Using Mobile Phone while Driving Could Become a Criminal Act[1]

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Abstract

Making a telephone call while driving is becoming a common behaviour in many societies in spite of the banning laws, although many nations imposed a fine for this, others went into incriminating the user.

Many societies and papers addressed the consequences of this attitude, one of these is the delay in the reaction time.

We have designed a test based on Pentium 4 processor computer, with special software designed to carry out Raven's progressive matrices response time in two different protocols with and without using mobile phone.

Thirteen young males, their ages range between 21-26, went into this experiment.

The results showed by no doubts that a significant delay in response time is a reality since that figure ranged from 3 to 6 seconds depending on the difficulties of the task was given to driver.

These results was confirmed by the simulation hypotheses and they confirmed the extend of the seriousness of such act.

[1] For the paper in Arabic see pages (177-178).

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Introduction:

The widespread of using mobile phone while driving is becoming the core of many research centres around the world.

Previous attempts of describing the danger of this habit was addressed by **Mcknight AJ et al [1]** where they investigated 150 subject observed a 25-minute video driving sequence containing 45 highway traffic situations, each was subjects to 4 different situation of distractions including carrying on a casual cellular phone conversation , all led to significant increase to which subjects failed to respond . Age was a faster to increase such failure with people above 50.

Strayer DL et al [2] concluded that unconstrained conversation using either a hand held or a hands-free cell phone resulted in a two fold increase in the failure to detect simulated traffic signal and slower reactions to those signals for discussion that were detect .

Suggestion that cellular –phone use disrupts performance by diverting attention to an engaging cognitive context other that the one immediately associated with driving

Dougherty D [3] , described in his report that cell phone users while driving should know that :

- reaction time will increase and thus there will be a need for increased following distance .
- there will be lateral deviation from path of travel if using phone while driving .

ROSPA [4] using hand-held or s-free phones while driving is a significant distraction and substantially increase the risk of the driver crashing .

This research paper will focus on measuring the delay of the response time during the use of mobile phone with a very similar situation of driving.

Material and Method :

-PC with Pentium 4 processor 800MHz

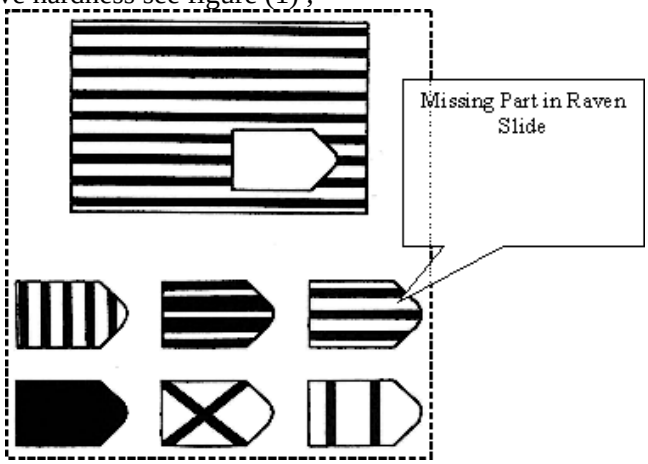
-17 inch HR Monitor, and a Mouse .

- Special software written with Delphi :

For purpose of carrying out the test .

Since driver is the only person has to take decision as quickly as possible , in all situation . It was very important to find a test which could reflect

the ability of car commander to think clearly and make sense of complex data , and the ability to store and reproduce information .
The relevant test was Raven's progressive matrices [5] which person under test is requested to find missing pattern in a series with 5 levels of progressive hardness see figure (1) ,



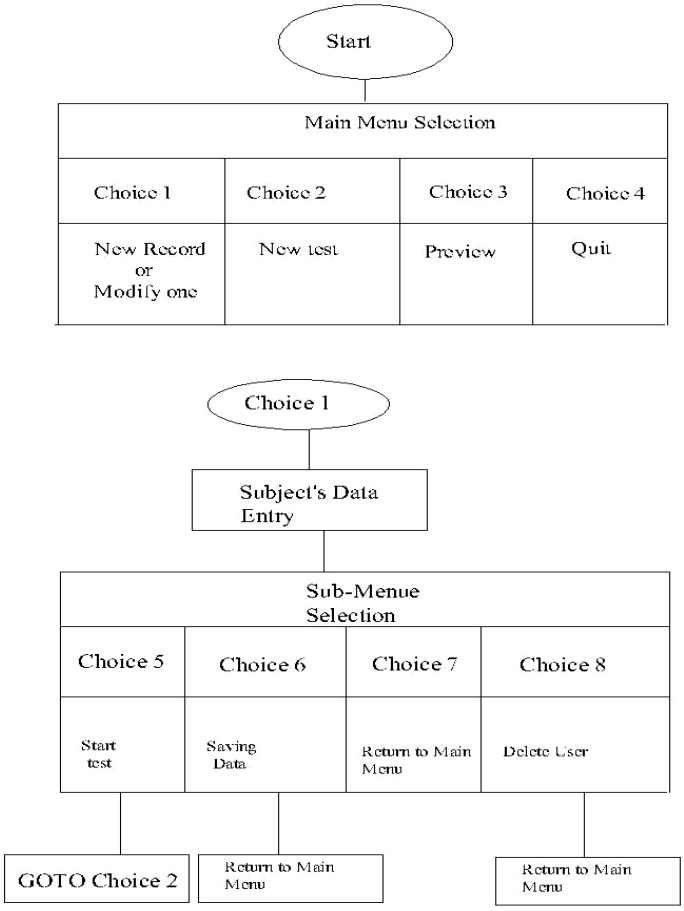
Figure(1)- Explains How the missing pattern in Raven's progressive matrices

which require cognitive capacity to encode and analyze . Each level composed of sixteen slides with the same.

Test Protocol :

First Protocol:
The person under test is requested to give his Bio data , and the test starts on computer screen which displayed four slides of each level randomly and consequently, subject response time is recorder in a file with question number .
The second protocol is engaging the person with the telephone conversation where we asked him many question so we kept him occupied by the telephone talk.
During this talk we requested the person to respond simultaneously to Raven test , and the time was recorder in a file , after both protocol tests , data were retrieved for comparison .
The flow chart of the program as shown in figure (2) illustrates that the program starts with main menu of 4 choices.

Choice 1 which is basically for creating a new Bio data record or modifying an existing one, figure (2) and figure (3) and figure (4), after doing this it takes the user into another sub-menu with four choices 5,6,7,8, choice 5 will progress the tester into performing Raven test, while choice 6,7,8 they are saving data, returning to main menu or delete the user consequently.



Figure(2)- Flow Chart for main menu and choice for Subject's data entry

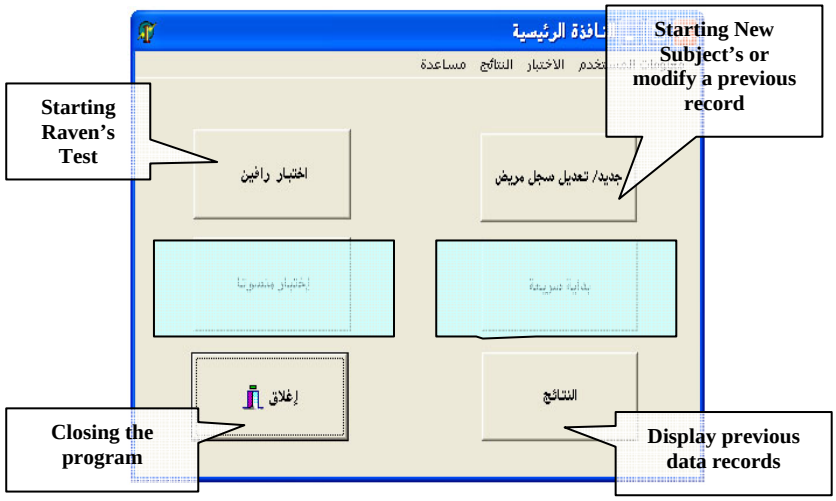


Figure (3)- Main Menu for the program.

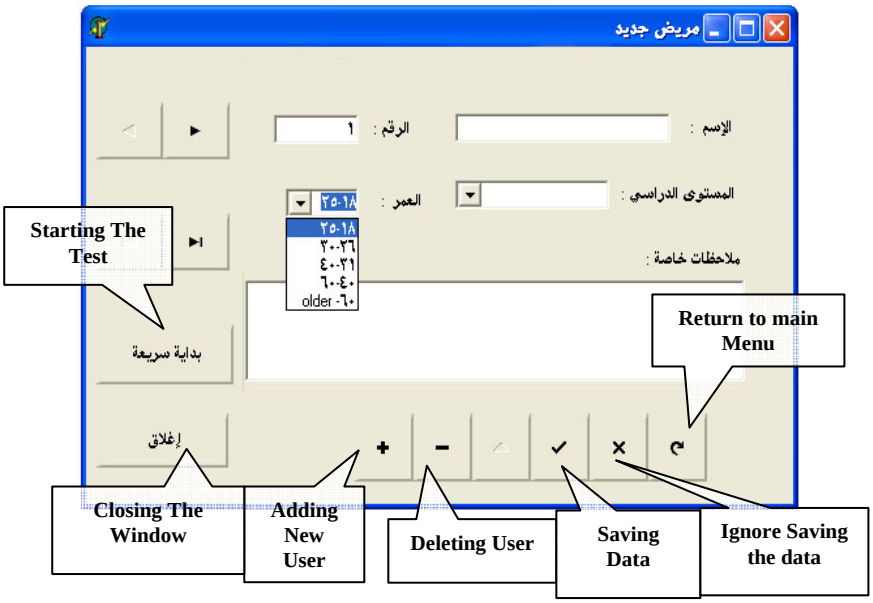


Figure (4)- Subject's Data Window.

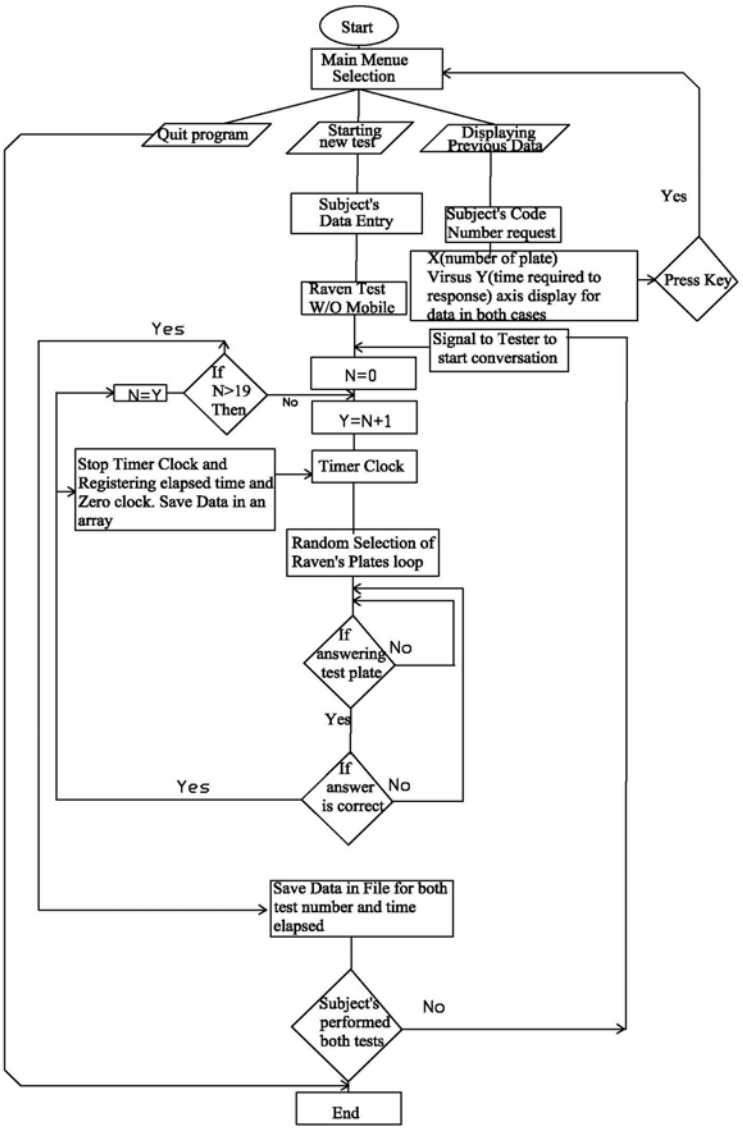


Figure (5) - Flow Chart of choice 2 for Testing Program

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Figure (6)- Subject's Selection Window for Start.

Choice 2 give the option to start the Raven test figure (3), figure (5) and figure (6), which have two procedures.

The program guides the user into test without using mobile, where new screens appears to viewer with first Raven's plate, requesting a click on the right missing part, at the same time a timer clock starts a timer between showing the screen until the correct answer is chosen figure (7). A loop will enable displaying twenty plates of different level of difficulties. After finishing the twenty plates quiz, then all data is saved in data file with all info, then program moves to the a second stage test by using mobile phone. At the same time starting displaying the first plate, a signal is given to initiate the phone call conversation which is composed of many questions are built to keep the user with the same level of distraction, again displaying Raven's plate as the previous sequence with the same steps until exam is completed.

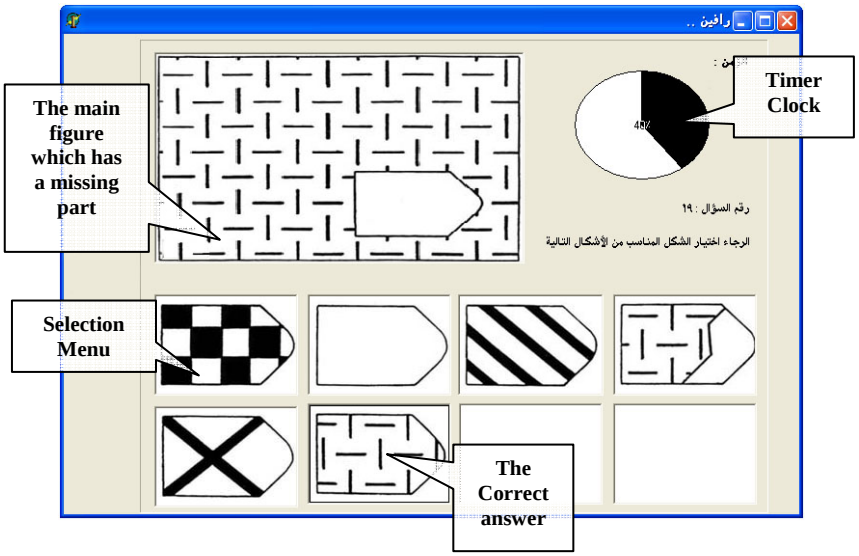
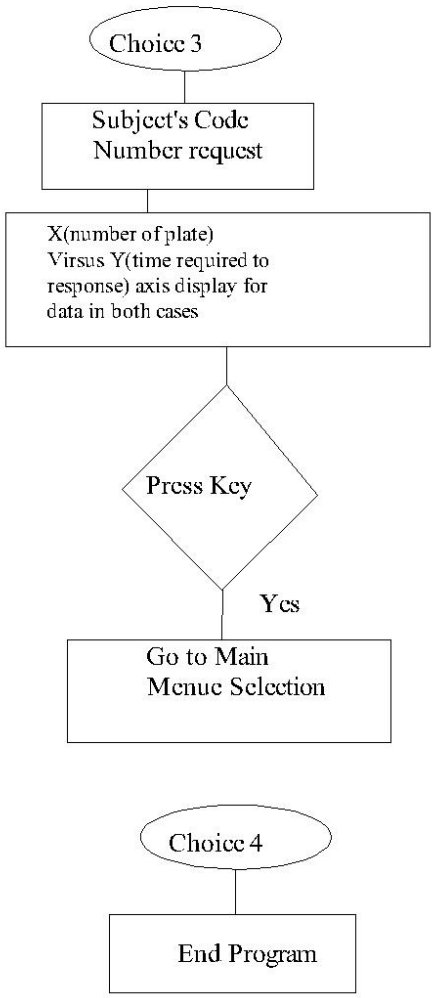


Figure (7)- Raven's Test Window.

Choice 3 makes it possible to preview a previous test results figure (2), figure (8), this requires subject's code number which plotted the results figure (8) and figure (9) . while choice 4 will end the program figure (8).



Figure(8)- Flow Chart of choice 3 and choice 4 for Testing Program

Then moving back to the main menu so examiner could display data, and eventually either move to another test or quitting the program.

Results:

Thirteen males between 21-26 went into the tests.

Results showed increase time of response for the group of questions when using mobile phone.

Figure (9) showing typical test result yielded from the experiment for 24 years male, final year at the school of engineering.

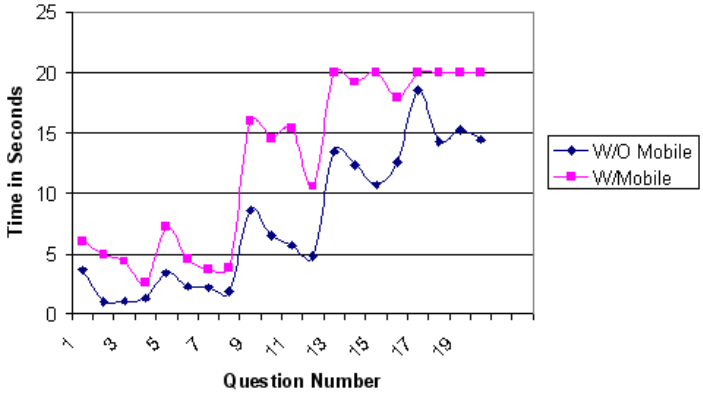


Figure (9)- Typical experiment result for subject response

We have calculated the mean of the response time in two cases (W/o Mobile and W/Mobile phone) for the thirteen subjects and plotted the results in Figure (10). The data confirmed the delay in response time when using the phone.

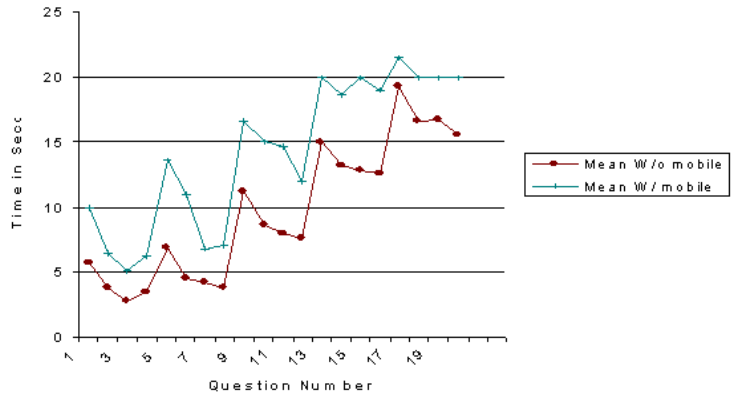
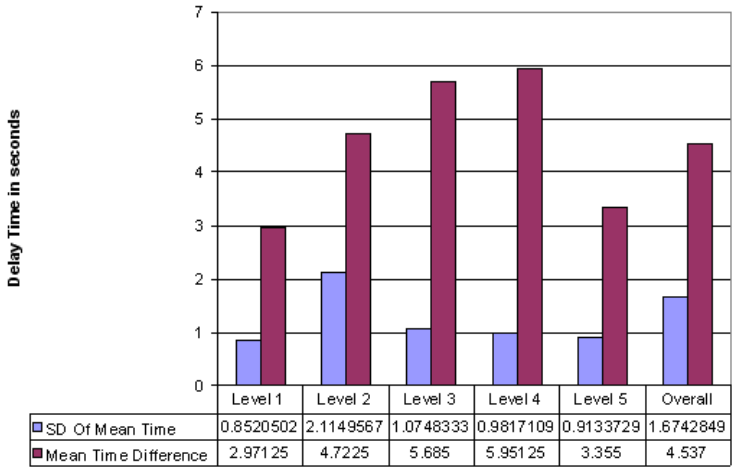


Figure (10)- Mean value of response time in 6 Subjects for both cases: - W/O Mobile and W/ Mobile



	Level 1	Level 2	Level 3	Level 4	Level 5	Overall
SD Of Mean Time	0.8520502	2.1149567	1.0748333	0.9817109	0.9133729	1.6742849
Mean Time Difference	2.97125	4.7225	5.685	5.95125	3.355	4.537

Figure (11)- Mean value of difference in response time for the 6 Subjects and SD

Again we have calculated the difference in the response time for the two protocols test for each test stage (level of difficulties) and plotted them in Figure (11).

Discussion:

We have drawn a diagram for the driving Model (Figure (12)) without a mobile (A) and with mobile (A+B).

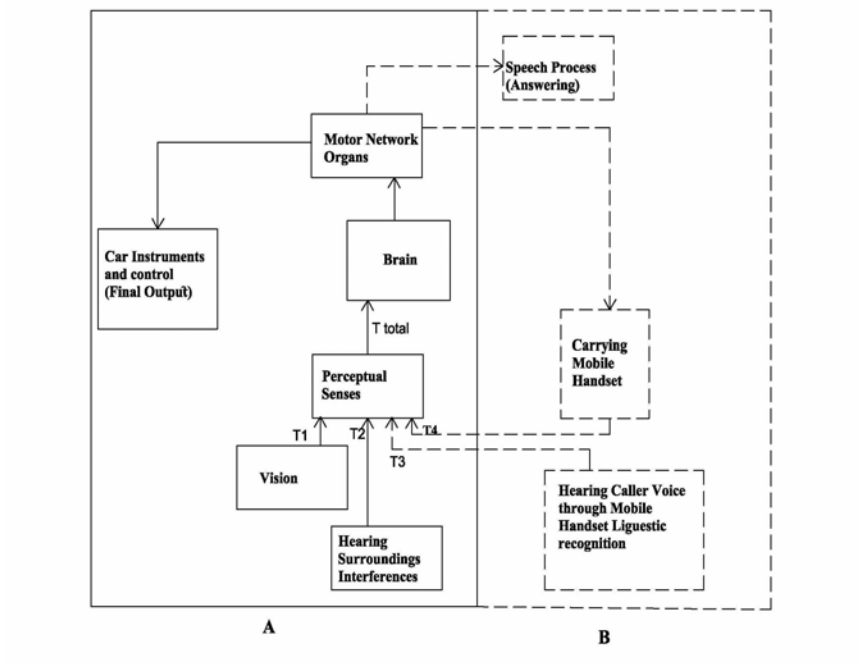


Figure (12)- Diagram for Driving Model for both cases:
A- Without Using Mobile
A+B Combined task while Using Mobile

As noticed from the Model diagram that during normal case inputs are mainly vision and hearing surrounding interferences both require time to be processed T1 and T2, while output only concentrated on hands and legs to control the vehicle, using the phone will add other inputs which needs extra time to be processed by brain, both are T3 (Linguistic recognition) and T4 (Carrying mobile handset), delaying in processing will definitely cause a considerable delay in outputs, and diversion of attention to other tasks, and other output tasks to be added on.

It is not only exposing themselves, but other innocent drivers or pedestrians to a huge danger.

Usually all inputs signal comes from many receptors which transform the signal from visual, hearing or sensation to electrical pulses travels through the concerned nerve, all meet in the spinal cord which plays the role of main conductor, the resistance of it increases with increasing the number of inputs since the used area cross section increases with the usage of different bundles of it.
Signals arrived to different areas in brain for processing, cells usually plays a role of capacitance where they go through polarization and depolarization.
The previous concept could be translated into an simple electrical circuit from resistors and capacitances as shown in figure (13).
If we ignore the resistance of the nerve until it arrives the spinal cord since it is very small. While as shown in figure (13) the three senses (Vision, Sensory, Hearing) each sense is represented by two components connected on series a varying resistance and a capacitor, each time any of these senses initiated the varying resistances drops allowing a higher current to be applied on the related capacitor, the more senses involved in the more current is required to charge the different capacitor this means more time of charging and discharging. A central processing unit which acted as a Band Pass Filter each of the discharged signal is directed to the addressed load.

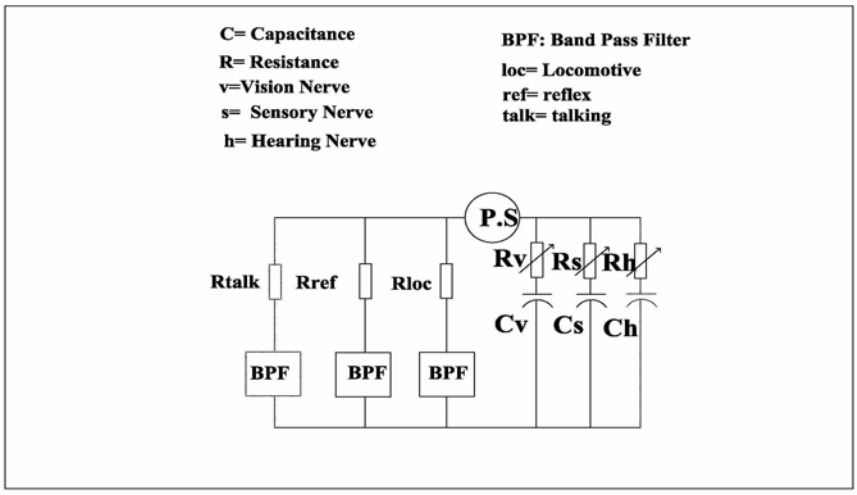


Figure (13)- Electrical Diagram for Driving Model for both cases:

The experiment results confirmed a difference ranging from 3 seconds to almost 6 seconds, Standard deviation (SD) was ranged from 0.8 to 2 seconds.

While mean difference for overall results 4.537 seconds, and SD is 1.67428

This means that if the car speed is 80 Km/h and the driver is talking on the phone, it will require at least 3 seconds for his brain to give an order for braking which is about 66 metres delay to realise how to tackle the problem on the road although the organization of safe law **[6]** has mentioned that if driver is driving on a speed of 80 Km/h it will require him 13 Car length to stop completely (the figure is divided between two amounts the thinking distance 3.5 Car length and the braking distance which is 9.5 Car length) an example of a car with a length of 4 meters the driver require in normal conditions a distance of 14 meters to make a decision for braking (0.64 seconds) this means that the total distance for the car to stop is:

Total distance to stop at speed of 80 km/hour= Delay time* speed+ 13 *car length
Total distance to stop 1= 66 meter + 13 *4 meter=118 m (at normal task condition)
Total distance to stop 2= 132 meter + 13 *4 meter= 184 (at difficult task condition)

Previous calculation is based on car length is 4 meters, car speed 80 km/h.

The above figures will highly increased by two factors the speed of the car and the vehicle length, if the problem is more complex (the conversation is requiring sophisticated queries) the driver would require almost double the time to brake and consequently the total distance to break is 184 meters, which make the crash with the car in front or hitting the pedestrian ahead is inevitable.

Conclusion:

The significance of this research that it is the first to report the delay time in numbers, it is becoming an evident that using mobile phone while driving is fatal action, since it would increase the reaction time. this would impair the tasks required from the brain to carry out orders for both the tasks of driving and conversation.

In our believe using mobile phone while driving should be treated as a criminal act.

Our finding confirmed **Redelmier .D.A . et al [7]** when they examined traffic accidents experienced by cell phone users in Toronto, they suggested that driving while using a cell phone resulted in a risk having an accident four times as high as that of driving by itself, according to the researches this was roughly the same level of impairment as driving with a blood alcohol level high enough for one to be arrested in most states . The only solution for this problem is to make people aware of the problem and push car manufacturer to implement a device into their car so mobile phones will not operate except for emergency calls, like ambulance or police station. Or perhaps a built in an answering machine which could tell other parties that the requested number in on the road.

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Received, 18/ 3/ 2007.