongevallen.

Naam	Prof. Dr. Raf Meesen
Functie	Promotor
Tel. - GSM	

2. De vrijwilliger: student-onderzoeker

Naam	Arne Daniels Poesmans Yves
Correspondentieadres	Zolderstraat 24, 3510 Kermt Trekschurenstraat 25, 3500 hasselt
Tel. - GSM	+32 474 05 83 09 +32 468 27 85 68

3. Verzekeringen

Waarborgen	De burgerlijke aansprakelijkheid van de organisatie.
Maatschappij	Ethias
Polisnummer	45009018

Waarborgen	Lichamelijke schade die geleden is door vrijwilligers bij ongevallen tijdens de uitvoering van het vrijwilligerswerk of op weg naar- en van de activiteiten.
Maatschappij	Ethias
Polisnummer	45055074

4. Vergoedingen

De organisatie betaalt geen vergoeding aan de vrijwilliger.

5. Aansprakelijkheid

De organisatie is burgerrechtelijk aansprakelijk voor de schade die de vrijwilliger aan derden veroorzaakt bij het verrichten van vrijwilligerswerk.

Ingeval de vrijwilliger bij het verrichten van het vrijwilligerswerk de organisatie of derden schade berokkent, is hij enkel aansprakelijk voor zijn bedrog en zijn zware schuld.
Voor lichte schuld is hij enkel aansprakelijk als die bij hem eerder gewoonlijk dan toevallig voorkomt.

Opgelet: voor het materiaal dat de vrijwilliger zelf meebrengt, is hij/zij zelf verantwoordelijk.

6. Geheimhoudingsplicht – verwerking persoonsgegevens

De vrijwilliger verleent de UHasselt toestemming om de gegevens die in het kader van zijn/haar inschrijving aan UHasselt werden verzameld, ook te gebruiken voor de uitvoering van deze afsprakennota (de evaluatie van de vrijwilliger alsook het aanmaken van een certificaat). UHasselt zal deze informatie vertrouwelijk behandelen en zal deze vertrouwelijkheid ook bewaken na de beëindiging van het statuut student-onderzoeker. De UHasselt neemt hiertoe alle passende maatregelen en waarborgen om de persoonsgegevens van de vrijwilliger conform de Algemene Verordening Gegevensbescherming (EU 2016/679) te verwerken.

De vrijwilliger verbindt zich ertoe om alle gegevens, documenten, kennis en materiaal, zowel schriftelijk als mondeling ontvangen in de hoedanigheid van student-onderzoeker aan de UHasselt als strikt vertrouwelijk te behandelen, ook indien deze niet als strikt vertrouwelijk werd geïdentificeerd. Indien de vertrouwelijke gegevens van de UHasselt ook persoonsgegevens bevatten dient de stagiair hiertoe steeds de Algemene Verordening Gegevensbescherming (EU 2016/679) na te leven en bij elke verwerking het advies van het intern privacycollege van de UHasselt in te winnen. Hij/zij verbindt zich ertoe om in geen geval deze vertrouwelijke informatie mee te delen aan derden of anderszins openbaar te maken, ook niet na de beëindiging van het statuut student-onderzoeker.

7. Concrete afspraken

Functie van de vrijwilliger

De vrijwilliger zal volgende taak vervullen: literatuur *onderzoek + opstelling protocol*
Deze taak omvat volgende activiteiten: *onderzoek + opstelling protocol*
De vrijwilliger voert zijn taak uit onder verantwoordelijkheid van de faculteit *Revalidatiewetenschappen en kinesitherapie*
De vrijwilliger wordt binnen de faculteit begeleid door Prof. Dr. Raf Meesen en Siel Depestele
Zijn vaste werkplek voor het uitvoeren van de taak is *thuis*

De vrijwilliger zal deze taak op volgende tijdstippen uitvoeren:

- op de volgende dag(en):
    - maandag
    - dinsdag
    - woensdag
    - donderdag
    - vrijdag
    - zaterdag
    - zondag
- het engagement wordt aangegaan voor de periode van februarie 2020 tot augustus 2020 (deze periode kan maximaal 1 kalenderjaar zijn en moet liggen tussen 1 januari en 31 december).

Begeleiding

De organisatie engageert zich ertoe de vrijwilliger tijdens deze proefperiode degelijk te begeleiden en te ondersteunen en hem/haar van alle informatie te voorzien opdat de activiteit naar best vermogen kan worden uitgevoerd.
De vrijwilliger voert de taken en activiteiten uit volgens de voorschriften vastgelegd door de faculteit. Hij/zij neemt voldoende voorzorgsmaatregelen in acht, en kan voor bijkomende informatie over de uit te voeren activiteit steeds terecht bij volgende contactpersoon: Raf Meesen

De vrijwilliger krijgt waar nodig vooraf een vorming. Het volgen van de vorming indien aangeboden door de organisatie, is verplicht voor de vrijwilliger.

De vrijwilliger heeft kennis genomen van het 'reglement statuut student-onderzoeker' dat als bijlage aan deze afsprakennota wordt toegevoegd en integraal van toepassing is op de vrijwilliger.

Certificaat

Indien de vrijwilliger zijn opdracht succesvol afrondt, ontvangt hij/zij een certificaat van de UHasselt ondertekend door de decaan van de faculteit waaraan de vrijwilliger zijn opdracht voltooide.

8. Einde van het vrijwilligerswerk.

Zowel de organisatie als de vrijwilliger kunnen afzien van een verdere samenwerking. Dat kan gebeuren:

- bij onderlinge overeenstemming;
- op vraag van de vrijwilliger zelf;
- op verzoek van de organisatie.

Indien de samenwerking op initiatief van de vrijwilliger of de organisatie wordt beëindigd, gebeurt dit bij voorkeur minstens 2 weken op voorhand. Bij ernstige tekortkomingen kan de samenwerking, door de organisatie, onmiddellijk worden beëindigd.

Datum: 06/06/2021

Naam en Handtekening decaan

Naam en Handtekening vrijwilliger

Opgemaakt in 2 exemplaren waarvan 1 voor de faculteit en 1 voor de vrijwilliger.

Bijlage 1

Reglement betreffende het statuut van student-onderzoeker[1]

Artikel 1. Definities

Voor de toepassing van dit reglement wordt verstaan onder:
student-onderzoeker: een regelmatig ingeschreven bachelor- of masterstudent van de UHasselt/tUL die als vrijwilliger wordt ingeschakeld in onderzoeksprojecten. De opdrachten uitgevoerd als student-onderzoeker kunnen op geen enkele wijze deel uitmaken van het studietraject van de student. De opdrachten kunnen geen ECTS-credits opleveren en zij kunnen geen deel uitmaken van een evaluatie van de student in ket kader van een opleidingsonderdeel. De onderzoeksopdrachten kunnen wel in het verlengde liggen van een opleidingsonderdeel, de bachelor- of masterproef.

Artikel 2. Toepassingsgebied

Enkel bachelor- en masterstudenten van de UHasselt/tUL die voor minstens 90 studiepunten credits hebben behaald in een academische bacheloropleiding komen in aanmerking voor het statuut van student-onderzoeker.

Artikel 3. Selectie en administratieve opvolging

§1 De faculteiten staan in voor de selectie van de student-onderzoekers en schrijven hiervoor een transparante selectieprocedure uit die vooraf aan de studenten kenbaar wordt gemaakt.
§2 De administratieve opvolging van de dossiers gebeurt door de faculteiten.

Artikel 4. Preventieve maatregelen en verzekeringen

§1 De faculteiten voorzien waar nodig in de noodzakelijke voorafgaande vorming van student-onderzoekers. De student is verplicht deze vorming te volgen vooraleer hij/zij kan starten als student-onderzoeker.
§2 Er moet voor de betrokken opdrachten een risicopostenanalyse opgemaakt worden door de faculteiten, analoog aan de risicopostenanalyse voor een stagiair van de UHasselt/tUL. De faculteiten zien er op toe dat de nodige veiligheidsmaatregelen getroffen worden voor aanvang van de opdracht.
§3 De student-onderzoekers worden door de UHasselt verzekerd tegen:
- Burgerlijke aansprakelijkheid
- Lichamelijke ongevallen

en dit ongeacht de plaats waar zij hun opdrachten in het kader van het statuut uitoefenen.

Artikel 5. Vergoeding van geleverde prestaties

§1 De student-onderzoeker kan maximaal 40 kalenderdagen, gerekend binnen één kalenderjaar, worden ingeschakeld binnen dit statuut. De dagen waarop de student-onderzoeker een vorming moet volgen, worden niet meegerekend als gepresteerde dagen.

§2 De student-onderzoeker ontvangt geen vrijwilligersvergoeding voor zijn prestaties. De student kan wel een vergoeding krijgen van de faculteit voor bewezen onkosten. De faculteit en de student maken hier aangaande schriftelijke afspraken.

Artikel 6. Dienstverplaatsingen

De student-onderzoeker mag dienstverplaatsingen maken. De faculteit en de student maken schriftelijke afspraken over deal dan niet vergoeding voor dienstverplaatsingen. De student wordt tijdens de dienstverplaatsingen en op weg van en naar de stageplaats uitsluitend verzekerd door de UHasselt voor lichamelijke ongevallen.

[1] Zoals goedgekeurd door de Raad van Bestuur van de Universiteit Hasselt op 15 juni 2017.

Artikel 7. Afsprakennota

§1 Er wordt een afsprakennota opgesteld die vooraf wordt ondertekend door de decaan en de student-onderzoeker. Hierin worden de taken van de student-onderzoeker alsook de momenten waarop hij/zij de taken moet uitvoeren zo nauwkeurig mogelijk omschreven.
§2 Aan de afsprakennota wordt een kopie van dit reglement toegevoegd als bijlage.

Artikel 8. Certificaat

Na succesvolle beëindiging van de opdracht van de student-onderzoeker, te beoordelen door de decaan, ontvangt hij een certificaat van de studentenadministratie. De faculteit bezorgt de nodige gegevens aan de studentenadministratie. Het certificaat wordt ondertekend door de decaan van de faculteit waaraan de student-onderzoeker zijn opdracht voltooide.

Artikel 9. Geheimhoudingsplicht

De student-onderzoeker verbindt zich ertoe om alle gegevens, documenten, kennis en materiaal, zowel schriftelijk (inbegrepen elektronisch) als mondeling ontvangen in de hoedanigheid van student-onderzoeker aan de UHasselt, als strikt vertrouwelijk te behandelen, ook indien deze niet als strikt vertrouwelijk werd geïdentificeerd. Hij/zij verbindt zich ertoe om in geen geval deze vertrouwelijke informatie mee te delen aan derden of anderszins openbaar te maken, ook niet na de beëindiging van zijn/haar opdracht binnen dit statuut.

Artikel 10. Intellectuele eigendomsrechten

Indien de student-onderzoeker tijdens de uitvoering van zijn/haar opdrachten creaties tot stand brengt die (kunnen) worden beschermd door intellectuele rechten, deelt hij/zij dit onmiddellijk mee aan de faculteit. Deze intellectuele rechten, met uitzondering van auteursrechten, komen steeds toe aan de UHasselt.

Artikel 11. Geschillenregeling

Indien zich een geschil voordoet tussen de faculteit en de student-onderzoeker met betrekking tot de interpretatie van dit reglement of de uitoefening van de taken, dan kan de ombudspersoon van de opleiding waarbinnen de student-onderzoeker zijn taken uitoefent, bemiddelen. Indien noodzakelijk, beslecht de vicerector Onderwijs het geschil.

Artikel 12. Inwerkingtreding

Dit reglement treedt in werking met ingang van het academiejaar 2017-2018.

Inschrijvingsformulier verdediging masterproef academiejaar 2020-2021,
Registration form jury Master's thesis academic year 2020-2021,

GEGEVENS STUDENT - *INFORMATION STUDENT*

Faculteit/School: **Faculteit Revalidatiewetenschappen**
Faculty/School: ***Rehabilitation Sciences***

Stamnummer + naam: **1539673 Poesmans Yves**
Student number + name

Opleiding/*Programme*: **2 ma revalid. & kine musc.**

INSTRUCTIES - *INSTRUCTIONS*

Neem onderstaande informatie grondig door.

Print dit document en vul het aan met DRUKLETTERS.

In tijden van van online onderwijs door COVID-19 verstuur je het document (scan of leesbare foto) ingevuld via mail naar je promotor. Je promotor bezorgt het aan de juiste dienst voor verdere afhandeling.

Vul luik A aan. Bezorg het formulier aan je promotoren voor de aanvullingen in luik B. Zorg dat het formulier ondertekend en gedateerd wordt door jezelf en je promotoren in luik D en dien het in bij de juiste dienst volgens de afspraken in jouw opleiding.
Zonder dit inschrijvingsformulier krijg je geen toegang tot upload/verdediging van je masterproef.

Please read the information below carefully.

Print this document and complete it by hand writing, using CAPITAL LETTERS.

In times of COVID-19 and during the online courses you send the document (scan or readable photo) by email to your supervisor. Your supervisor delivers the document to the appropriate department.

Fill out part A. Send the form to your supervisors for the additions in part B. Make sure that the form is signed and dated by yourself and your supervisors in part D and submit it to the appropriate department in accordance with the agreements in your study programme.
Without this registration form, you will not have access to the upload/defense of your master's thesis.

LUIK A - VERPLICHT - IN TE VULLEN DOOR DE STUDENT
PART A - MANDATORY - TO BE FILLED OUT BY THE STUDENT

Titel van Masterproef/*Title of Master's thesis:*

◉ behouden - *keep* THE INFLUENCE OF A COGNITIVE DUAL-TASK ON DRIVING PERFORMANCE OF YOUNG ADULTS IN A DRIVING SIMULATOR

O wijzigen - *change*

UHvoorlev5 30/05/2021

/:

O behouden - *keep*

O wijzigen - *change to*:

In geval van samenwerking tussen studenten, naam van de medestudent(en)/*In case of group work, name of fellow student(s)*:

● behouden - *keep* ARNE DANIELS

O wijzigen - *change to:*

LUIK B - VERPLICHT - IN TE VULLEN DOOR DE PROMOTOR(EN)
PART B - MANDATORY - TO BE FILLED OUT BY THE SUPERVISOR(S)

Wijziging gegevens masterproef in luik A/*Change information Master's thesis in part A:*

O goedgekeurd - *approved*

O goedgekeurd mits wijziging van - *approved if modification of:*

Scriptie/*Thesis:*

O openbaar (beschikbaar in de document server van de universiteit)- *public (available in document server of university)*

O vertrouwelijk (niet beschikbaar in de document server van de universiteit) - *confidential (not available in document server of university)*

Juryverdediging/*Jury Defense:*

De promotor(en) geeft (geven) de student(en) het niet-bindend advies om de bovenvermelde masterproef in de bovenvermelde periode/*The supervisor(s) give(s) the student(s) the non-binding advice:*

O te verdedigen/*to defend the aforementioned Master's thesis within the aforementioned period of time*

O de verdediging is openbaar/*in public*

O de verdediging is niet openbaar/*not in public*

O niet te verdedigen/*not to defend the aforementioned Master's thesis within the aforementioned period of time*

LUIK C - OPTIONEEL - IN TE VULLEN DOOR STUDENT, alleen als hij luik B wil overrulen
PART C - OPTIONAL - TO BE FILLED OUT BY THE STUDENT, only if he wants to overrule part B

In tegenstelling tot het niet-bindend advies van de promotor(en) wenst de student de bovenvermelde masterproef in de bovenvermelde periode/*In contrast to the non-binding advice put forward by the supervisor(s), the student wishes:*

O niet te verdedigen/*not to defend the aforementioned Master's thesis within the aforementioned period of time*

● te verdedigen/*to defend the aforementioned Master's thesis within the aforementioned period of time*

LUIK D - VERPLICHT - IN TE VULLEN DOOR DE STUDENT EN DE PROMOTOR(EN)
PART D - MANDATORY - TO BE FILLED OUT BY THE STUDENT AND THE SUPERVISOR(S)

Datum en handtekening student(en)
Date and signature student(s)

30/05/202

Datum en handtekening promotor(en)
Date and signature supervisor(s)

Inschrijvingsformulier verdediging masterproef academiejaar 2020-2021,
Registration form jury Master's thesis academic year 2020-2021,

GEGEVENS STUDENT - *INFORMATION STUDENT*

Faculteit/School: **Faculteit Revalidatiewetenschappen**
Faculty/School: ***Rehabilitation Sciences***

Stamnummer + naam: **1438358 Daniëls Arne**
Student number + name

Opleiding/*Programme*: **2 ma revalid. & kine musc.**

INSTRUCTIES - *INSTRUCTIONS*

Neem onderstaande informatie grondig door.

Print dit document en vul het aan met DRUKLETTERS.

In tijden van van online onderwijs door COVID-19 verstuur je het document (scan of leesbare foto) ingevuld via mail naar je promotor. Je promotor bezorgt het aan de juiste dienst voor verdere afhandeling.

Vul luik A aan. Bezorg het formulier aan je promotoren voor de aanvullingen in luik B. Zorg dat het formulier ondertekend en gedateerd wordt door jezelf en je promotoren in luik D en dien het in bij de juiste dienst volgens de afspraken in jouw opleiding.
Zonder dit inschrijvingsformulier krijg je geen toegang tot upload/verdediging van je masterproef.

Please read the information below carefully.

Print this document and complete it by hand writing, using CAPITAL LETTERS.

In times of COVID-19 and during the online courses you send the document (scan or readable photo) by email to your supervisor. Your supervisor delivers the document to the appropriate department.

Fill out part A. Send the form to your supervisors for the additions in part B. Make sure that the form is signed and dated by yourself and your supervisors in part D and submit it to the appropriate department in accordance with the agreements in your study programme.
Without this registration form, you will not have access to the upload/defense of your master's thesis.

LUIK A - VERPLICHT - IN TE VULLEN DOOR DE STUDENT
PART A - MANDATORY - TO BE FILLED OUT BY THE STUDENT

Titel van Masterproef/*Title of Master's thesis:*

O behouden - *keep* THE INFLUENCE OF A COGNITIVE DUAL-TASK ON DRIVING PERFORMANCE OF YOUNG ADULTS IN A DRIVING SIMULATOR

O wijzigen - *change to*:

UHvoorlev5 30/05/2021

/:

O behouden - *keep*

O wijzigen - *change to*:

In geval van samenwerking tussen studenten, naam van de medestudent(en)/*In case of group work, name of fellow student(s)*:

O behouden - *keep* YVES POESMANS

O wijzigen - *change to:*

LUIK B - VERPLICHT - IN TE VULLEN DOOR DE PROMOTOR(EN)
PART B - MANDATORY - TO BE FILLED OUT BY THE SUPERVISOR(S)

Wijziging gegevens masterproef in luik A/*Change information Master's thesis in part A:*

O goedgekeurd - *approved*

O goedgekeurd mits wijziging van - *approved if modification of:*

Scriptie/*Thesis:*

O openbaar (beschikbaar in de document server van de universiteit)- *public (available in document server of university)*

O vertrouwelijk (niet beschikbaar in de document server van de universiteit) - *confidential (not available in document server of university)*

Juryverdediging/*Jury Defense:*

De promotor(en) geeft (geven) de student(en) het niet-bindend advies om de bovenvermelde masterproef in de bovenvermelde periode/*The supervisor(s) give(s) the student(s) the non-binding advice:*

O te verdedigen/*to defend the aforementioned Master's thesis within the aforementioned period of time*

O de verdediging is openbaar/*in public*

O de verdediging is niet openbaar/*not in public*

O niet te verdedigen/*not to defend the aforementioned Master's thesis within the aforementioned period of time*

LUIK C - OPTIONEEL - IN TE VULLEN DOOR STUDENT, alleen als hij luik B wil overrulen
PART C - OPTIONAL - TO BE FILLED OUT BY THE STUDENT, only if he wants to overrule part B

In tegenstelling tot het niet-bindend advies van de promotor(en) wenst de student de bovenvermelde masterproef in de bovenvermelde periode/*In contrast to the non-binding advice put forward by the supervisor(s), the student wishes:*

O niet te verdedigen/*not to defend the aforementioned Master's thesis within the aforementioned period of time*

O te verdedigen/*to defend the aforementioned Master's thesis within the aforementioned period of time*

UHvoorlev5 30/05/2021

LUIK D - VERPLICHT - IN TE VULLEN DOOR DE STUDENT EN DE PROMOTOR(EN)
PART D - MANDATORY - TO BE FILLED OUT BY THE STUDENT AND THE SUPERVISOR(S)

Datum en handtekening student(en)
Date and signature student(s)

30/05/2021

Datum en handtekening promotor(en)
Date and signature supervisor(s)

Raf MEESEN 08:55 (39 minuten geleden)

aan Arne, Siel, mij

Beste Arne en Yves,

Bij deze GUNSTIG ADVIES VOOR INDIENING van dra. Depestele en mezelf, jullie hebben het werk substantieel verbeterd.

Succes met de verdediging,

Op ma 16 aug. 2021 om 19:51 schreef Arne Daniëls <arne.daniels@student.uhasselt.be>: