Biology

An investigation of factors affects the reaction time when driving in Vietnam.

Research Question: How do distractions on the auditory and visual systems affect the reaction time?

Word count: 3465

Contents

Introduction

Using a mobile phone while driving is one of the distractive factors that cause transportation accidents. Usually, those distractions are talking, listening to music and reading a map on the phone. In the observation conducted in the USA among 3265 drivers in 2017, 31.4% of drivers talk on the phone and 16.6% test or dial, reported that about 2.2% of motor vehicle drivers were observed using the phone while driving (Roadsafety.gov.au, 2019). In Vietnam, many traffic accidents were caused by the use of a mobile phone while driving (Thanh Nien Daily, 2019). This has led to many serious injuries, even deaths to the drivers. However, many of them are not aware of the extreme dangers they are placing themselves and others in when they indulged this behavior (Thanh Nien Daily, 2019). There has not been any plan nor conduct any study on this matter yet in Vietnam (Thanh Nien Daily, 2019) therefore, I will use this investigation as exemplar study to raise awareness to drivers in Vietnam.

When drivers see an obstacle on the road, they react by pressing the brake to stop the car before hitting that obstacle. The amount of time they need to perceive and process the information, leading them to respond by pressing the brake is called the reaction time. Reaction time is the amount of time required for the nervous system to receive and integrate incoming sensory information and cause the body to respond (Nabt.org, 2019). This is an involuntary behavior. The action ‘press the break’ is to give the desired consequence that a driver wants to: slow down and stop before the car hit the obstacle. The action of pressing the brake is a reflex but does not stay as simple as a knee-jerk reflex arc. The action is a learned reflex and more complex and involves the brain to produce a conscious decision. (Backyardbrains.com, 2019).

There are many factors that can affect the reaction time: the complexity of the stimulus, familiarity, sensory type and state of the organism (Response time or Reaction Time-Cognitive Ability, 2019). The complexity of the stimuli shows that the more complicated it is, the more information would be needed to process through, taking longer to react. The more familiar the person with the stimuli, less time would be needed to make a decision. If the state of the person is fatigued, it will take more time for that person to react. Generally, auditory stimuli take less time processing in the brain than other stimuli, for example: visual. However, depending on the type of stimuli, the reaction time can vary (Backyardbrains.com, 2019).

When the participant is talking on the phone, information is input in the auditory system and the impulse is brought up to the brain in the temporal lobe, where words are processing (Humanbrainfacts.org, 2019). (Figure 2) shows areas of the brain and their functions. The information is passed on to Wernicke’s area, where the language is processed and move to the Temporal lobe, where the driver thinks for the response and generating speech. It travels to the Bronca’s area where speech is controlled and move to the primary motor cortex where the motor control the mouth and larynx to talk (Sadava et al., 2012). The whole process is long, complex and distracting so the drivers focus on the conversation on the phone, instead of the road. (Figure 1) shows which parts of the brain working while generating speech. Many regions are colored white, yellow and red, showing the intake of glucose at parts of the brain, suggesting the brain is focused on talking rather than driving. Talking while driving is distracting and take more time for the driver to respond to the sudden changes which slow down the reaction time because the driver's brain has to too many areas working at once.

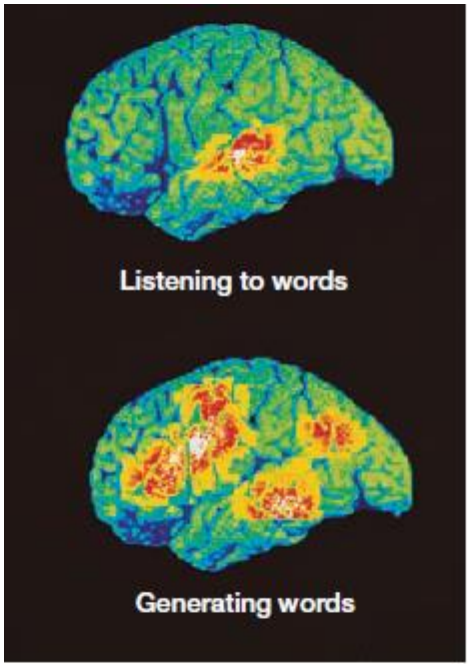


Figure 1: PET scanning reveals the brain regions activated by different aspects of language use. Radioactively labeled glucose is given to the subject. Brain areas take up radioactivity in proportion to their metabolic use of glucose. The PET scan visualizes levels of radioactivity in specific brain regions when a particular activity is performed. The red and white areas are the most active (Sadava et al., 2012).

When the participants listen to music, their ears receive the wave sound, hitting the eardrum and pass on the signal to the coachload. It releases neurotransmitters across a synapse and stimulating an adjacent sensory neuron. This triggers an action potential in the sensory neuron which propagates the brain along the auditory nerve (Allott and Mindorff, 2014). The signal is sent to the auditory nerve, one of the cranial nerves in the brain, making drivers distract from the task. (Figure 1) shows which part of the brain is working when listening. Listening to music in a long period while driving can increase the release of neurotransmitter of dopamine (Llapa et al., 2019). Dopamine is a neurotransmitter in the brain, released during a pleasurable situation, causing arousal and motivation (Enzolifesciences.com, 2019). For young people, this might not affect the reaction time and the decision-making process as much but for older people, music can be a distraction. (Brain Fodder, 2019). This is because as the age increases, the brain shrinks its volume, especially the frontal lobe, is responsible for thinking (Peters, 2019). Because of that, it will take longer for the older drivers to process in information about the obstacle on the road and press the brake since they are already occupied with the music, which increases the reaction time.

When a person is reading the map on their phone, the driver's eyes register incoming light. Photoreceptors detect the stimuli and send the impulse to the visual cortex; inside the occipital lobe through the optic nerve, which is responsible for analyzing visual (Backyardbrains.com, 2019). The visual cortex then sends the impulse to the frontal lobe so the driver can think of finding the ways on the map, losing focus on the driveway. If there is an object appears on the road, the reaction time will be slower because the drivers take more time to react because the driver is busy figuring out the map and their visual receptors are occupied. The frontal lobe is occupied thinking about the map, therefore, the time needed for the information about the obstacle on the road that's detected by the visual receptors will process up is slower, which slows down the reaction time of the driver on the highway, endangers themselves in a risky situation. This can be even more dangerous for the older driver because initially, they take longer to react, which may result in an accident.

This has led me to look at 2 types of reflexes and their responses: auditory and visual. Therefore, this research will look into "How do distractions on the auditory and visual systems affect the reaction time?"

To answer the research question, I will be investigating how does reading the map, listening to music and calling on the mobile phone has effects on the reaction time when driving in Vietnam? From the research, I predict the distraction on the auditory system will have the smallest increase in reaction time while the distraction on the visual system will have the largest increase in reaction time.

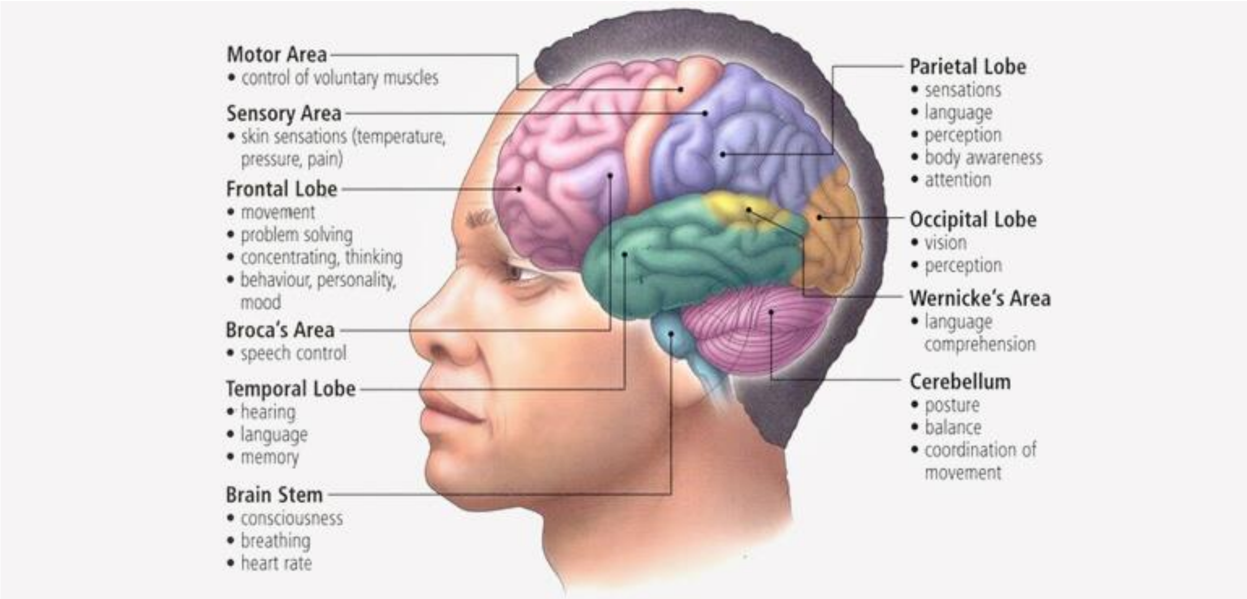


Figure 2: The brain structures and their functions (Humanbrainfacts.org, 2019).

Methodology

Participants: 50 people: 25 men and 25 women between the ages of 30 and 50

- Has legally has licensed at least 6 years of driving experience in Vietnam and still driving.
- Vietnamese drivers.
- None is red and green color blinded.

Variables

Independent: Reaction time of participant when they are using the phone and when they are not using the phone.

Dependent: Type of distractions

Control:

- Amount of time drive before taking a test
- Nationality
- Type of simulation: https://www.justpark.com/creative/reaction-time-test/
- Participant health condition: none of them has a history of having mental disorder disease, none is red or green colorblind.
- Amount of time repeated: 3 times
- The genre of music: rock
- Amount of time talking on the phone before taking the test: 1 minute

Method 1

Finding the reaction time without distraction.

1. Using the website given to measure the participant's reaction time
2. The participant clicks on the green button "start" after they read the instructions and ready.
3. The simulation will start after the green button is clicked. The simulation will start to mimic the driving condition of a car.
4. The participant's task is to click anywhere on the screen when it appears the red sign with a hand.
5. The simulation will give their reaction time value in milli-second.
6. Record the result and let the participant does 3 times their initial reaction times.

Method 2

Finding the reaction time when they are distracted

1. Let the participant use the phone while experimenting.
2. Open the simulation and let them do the test while using the phone.
3. Record the time on the simulation down.
4. Repeat the experiment 3 times with each distraction. Repeat the experiment for the new distraction.

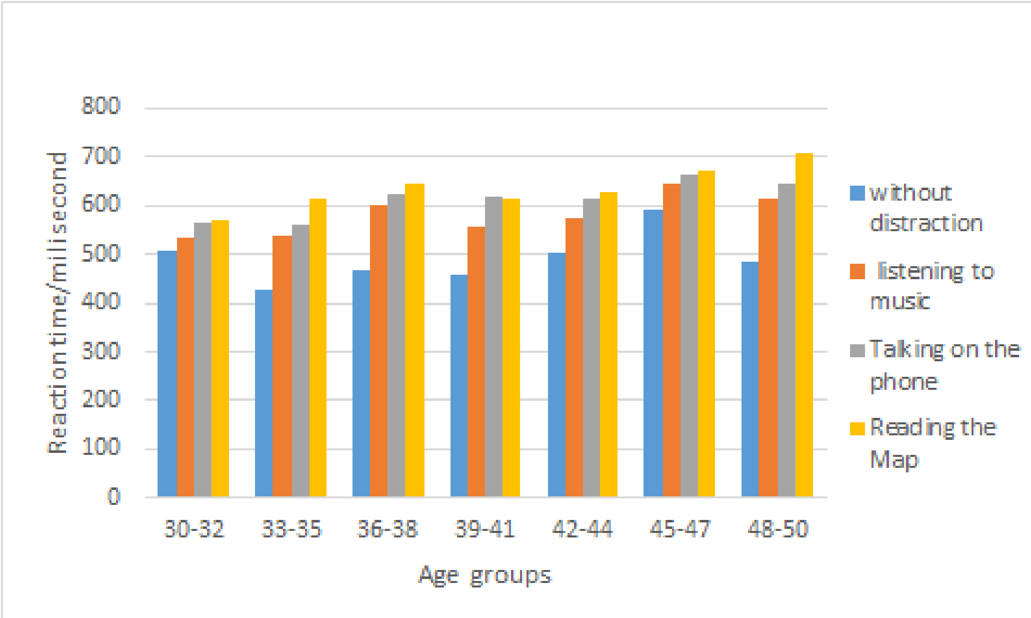
Data results

Age groups/ years	Average reaction time without distraction/ milliseconds ± 1.0	Average reaction time when listening to music/ milliseconds ± 1.0	Average reaction time when talking on the phone/ milliseconds ± 1.0	Average reaction time when reading the map/ milliseconds ± 1.0
30-32	507	535	564	571
33-35	430	541	560	616
36-38	466	600	623	646
39-41	459	556	621	617
42-44	502	576	616	630
45-47	590	645	663	674
48-50	485	615	645	708

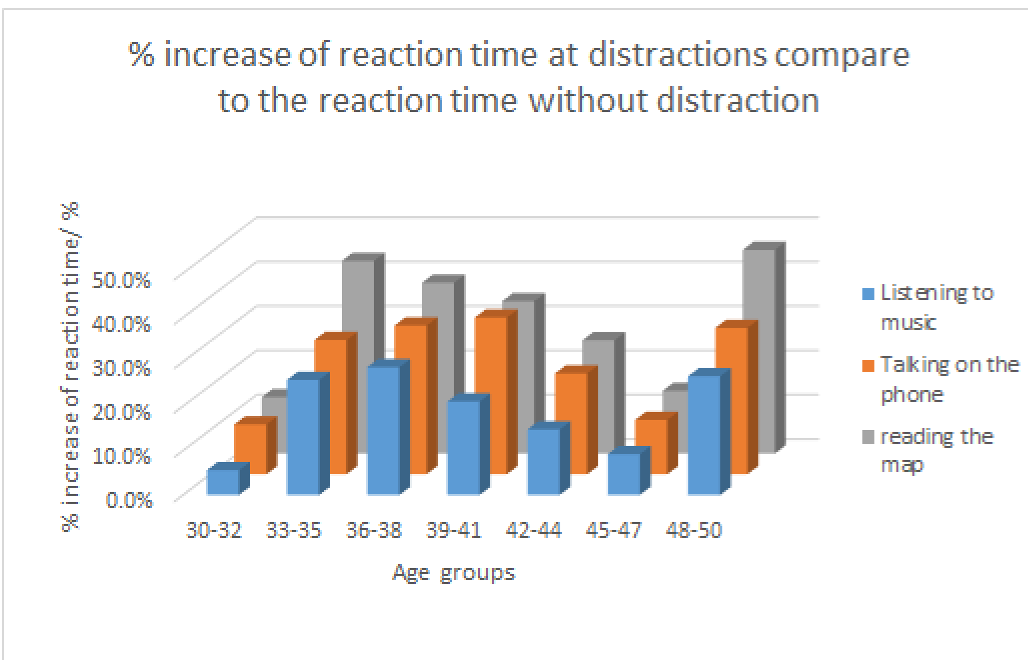
Table 1: Processed table of the average reaction time of both genders sort into groups of age.

	% increase in the reaction time without distraction when $\pm$*0.1%*		
Age group	Listening to music	Talking on the phone	Reading the map
30-32	5.6%	11.3%	12.7%
33-35	26.0%	30.3%	43.4%
36-38	28.8%	33.6%	38.5%
39-41	21.1%	35.3%	34.3%
42-44	14.8%	22.7%	25.5%
45-47	9.2%	12.2%	14.1%
48-50	26.8%	33.0%	45.9%
Average % increase per distraction	19.0 %	25.4%	30.7%

Table 2: The percentage increase of the reaction time on each distraction compares to the initial reaction time of 2 genders at the age group of 30-50.



Graph 1: Reaction time without distraction compares with reaction time with other 3 distractions: listening to music, talking on the phone, reading a map.



Graph 5: % increase of reaction time at distractions compared to the reaction time without distraction

Discussion

(Graph 1) shows the comparison of reaction time without distraction and reaction time with distractions. The overall trend is increasing as the age of 48-50 has the highest reaction time out of all. The results support the hypothesis stated above as the reaction time when listening to music has the smallest increases from the reaction time without distraction out of all distractions. This suggests that listening to music has the least effect on the driver's reaction time. It also shows that reaction time when reading the map tallest bars in the chart, suggesting reading the map has the most effect on reaction time when driving, which supports my hypothesis. In addition, this also suggests that age is also a factor that increases the reaction time of the participants.

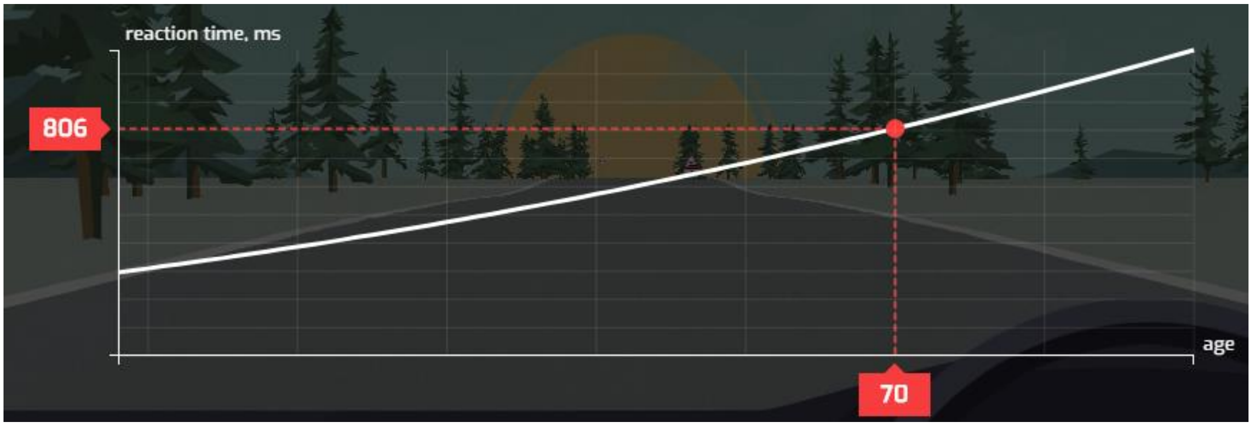
It also shows the positive trend of the % increases in reaction time at different distractions compared to the reaction time without distractions. Many have large anomalies, which disrupt the trend of the graph but overall, they have a slightly positive correlation. All distractions have the same anomalous results at the age of 36-47, decreasing instead of increasing. This is because of the unequal distribution of participants at different ages, result in similar anomalies at the different graph, where an age category has 5 participants and the other only has 2 participants, making the average results have a big difference from each other. By looking at the graph, age is one of the factors that increases the driver's reaction time, other than the distractions like listening to music, talking on the phone and reading the map. From this, it can be deduced that as people get older, their reaction time and reflex are taking longer than young people. The result is expected as the generally positive correlation of reaction time as the age is increasing. Within the same distraction: reading the map, the reaction time increases from 571 milliseconds at the age of 30-32 to 708 milliseconds at the age of 48-50, shows a clear increase in reaction time, suggests older people take longer to react than younger people. This is because their brain is shrinking (National Institute on Aging, 2019), especially the frontal lobe where thinking is happening, therefore, taking older people longer to react. In some brain regions, there will be fewer nerve cells (National Institute on Aging, 2019) because of the neural pruning due to the little use of nerve cells, resulting in fewer pathways for the impulse to travel and slows down the reaction time.

(Graph 5) shows the % increase in reaction time with distractions. From the graph, there is a clear trend of increasing reaction time as age increases and a clear correlation of increasing in reaction time when listening to music, talking on the phone and reading the map. This proves the proposed hypothesis is correct, auditory distraction has the least effect on the reaction time while visual distraction has the most effect on the reaction time. The % differences of each distraction compared to the reaction time without distraction is quite big, with the average smallest % increases in reaction time when listening to music is 19% while the average % increase in reaction time when reading the map highest out of all 3: 30.7%. The results show big differences between each distraction, suggesting reading the map has a significant effect on the participants' reaction time.

This can be very dangerous for the driver as the reaction time reaches over approximately 800 milliseconds (Graph 6), there will be a high chance driver might cause an accident. This relies on the advised maximum age that is allowed for elderly to drive in Vietnam is 70, assuming that at the age of 70, their reaction time is 800 ms:

very slow, which make driving dangerous. This might suggest that the dangerous reaction time when driving is 800 milliseconds as it is too slow to for the driver to react and it's approximately the same with the maximum legal age to drive.

In the average result, there is no reaction time at any distraction has reached over 800, however, the result in the appendix has a reaction time of 898 milliseconds when reading the map, suggesting there is highly a chance that reading the map while driving can cause an accident. The results are quite accurate as some results of reaction time when reading the map are close to 800 milliseconds, supporting reading the map while driving is the distraction has the most effect on the reaction time, therefore, likely has the most potential to cause an accident.



Graph 6: Reaction time over the age plotted using the data of 2000 people who did the test. (Justpark.com, 2019)

The results above show that the auditory reaction time is faster than the visual reaction time by showing looking at the graph. Reaction time when listening to music and talking on the phone is lower compared to reaction time when reading the map. This is supported by the research of comparison between auditory and visual simple reaction time (Shelton and Kumar, 2010). The result follows the expected patterns, similar to the results with Shelton and Kumar (2010): auditory reaction time is faster than visual reaction time. Another research from Pain and Hibbs looks into the reaction time on auditory and visual also found similar results to the investigation (Pain and Hibbs, 2007), suggesting the overall results are accurate and follow the general pattern. This implies that as the faster the stimulus reaches the motor cortex, the faster the reaction time (Shelton and Kumar, 2010). The studies of braking response by Consiglio also shows that listening to music has the least interference on the reaction time of the participant (Consiglio et al., 2003). The studies above also have a similar result with the effect of talking on the phone on the reaction time is more than listening to music (Consiglio et al., 2003). This suggests the auditory stimulus reaches the motor cortex faster than the visual stimulus, result in visual stimulus has the most effect on the decreasing of reaction time.

Statistic test

Paired t-test

For this type of data, the paired t-test is used to do the statistical calculation to check the accuracy of the data. The paired t-test was used to compare the mean values between the reaction time without distraction and reaction time with distractions (Statistics Solutions, 2019). By looking at the result, we can come up with 2 hypotheses:

Null hypothesis: There is no difference in the mean initial reaction time and the reaction time in distractions at different age groups.

Alternate hypothesis: There is a difference in the initial reaction time and the reaction time in distractions at different age groups.

Reaction time without distraction pair with	t value calculated	Critical value at 0.05	Standard Deviation
Reaction time when listening to music	-6.02	2.47	40.78
Reaction time when talking on the phone	-7.52	2.47	38.53
Reaction time when reading the map	-6.74	2.47	44.23

Table 3: The paired t-test results and standard deviation.

Because there are 7 age groups to compare, the degree of freedom is 6. From table 3, the calculated t value of controlled reaction time and reaction time when listening to music is 6.02 and the critical value is 2.47. The calculated t value > p-value (critical value) at 0.05, therefore the null hypothesis can be rejected. With the confidence level of 95%, listening to music as a distraction affects slowing down the reaction time.

The calculated t value of reaction time when talking on the phone and controlled reaction time is 7.52 > critical value, rejecting the null hypothesis. With the confidence level is 95%, talking on the phone affects the reaction time.

Similarly, the calculated t value of reaction time when reading the map is 6.47, larger than the critical value, rejecting the null hypothesis.

The standard deviation of all distractions is quite big, showing that the data is spread over a large range. This is because of the unit. Reaction time is measured in a unit of millisecond; therefore, a slight change can cause huge different. In addition, the reaction time is also affected by age, therefore, the range between the results is quite large.

Overall, the data is quite accurate because the paired t-test proves it's 95% confident that all 3 types of distraction have interferences in slowing reaction time.

Evaluation

In this experiment, there were some mistakes. The first source of error is the number of participants collected at different age groups is not consistency. For example, there are 5 participants in the age group of 42-44 who participate in taking the test while at the age group of 33-35, only 2 people are taking the test. This leads to the inconsistency of the results and averages, affecting the graph correlation and result in anomalies. The errors are visible the most when drawing the graph about the % increase in reaction time without distraction. This results in an unclear pattern of the data, making the investigation not very accurate.

Another source of error is the learned response. The learned response is the reaction that has been acquired by the learning of the stimulus appears several times. As the test repeats, the participants will learn more about the simulation, improving their reaction time after a few repeats. From the data collected, there are signs of improvement in reaction time. For example: the reaction time without the distraction of a man at the age of 30 starts off with 414 ms and starts to decreases to 403 ms and down to 396 ms by the end of the third trial, the reaction time when talking on the phone of a man at the age of 38 in the first trial is 498 ms but reduce down to 478 ms in the second trial and reduce down to 560 ms by the third trial. There are other studies also have the same problem when experimenting. An example of this is a study conducted by Ando et al., (Ando, 2002) also shows the same result when conducting the experiment related to reaction time on the peripheral and central field. The research shows that reaction time reduces with the repeating stimulus. This can improve the reaction time of the participant as long as they practice long enough, making the results inaccurate.

Lastly, the sample size is too small for the investigation. This investigation only has 50 participants with 25 males and 25 females at different age groups. To make the results more reliable, the sample size should be bigger and evenly distributed at different age groups. Many studies investigate the reaction time have a big sample size, up to 200 participants like the research from White, Eiser and Harris, studying about the risk of using a mobile phone while driving (White, Eiser and Harris, 2004). However, there is much other research that has a small sample size, like the Ando et al. (Ando, 2002) has only 16 participants or the finding of Shelton and Kumar (Shelton and Kumar, 2010) only has 14 subjects. Similarly, the study of the effect of cellular telephone conversations and other interference on reaction time in a braking response (Consiglio et al., 2003) only has 22 participants and the results are quite similar to this research. However, to make the investigation more accurate, the sample size should be bigger.

Conclusion

This study clearly shows how different distractions affect reaction time. According to the results, listening to music has the least effect on the reaction time while reading the map has the most interference on the reaction time. This finding is supported by the results and other researchers, which proves the hypothesis is correct: the distraction on auditory has the least effect on the reaction time while the visual distraction has the most effect on the reaction time when driving. The increase in reaction time is dangerous, and when the reaction time is increased up to around 800 ms - the reaction time of 70 years old, there will be likely chance the driver will cause the accident. This is only an assumption from the result above and there have not been any researchers to support that statement but I believe that reaching 800 ms or above for reaction time when having distraction is very dangerous and should be noticed.

This investigation can use to contribute to the research in the case study of how the use of mobile phone while driving can cause accidents. There has not been any plan nor conduct any study on this matter yet in Vietnam (Thanh Nien Daily, 2019), therefore, this research will be very useful as a material to raise awareness in Vietnam.

Extension

The investigation could have been better if there are more people involved in the experiment. More people in the investigation means that the results will be more reliable and have fewer repeats, preventing the learned response which makes the result inaccurate. To prevent the learned response, adequate periods of rest between each test will decrease the chance participants improve from the test. The distribution of participants in different age groups is also needed to consider if possible. It's advisable to have at least 5 participants at each age group so that the data is more accurate. For future reference, the distraction when talking on the phone should not be conducted by themselves but to create a list of questions to ask the participant, which can easily control than letting them talking on their own on the phone. A specific song should be chosen next time for listening to music distraction rather than controlling on the music genre. Different people have different taste in music but their preference would not likely to affect the result but the result might affect if they choose a rock song they enjoy. Choosing a song the participants enjoy and already listen to many times does not distract them, make the results inaccurate. In the future, a song should be chosen to control their distraction. If possible, rather than using the online website to check the reaction time, I would like to have a driving simulation which can measure the reaction time more accurate.

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Appendix

Key:

F: Female

M: Male

Person number : Gender, age		Reaction time/ millisecond		
		Trial 1	Trial 2	Trial 3
1: F, 30	initial reaction time	454.000	452.000	482.000
	reaction time when listening to music	561.000	510.000	486.000
	reaction time when talking on the phone	576.000	571.000	486.000
	reaction time when reading the map	533.000	520.000	451.000
2: M, 30	initial reaction time	414.000	403.000	396.000
	reaction time when listening to music	390.000	419.000	402.000
	reaction time when talking on the phone	369.000	412.000	415.000
	reaction time when reading the map	401.000	414.000	401.000
3: F, 37	initial reaction time	473.000	405.000	415.000
	reaction time when listening to music	412.000	482.000	423.000
	reaction time when talking on the phone	520.000	512.000	490.000
	reaction time when reading the map	487.000	415.000	461.000
4: F, 42	initial reaction time	427.000	355.000	402.000
	reaction time when listening to music	441.000	533.000	460.000
	reaction time when talking on the phone	470.000	458.000	466.000
	reaction time when reading the map	552.000	500.000	498.000

5: M, 40	initial reaction time	441.000	409.000	327.000
	reaction time when listening to music	460.000	392.000	475.000
	reaction time when talking on the phone	436.000	461.000	378.000
	reaction time when reading the map	350.000	320.000	366.000
6: F, 30	initial reaction time	399.000	393.000	439.000
	reaction time when listening to music	450.000	403.000	368.000
	reaction time when talking on the phone	394.000	464.000	418.000
	reaction time when reading the map	300.000	420.000	476.000
7: F, 50	initial reaction time	340.000	349.000	342.000
	reaction time when listening to music	420.000	417.000	429.000
	reaction time when talking on the phone	448.000	522.000	543.000
	reaction time when reading the map	526.000	550.000	602.000
8: M, 39	initial reaction time	450.000	440.000	210.000
	reaction time when listening to music	520.000	320.000	420.000
	reaction time when talking on the phone	510.000	550.000	428.000

	reaction time when reading the map	420.000	553.000	549.000
10: F, 37	initial reaction time	458.000	420.000	442.000
	reaction time when listening to music	592.000	522.000	576.000
	reaction time when talking on the phone	610.000	623.000	539.000
	reaction time when reading the map	533.000	576.000	589.000
11: F, 35	initial reaction time	339.000	478.000	443.000
	reaction time when listening to music	520.000	524.000	544.000
	reaction time when talking on the phone	555.000	566.000	576.000
	reaction time when reading the map	598.000	567.000	523.000
12: M, 38	initial reaction time	339.000	458.000	320.000
	reaction time when listening to music	449.000	578.000	567.000
	reaction time when talking on the phone	498.000	478.000	560.000
	reaction time when reading the map	489.000	572.000	544.000
13: M, 48	initial reaction time	321.000	334.000	337.000

	reaction time when listening to music	443.000	446.000	561.000
	reaction time when talking on the phone	461.000	487.000	439.000
	reaction time when reading the map	678.000	778.000	657.000
14: M, 44	initial reaction time	233.000	355.000	453.000
	reaction time when listening to music	445.000	550.000	545.000
	reaction time when talking on the phone	589.000	602.000	665.000
	reaction time when reading the map	490.000	559.000	599.000
15: M, 44	initial reaction time	445.000	667.000	479.000
	reaction time when listening to music	544.000	534.000	564.000
	reaction time when talking on the phone	551.000	510.000	569.000
	reaction time when reading the map	567.000	489.000	409.000
16: M, 40	initial reaction time	687.000	667.000	637.000
	reaction time when listening to music	788.000	689.000	699.000
	reaction time when talking on the phone	756.000	778.000	756.000

	reaction time when reading the map	598.000	675.000	698.000
17: F, 45	initial reaction time	558.000	536.000	523.000
	reaction time when listening to music	578.000	599.000	609.000
	reaction time when talking on the phone	689.000	624.000	645.000
	reaction time when reading the map	667.000	623.000	644.000
18, F 49	initial reaction time	568.000	587.000	568.000
	reaction time when listening to music	677.000	568.000	502.000
	reaction time when reading the map	766.000	687.000	687.000
	reaction time when reading the map	776.000	773.000	765.000
19 F 50	initial reaction time	445.000	458.000	476.000
	reaction time when listening to music	557.000	567.000	598.000
	reaction time when talking on the phone	677.000	723.000	767.000
	reaction time when reading the map	765.000	766.000	788.000
20 M 46	initial reaction time	458.000	449.000	569.000

	reaction time when listening to music	610.000	611.000	678.000
	reaction time when talking on the phone	662.000	678.000	647.000
	reaction time when reading the map	677.000	687.000	612.000
21 F 42	initial reaction time	601.000	554.000	550.000
	reaction time when listening to music	457.000	562.000	572.000
	reaction time when talking on the phone	578.000	678.000	512.000
	reaction time when reading the map	522.000	546.000	578.000
22 F 33	initial reaction time	466.000	476.000	564.000
	reaction time when listening to music	552.000	499.000	487.000
	reaction time when talking on the phone	543.000	541.000	512.000
	reaction time when reading the map	557.000	576.000	587.000
23 F 43	initial reaction time	355.000	389.000	547.000
	reaction time when listening to music	657.000	622.000	624.000
	reaction time when talking on the phone	647.000	624.000	689.000

	reaction time when reading the map	789.000	772.000	774.000
24 F 45	initial reaction time	676.000	623.000	531.000
	reaction time when listening to music	622.000	512.000	587.000
	reaction time when talking on the phone	723.000	634.000	689.000
	reaction time when reading the map	723.000	627.000	667.000
25 F 40	initial reaction time	487.000	447.000	589.000
	reaction time when listening to music	512.000	546.000	578.000
	reaction time when talking on the phone	573.000	589.000	512.000
	reaction time when reading the map	611.000	534.000	697.000
26 F 41	initial reaction time	367.000	387.000	457.000
	reaction time when listening to music	524.000	467.000	632.000
	reaction time when talking on the phone	524.000	578.000	561.000
	reaction time when reading the map	656.000	675.000	645.000
27 F 42	initial reaction time	563.000	587.000	543.000

	reaction time when listening to music	446.000	564.000	464.000
	reaction time when talking on the phone	657.000	645.000	632.000
	reaction time when reading the map	647.000	633.000	623.000
28 F 49	initial reaction time	446.000	489.000	349.000
	reaction time when listening to music	787.000	845.000	637.000
	reaction time when talking on the phone	647.000	621.000	637.000
	reaction time when reading the map	781.000	628.000	741.000
29 M 41	initial reaction time	362.000	462.000	364.000
	reaction time when listening to music	385.000	573.000	563.000
	reaction time when talking on the phone	635.000	637.000	689.000
	reaction time when reading the map	745.000	761.000	743.000
30 F 39	initial reaction time	438.000	425.000	556.000
	reaction time when listening to music	676.000	623.000	647.000
	reaction time when talking on the phone	637.000	765.000	765.000

	reaction time when reading the map	537.000	587.000	598.000
31 M 40	initial reaction time	485.000	748.000	765.000
	reaction time when listening to music	612.000	645.000	621.000
	reaction time when talking on the phone	637.000	612.000	623.000
	reaction time when reading the map	765.000	647.000	661.000
32 F 46	initial reaction time	446.000	637.000	637.000
	reaction time when listening to music	761.000	651.000	762.000
	reaction time when talking on the phone	676.000	674.000	767.000
	reaction time when reading the map	786.000	748.000	642.000
33 M 36	initial reaction time	465.000	487.000	489.000
	reaction time when listening to music	656.000	621.000	562.000
	reaction time when talking on the phone	678.000	698.000	699.000
	reaction time when reading the map	647.000	748.000	657.000
34 M 49	initial reaction time	540.000	547.000	560.000

	reaction time when listening to music	580.000	670.000	620.000
	reaction time when talking on the phone	580.000	680.000	710.000
	reaction time when reading the map	720.000	690.000	689.000
35 F 30	initial reaction time	550.000	320.000	340.000
	reaction time when listening to music	610.000	420.000	543.000
	reaction time when talking on the phone	640.000	677.000	536.000
	reaction time when reading the map	667.000	689.000	558.000
36 F 35	initial reaction time	440.000	430.000	449.000
	reaction time when listening to music	552.000	509.000	599.000
	reaction time when talking on the phone	520.000	621.000	522.000
	reaction time when reading the map	662.000	728.000	622.000
37 F 40	initial reaction time	340.000	550.000	523.000
	reaction time when listening to music	544.000	524.000	662.000
	reaction time when talking on the phone	662.000	672.000	728.000

	reaction time when reading the map	661.000	652.000	561.000
38 M 49	initial reaction time	552.000	562.000	587.000
	reaction time when listening to music	676.000	690.000	689.000
	reaction time when talking on the phone	667.000	562.000	627.000
	reaction time when reading the map	762.000	627.000	692.000
39 F 39	initial reaction time	320.000	330.000	458.000
	reaction time when listening to music	592.000	512.000	491.000
	reaction time when talking on the phone	637.000	734.000	723.000
	reaction time when reading the map	737.000	783.000	698.000
40 F 50	initial reaction time	558.000	570.000	529.000
	reaction time when listening to music	672.000	698.000	678.000
	reaction time when talking on the phone	728.000	721.000	789.000
	reaction time when reading the map	726.000	768.000	781.000
41 F 49	initial reaction time	637.000	612.000	632.000

	reaction time when listening to music	689.000	721.000	798.000
	reaction time when talking on the phone	725.000	663.000	898.000
	reaction time when reading the map	676.000	745.000	647.000
42 M 46	initial reaction time	758.000	526.000	656.000
	reaction time when listening to music	647.000	758.000	676.000
	reaction time when talking on the phone	734.000	756.000	756.000
	reaction time when reading the map	673.000	756.000	745.000
43 M 31	initial reaction time	546.000	647.000	723.000
	reaction time when listening to music	657.000	687.000	689.000
	reaction time when talking on the phone	586.000	748.000	721.000
	reaction time when reading the map	756.000	721.000	634.000
44 M 36	initial reaction time	450.000	556.000	561.000
	reaction time when listening to music	573.000	634.000	721.000
	reaction time when talking on the phone	748.000	758.000	721.000

	reaction time when reading the map	738.000	758.000	873.000
45 M 36	initial reaction time	440.000	562.000	627.000
	reaction time when listening to music	739.000	745.000	634.000
	reaction time when talking on the phone	638.000	731.000	627.000
	reaction time when reading the map	647.000	736.000	872.000
46 F 36	initial reaction time	450.000	457.000	519.000
	reaction time when listening to music	634.000	762.000	731.000
	reaction time when talking on the phone	635.000	631.000	687.000
	reaction time when reading the map	762.000	748.000	712.000
47 F 42	initial reaction time	520.000	621.000	562.000
	reaction time when listening to music	621.000	762.000	627.000
	reaction time when talking on the phone	637.000	698.000	768.000
	reaction time when reading the map	728.000	721.000	627.000
48 F 43	initial reaction time	627.000	562.000	581.000

	reaction time when listening to music	627.000	682.000	789.000
	reaction time when talking on the phone	645.000	736.000	621.000
	reaction time when reading the map	873.000	763.000	621.000
49 M 57	initial reaction time	652.000	678.000	526.000
	reaction time when listening to music	736.000	672.000	763.000
	reaction time when talking on the phone	627.000	637.000	564.000
	reaction time when reading the map	738.000	673.000	637.000
50 M 32	initial reaction time	563.000	673.000	762.000
	reaction time when listening to music	748.000	652.000	723.000
	reaction time when talking on the phone	748.000	628.000	781.000
	reaction time when reading the map	758.000	773.000	873.000