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# Crash Warning Interface Metrics

## Task 3: Report Appendices

# Crash Warning Interface Metrics Task 3: Report Appendices

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# Appendix A: Negative Transfer with Auditory FCW Experiment

## *Appendix A1: Experimental Protocol with Scripts*

## Session 1

### Welcome

Participant arrives
Obtain informed consent (2 parts)
- Study consent
- Video recording consent

Administer vision and audition tests
Administer first packet of questionnaires:
- Demographic
- Motion Sickness Screener
- SSQ

### Training

Tell the participant the purpose of the study
"This study is investigating safe driving in the midst of various in-vehicle devices. We are interested in examining how different in-vehicle devices and systems affect driver safety in different driving situations. We will also be evaluating your performance on the different in-vehicle tasks in these different driving situations. Lastly, we are interested in how safe driving and overall driving performance change when drivers do or do not change vehicles that have similar features."

Have the participant get into the simulator for the presentation.

Walk the participant through the training presentation. This includes:
Outline of experiment sessions
"This experiment will be conducted over the course of 3 days separated by no more than 3 days in between. The first and last day will be 1.5 hours long and the second day will only be an hour in length. Each day you will drive 3 experimental drives and complete surveys after each drive. Today is the first session and you will be trained and familiarized with the simulator and tasks that you will be completing throughout the study. After your last drive on the third day you will complete an final auditory test."

Simulator features (safety and mechanical)
"The George Mason University driving simulator is a motion-base simulator with two different degrees of freedom. First, there is yaw motion. The simulator can move 180 degrees to the left and right to simulate turning. Second, there is pitch motion. Your seat is fixed on a sled that will move 1 degree forward and backward to simulate acceleration and braking.

The simulator was built using the driver compartment from a Ford Focus and operates just like the actual vehicle. All of the gauges, buttons, and displays operate as they do in an actual vehicle. In your instrument cluster you see that you have a speedometer to monitor speed, tachometer to monitor RPM, fuel gauge, and an array of standard system warning lights such as your check engine light, brake warning light, and oil pressure light. The simulator vehicle is automatic so you will need to place the gear selector into drive to move forward.

There are several important safety features related to stopping the simulation or motion base in the event that you feel uncomfortable with the scenario and/or motion or need to stop the simulation due to motion sickness. The first safety feature is your seat belt. The seat belt must be

worn at all times when you are seated in the simulator. If the seat belt is not engaged then the motion base system will not work. Thus, the easiest way to stop the simulator is to unbuckle your seat belt. A second safety feature is the emergency stop button located to your left. If you would like to stop the simulator press this button. Lastly, there is an entry gate to the simulator that, if opened, will halt the motion base. You can also open this gate to stop the simulator."

Introduce vehicle and vehicle systems

"Today you will be driving the [FORD or TOYOTA] vehicle. Please note the emblem on the steering wheel along with the markings on the back of your vehicle (the simulator). Your vehicle is equipped with several in-vehicle technology and safety systems. First you have a navigation system that will help guide you at intersections during your drives. The navigation system will provide you with an auditory message and a visual turn arrow at intersections. Your vehicle also has hands-free cell phone capability. If you receive a cell phone call during the drive you will hear the ringer over the vehicle speakers. We do not want you to answer the cell phone while driving and ask that if you hear the cell phone ringing that you silence the phone by pressing the Silence Phone button the touchscreen display. Your vehicle is also equipped with a collision warning system. The collision warning system provides an audible alert if a possible forward collision threat is detected. If the alert sounds you should respond appropriately to avoid the collision. It is important to know that the forward collision warning system is passive in that it will not take control of the vehicle to prevent a collision but will only warn you of a possible collision threat. Lastly, your vehicle has the standard set of vehicle system indicator lights. If one of these lights such as the check engine or oil warning light appears during the scenario please note the warning and continue driving. Please do not pull over or stop the vehicle if a warning light appears."

Tasks overview (Driving task & Simon task)

"For all drives we ask that you drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in all of the scenarios is 40 mph. In each drive you will follow a lead vehicle that will guide you down the roadway. The lead vehicle will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. Essentially, you will be "pushing" the lead vehicle down the roadway. At the start of each scenario the lead vehicle will appear in front of you and will begin to move shortly after you start accelerating. Once the lead vehicle starts accelerating you can accelerate up to 40 miles per hour and the lead vehicle will maintain the preset distance. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again

While driving you will also be completing a secondary task called the Simon Task. The Simon task is based on a child game called Simon where you will hear a set of directions and must imitate the sequence by entering it using the touch screen. In the Simon Task you will be presented with a sequence of 3 to 5 directions, Up, Left, Down, and Right over the vehicle speakers. After you hear the last direction in the sequence you can begin to mimic the sequence by pressing the corresponding direction buttons on the touch screen in the same order. After you replicate the order of directions press the Done button to submit your answer. Be sure that you hear a click after each button press. A click sound confirms that your button press has been logged. Also, it is important to note that the chime you hear after hitting the Done button does not reflect the correctness of your response. You will be responding to Simon Task prompts each drive. Please be sure to respond quickly while maintaining accuracy and safe driving behavior."

Sound Matching Test

Play sounds and have participant choose appropriate response until they respond with 100% accuracy

Begin video recording

Begin training scenario

Administer Instructions

"There are 4 sections to the training scenario. In the first section you will be performing the Simon Task while in park for 2 minutes. This will give an opportunity to learn the Simon Task. In the second section of the training you will follow the lead vehicle through a city to become familiar with controlling your vehicle. Please keep up with the lead vehicle, stay in the same lane as the lead vehicle, and follow it at each turn unless we tell you otherwise. The third section of the training will give you an opportunity to practice the Simon Task while driving. Lastly, the fourth section of the drive will be additional driving while performing the Simon Task with other ambient sounds included."

2 minutes of Simon task practice in park

Familiarization with simulator control – drive through city using navigation

Multitasking – simon task while driving rural highway

Extended multitasking – Simon task while driving with ambient sounds

Administer post-training SSQ

## Experimental Drives

### Drive 1

Administer pre-drive instructions:

"Today you are driving the [FORD or TOYOTA]. We will now begin the experimental drives. You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation

Save simulator data

Administer post-drive 1 SSQ

Participant receives up to a 5 minute break

### Drive 2

Administer pre-drive instructions:

"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around

45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 2 SSQ
Participant receives up to a 5 minute break

### Drive 3

Administer pre-drive instructions:
"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 3 SSQ
Confirm schedule with participant
Compensate participant $10 and retain receipt
Dismiss participant
Save video data

## Session 2

### Welcome

Participant arrives
Answer any questions participant has
Reintroduce participant to simulator and vehicle features (do not play sounds again)
Review any task instructions or procedures if needed

## Experimental Drives

### Drive 1

Administer pre-drive instructions:
"Today you will be driving the [FORD or TOYOTA] vehicle. Please note the emblem on the steering wheel along with the markings on the back of your vehicle (the simulator). Your vehicle is equipped with the same in-vehicle technology and safety systems as before. We will now begin the experimental drives for Day 2. These drives will be similar in nature to the drives you have already completed. You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 1 SSQ
Participant receives up to a 5 minute break

### Drive 2

Administer pre-drive instructions:
"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 2 SSQ
Participant receives up to a 5 minute break

Drive 3

Administer pre-drive instructions:
"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 3 SSQ
Confirm schedule with participant
Dismiss participant
Save video data

## Session 3

### Welcome

Participant arrives
Answer any questions participant has
Reintroduce participant to simulator and vehicle features (do not play sounds again)

**IF VEHICLE HAS CHANGED SAY THE FOLLOWING:**

"Today you will be driving a different vehicle. The past two days you have driven the [FORD or TOYOTA] but today you will be driving the [FORD or TOYOTA]. Please note the new emblem on the steering wheel along with the new markings on the back of your vehicle (the simulator). Your new vehicle is similar in many respects to the vehicle you have been driving. It is still equipped with the same in-vehicle technology and safety systems. You will still have the same touch screen interface to complete the Simon Task and silence any incoming phone calls. Also, your car still has a collision warning system and similar system indicator lights in the meter cluster. Lastly, your navigation system will still give you auditory directions and a visual icon. While all of the systems will be similar you may notice slight differences in how the vehicle handles. Steering, braking, and acceleration in your new vehicle today may feel different from the vehicle you have driven the past two days. Also the engine will sound different since the vehicle is of a different make."

Review any task instructions or procedures if needed

**Experimental Drives**

Drive 1

Administer pre-drive instructions:
"Today is the last day of experimentation. The drives today will be similar in nature to the two previous days. You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 1 SSQ
Participant receives up to a 5 minute break

Drive 2

Administer pre-drive instructions:
"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 2 SSQ
Participant receives up to a 5 minute break

Drive 3

Administer pre-drive instructions:
"You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin

driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

Run simulation
Save simulator data
Administer post-drive 3 SSQ
Compensate participant $50 and retain receipt
Save video data

## Transfer Questions

Ask the participant the following questions after they finish the third drive but before the sound comparison test:

What was the purpose of this study?
Was there anything different about your drive today compared to the previous two days? If so, what was different?
Did you notice anything different about your vehicle that you drove today compared to the previous two days? If so, what was different?
Did you notice a difference in the collision warning that you heard during your first 2 drives today compared to the collision warning you heard the previous two days? If so, how did the warnings differ?
Did you change your driving style when traffic approached your vehicle from behind? How did you change your driving style?
Was the Simon task difficult to complete while driving?
Do you have any other comments regarding your driving or experiences over the course of these three days?

## Sound Test and Debriefing (After session 3 only)

### Sound Comparison Test

Administer the sound comparison test. Administer the following instructions:

"You will be presented with a series of tone pairs. For each pair, please rate how similar or dissimilar you find the tones to be by adjusting the slider and then clicking the submit button. The next pair of tones will not be presented until you submit your rating, however please respond relatively quickly; if you have not submitted a rating within 5 seconds, a message will be presented indicating a rating should be made."

### Debriefing

Say the following to the participant before dismissing them:

"At the beginning of the study we told you that the purpose of the study was to investigate safe driving in the midst of various in-vehicle devices. However, this was not the true purpose of the

study. We are actually investigating if prior exposure and learning with one collision warning system interferes with responses to a new, unfamiliar collision warning system. This is a phenomenon known as negative transfer of learning. In the near future collision warning systems will no longer be a luxury available only in high-end vehicles but a common safety feature that is available or standard in all vehicles. Currently, there are design guidelines for collision warning development but the warnings themselves can be quite different between car manufacturers. Thus, it is important to know how responses to collision warning systems can be affected if a driver familiar with one car maker's system hears an unfamiliar collision warning in another vehicle such as a rental car or a friend or family members car. If there is negative transfer of learning then perhaps warnings should be standardized across car manufacturers. We are conducting this study with the support of the National Highway Traffic Safety Administration and if you have any additional questions feel free to contact one of the researchers listed on your informed consent."

## *Appendix A2: Protocol Scripts*

Information in red was read to participants.

**Purpose of the study (administered during training)**

"This study is investigating safe driving in the midst of various in-vehicle devices. We are interested in examining how different in-vehicle devices and systems affect driver safety in different driving situations. We will also be evaluating your performance on the different in-vehicle tasks in these different driving situations. Lastly, we are interested in how safe driving and overall driving performance change when drivers do or do not change vehicles that have similar features."

**Training Presentation Scripts**

**Training Presentation Slides**

1) **Outline of experiment sessions**

"This experiment will be conducted over the course of 3 days separated by no more than 3 days in between. The first and last day will be 1.5 hours long and the second day will only be an hour in length. Each day you will drive 3 experimental drives and complete surveys after each drive. Today is the first session and you will be trained and familiarized with the simulator and tasks that you will be completing throughout the study. After your last drive on the third day you will complete an final auditory test."

2) **Simulator features**

"The George Mason University driving simulator is a motion-base simulator with two different degrees of freedom. First, there is yaw motion. The simulator can move 180 degrees to the left and right to simulate turning. Second, there is pitch motion. Your seat is fixed on a sled that will move 1 degree forward and backward to simulate acceleration and braking.

The simulator was built using the driver compartment from a Ford Focus and operates just like the actual vehicle. All of the gauges, buttons, and displays operate as they do in an actual vehicle. In your instrument cluster you see that you have a speedometer to monitor speed, tachometer to monitor RPM, fuel gauge, and an array of standard system warning lights such as your check engine light, brake warning light, and oil pressure light. The simulator vehicle is automatic so you will need to place the gear selector into drive to move forward.

There are several important safety features related to stopping the simulation or motion base in the event that you feel uncomfortable with the scenario and/or motion or need to stop the simulation due to motion sickness. The first safety feature is your seat belt. The seat belt must be worn at all times when you are seated in the simulator. If the seat belt is not engaged then the motion base system will not work. Thus, the easiest way to stop the simulator is to unbuckle your seat belt. A second safety feature is the emergency stop button located to your left. If you would like to stop the simulator press this button. Lastly, there is an entry gate to the simulator that, if opened, will halt the motion base. You can also open this gate to stop the simulator."

3) **Introduce vehicle and vehicle systems**

"Today you will be driving the [FORD or TOYOTA] vehicle. Please note the emblem on the steering wheel along with the markings on the back of your vehicle (the simulator). Your vehicle is

equipped with several in-vehicle technology and safety systems. First you have a navigation system that will help guide you at intersections during your drives. The navigation system will provide you with an auditory message and a visual turn arrow at intersections. Your vehicle also has hands-free cell phone capability. If you receive a cell phone call during the drive you will hear the ringer over the vehicle speakers. We do not want you to answer the cell phone while driving and ask that if you hear the cell phone ringing that you silence the phone by pressing the Silence Phone button the touchscreen display. Your vehicle is also equipped with a collision warning system. The collision warning system provides an audible alert if a possible forward collision threat is detected. If the alert sounds you should respond appropriately to avoid the collision. It is important to know that the forward collision warning system is passive in that it will not take control of the vehicle to prevent a collision but will only warn you of a possible collision threat. Lastly, your vehicle has the standard set of vehicle system indicator lights. If one of these lights such as the check engine or oil warning light appears during the scenario please note the warning and continue driving. Please do not pull over or stop the vehicle if a warning light appears."

4) **Tasks overview**

***Driving Task Overview***

"For all drives we ask that you drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in all of the scenarios is 40 mph. In each drive you will follow a lead vehicle that will guide you down the roadway. The lead vehicle will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. Essentially, you will be "pushing" the lead vehicle down the roadway. At the start of each scenario the lead vehicle will appear in front of you and will begin to move shortly after you start accelerating. Once the lead vehicle starts accelerating you can accelerate up to 40 miles per hour and the lead vehicle will maintain the preset distance. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again.

***Simon Task***

While driving you will also be completing a secondary task called the Simon Task. The Simon task is based on a child game called Simon where you will hear a set of directions and must imitate the sequence by entering it using the touch screen. In the Simon Task you will be presented with a sequence of 3 to 5 directions, Up, Left, Down, and Right over the vehicle speakers. After you hear the last direction in the sequence you can begin to mimic the sequence by pressing the corresponding direction buttons on the touch screen in the same order. After you replicate the order of directions press the Done button to submit your answer. Be sure that you hear a click after each button press. A click sound confirms that your button press has been logged. Also, it is important to note that the chime you hear after hitting the Done button does not reflect the correctness of your response. You will be responding to Simon Task prompts each drive. Please be sure to respond quickly while maintaining accuracy and safe driving behavior."

**Training Scenario Instructions**

"There are 4 sections to the training scenario. In the first section you will be performing the Simon Task while in park for 2 minutes. This will give an opportunity to learn the Simon Task. In the

second section of the training you will follow the lead vehicle through a city to become familiar with controlling your vehicle. Please keep up with the lead vehicle, stay in the same lane as the lead vehicle, and follow it at each turn unless we tell you otherwise. The third section of the training will give you an opportunity to practice the Simon Task while driving. Lastly, the fourth section of the drive will be additional driving while performing the Simon Task with other ambient sounds included."

**Experimental Drive Instructions (These are administered before each drive and are adjusted to match the appropriate day and drive)**

"Today you are driving the [FORD or TOYOTA]. We will now begin the experimental drives. You will follow a lead vehicle down the roadway while completing the Simon Task. The lead vehicle is will maintain a preset distance from your vehicle and match your speed up to around 45 miles per hour. You will basically be "pushing" the lead vehicle down the roadway. At the start of the scenario the lead vehicle will appear in front of you at which time you can begin driving. Shortly after you accelerate the lead vehicle will begin to speed up and you can accelerate up to 40 miles per hour. Please stay in the same lane as the lead vehicle as best you can. If you do get separated from the lead vehicle you should take the appropriate actions to follow it again. Please drive as you normally would in your own car on the roadway. Please obey all rules of the road, speed limit signs, lane markings, and traffic control devices. The posted speed limit in the scenario is 40 mph. Lastly, please be sure to respond quickly to the Simon Task prompts while maintaining accuracy and safe driving behavior."

**Session 3 Vehicle Change (if change occurs)**

"Today you will be driving a different vehicle. The past two days you have driven the [FORD or TOYOTA] but today you will be driving the [FORD or TOYOTA]. Please note the new emblem on the steering wheel along with the new markings on the back of your vehicle (the simulator). Your new vehicle is similar in many respects to the vehicle you have been driving. It is still equipped with the same in-vehicle technology and safety systems. You will still have the same touch screen interface to complete the Simon Task and silence any incoming phone calls. Also, your car still has a collision warning system and similar system indicator lights in the meter cluster. Lastly, your navigation system will still give you auditory directions and a visual turn icon. While all of the systems will be similar you may notice slight differences in how the vehicle handles compared to your previous vehicle. Steering, braking, and acceleration in your new vehicle today may feel different from the vehicle you have driven the past two days. Also the engine will sound different since the vehicle is of a different make."

**Transfer questions administered after last drive**

1) What was the purpose of this study?
2) Was there anything different about the driving scenario today compared to the previous two days? If so, what was different?
3) Did you notice anything different about your vehicle (e.g., handling) that you drove today compared to the previous two days? If so, what was different?

4) Did you notice a difference in the collision warning that you heard during your first 2 drives today compared to the collision warning you heard the previous two days? If so, how did the warnings differ?
5) Did you change your driving style when traffic approached your vehicle from behind? How did you change your driving style?
6) Was the Simon task difficult to complete while driving?
7) Do you have any other comments regarding your driving or experiences over the course of these three days?

**Sound Comparison Test Instructions**

"You will be presented with a series of tone pairs. For each pair, please rate how similar or dissimilar you find the tones to be by adjusting the slider and then clicking the submit button. The next pair of tones will not be presented until you submit your rating, however please respond relatively quickly; if you have not submitted a rating within 5 seconds, a message will be presented indicating a rating should be made."

**Debriefing Statement**

"At the beginning of the study we told you that the purpose of the study was to investigate safe driving in the midst of various in-vehicle devices. However, this was not the true purpose of the study. We are actually investigating if prior exposure and learning with one collision warning system interferes with responses to a new, unfamiliar collision warning system. This is a phenomenon known as negative transfer of learning. In the near future collision warning systems will no longer be a luxury available only in high-end vehicles but a common safety feature that is available or standard in all vehicles. Currently, there are design guidelines for collision warning development but the warnings themselves can be quite different between car manufacturers. Thus, it is important to know how responses to collision warning systems can be affected if a driver familiar with one car maker's system hears an unfamiliar collision warning in another vehicle such as a rental car or a friend or family members car. If there is negative transfer of learning then perhaps warnings should be standardized across car manufacturers. We are conducting this study with the support of the National Highway Traffic Safety Administration and if you have any additional questions feel free to contact one of the researchers listed on your informed consent."

## *Appendix A3: List of Sound Comparisons Made*

**Warning sound parameters compared for each of the warning sounds:**

| | Heavy Warning | Light Warning | Heavy 100 ms burst | Heavy, F0 1000Hz | Heavy, F0 1500Hz | Heavy, 8bit, 5000Hz | Light, 150ms burst | Light, 300ms burst |
|---|---|---|---|---|---|---|---|---|
| **Heavy Warning** | | | | | | | | |
| **Light Warning** | 2 | | | | | | | |
| **Heavy 100ms burst** | 1 | 1 | | | | | | |
| **Heavy, F0 1000 Hz** | 1 | 1 | 1 | | | | | |
| **Heavy, F0 1500 Hz** | 1 | 1 | 1 | 1 | | | | |
| **Heavy, 8bit, 5000Hz** | 2 | 1 | 1 | 1 | 1 | | | |
| **Light,150ms burst** | 1 | 1 | 1 | 1 | 1 | 1 | | |
| **Light,300ms burst** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Light, 8 bit, 5000 Hz** | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |

*Note that cells with 2 comparisons were used for reliability testing*

**Sound comparisons between warning sounds used and other environmental sounds:**

| | Heavy Warning | Light Warning |
|---|---|---|
| **Siren** | 1 | 1 |
| **Car Horn** | 1 | 1 |
| **Oil Warning** | 2 | 2 |
| **Phone Ring** | 2 | 2 |

## *Appendix A4: Frequency of Events*

A breakdown of the frequency of event type by time exposure as a function of the day of drive (Day 1, 2, or 3) is illustrated below.

**FIRST EXPOSURE**

| Event Type | Day 1 | Day 2 | Day 3 |
|---|---|---|---|
| Lead vehicle | 39 | 0 | 0 |
| Manual lead vehicle | 12 | 0 | 0 |
| Cut in | 0 | 0 | 0 |
| Workzone | 8 | 0 | 0 |
| Reveal | 0 | 0 | 0 |
| **Total** | **59** | **0** | **0** |

**PRE-SWITCH EXPOSURE**

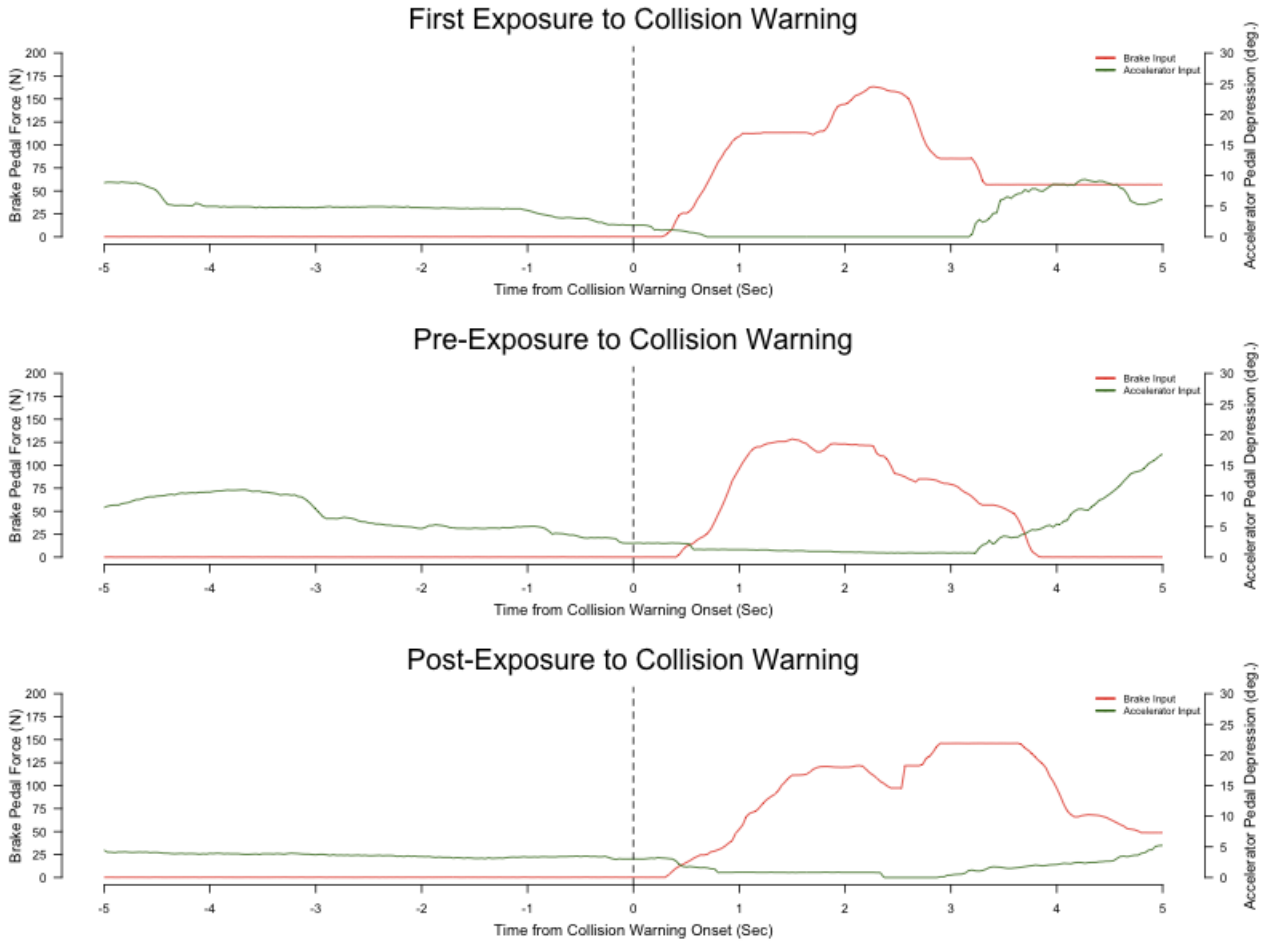
| Event Type | Day 1 | Day 2 | Day 3 |
|---|---|---|---|
| Lead vehicle | 0 | 28 | 0 |
| Manual lead vehicle | 1 | 14 | 0 |
| Cut in | 0 | 5 | 0 |
| Workzone | 0 | 0 | 0 |
| Reveal | 1 | 11 | 0 |
| **Total** | **2** | **58** | **0** |

**POST-SWITCH EXPOSURE**

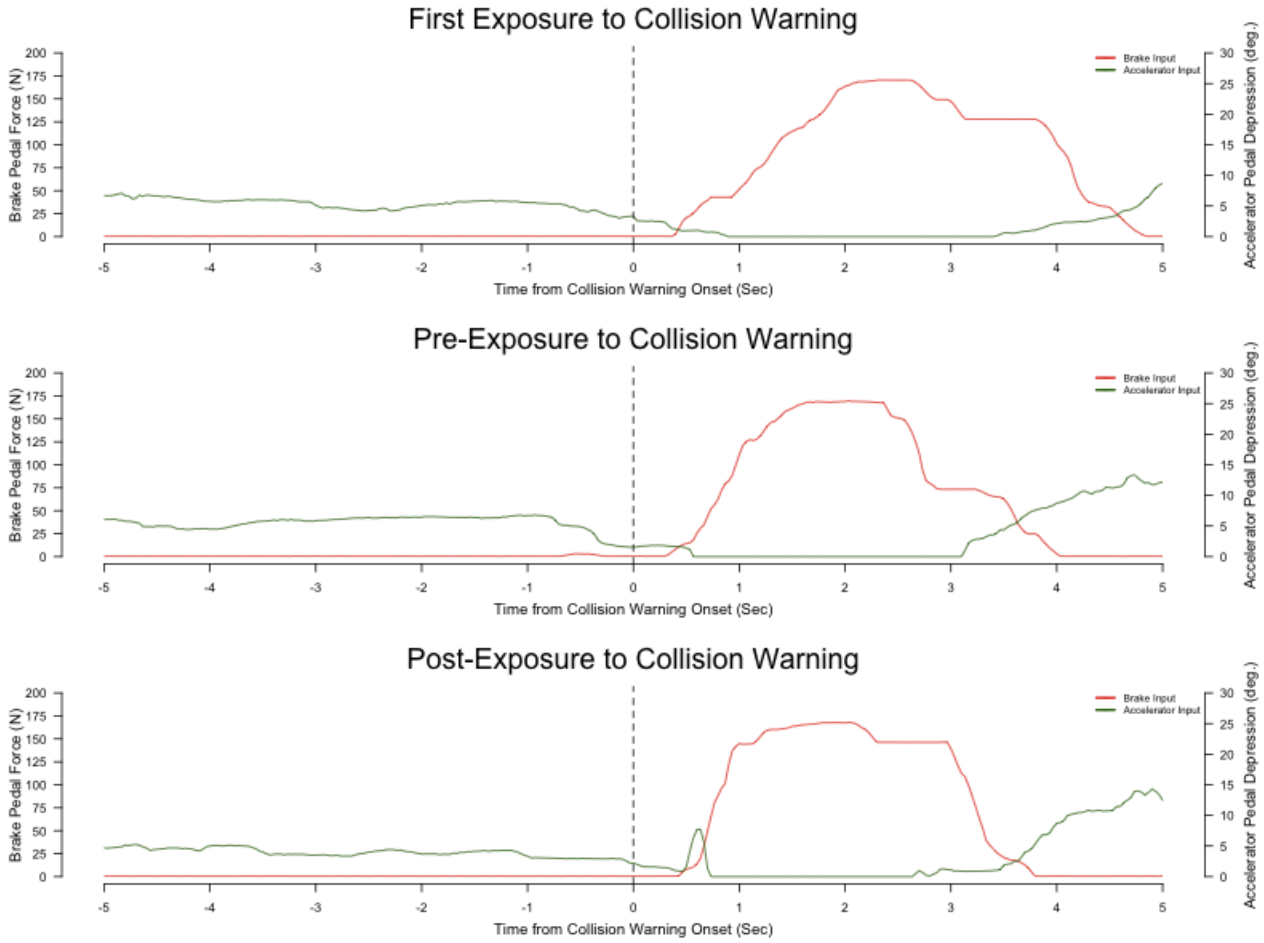
| Event Type | Day 1 | Day 2 | Day 3 |
|---|---|---|---|
| Lead vehicle | 0 | 0 | 28 |
| Manual lead vehicle | 0 | 0 | 16 |
| Cut in | 0 | 0 | 12 |
| Workzone | 0 | 0 | 3 |
| Reveal | 0 | 0 | 0 |
| **Total** | **0** | **0** | **59** |

## *Appendix A5: Speed Profiles Reflecting Brake Response and Accelerator Input at Each Time Exposure as a Function of Warning Condition Group*

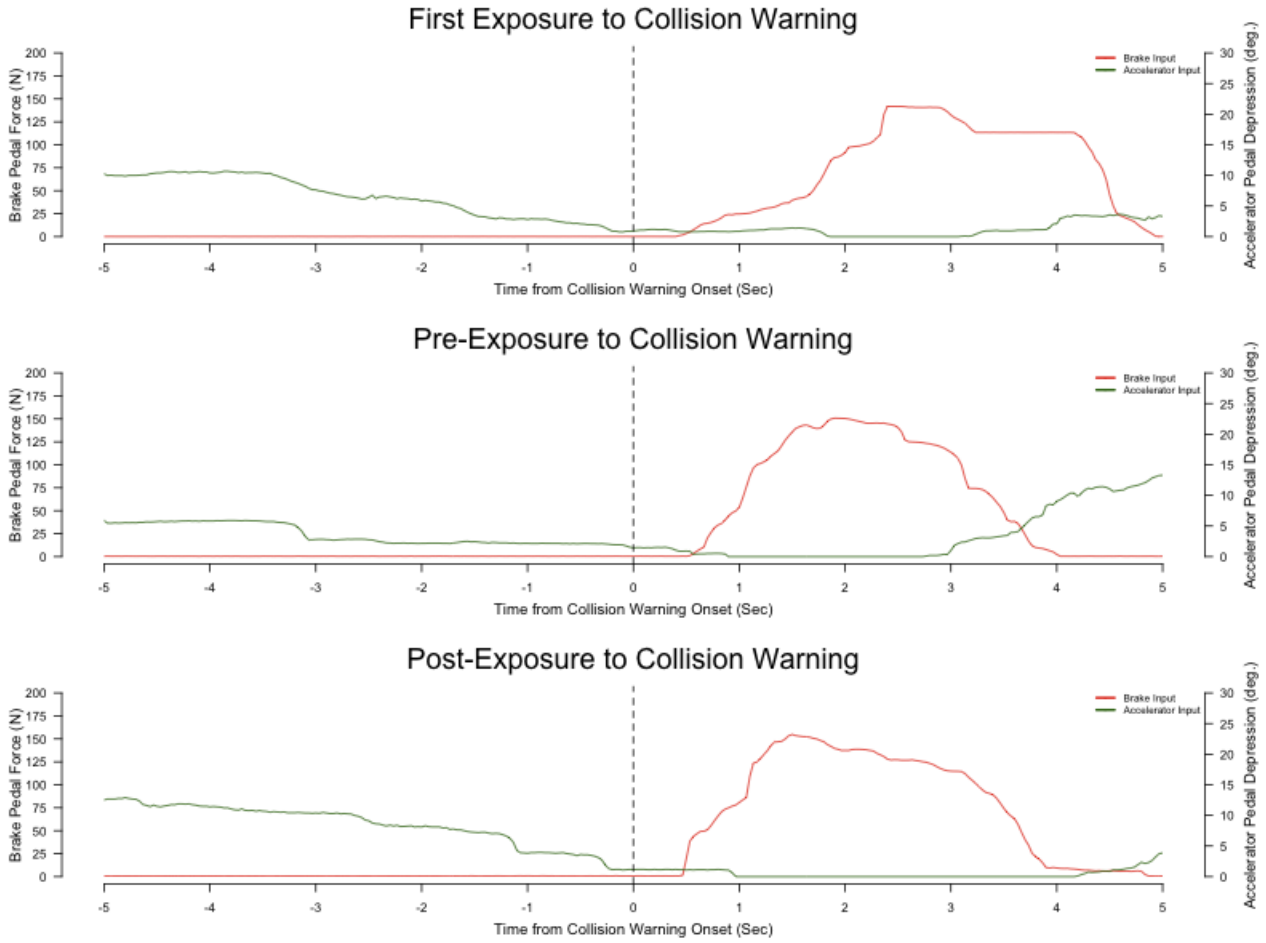
**Condition A. Experimental switch condition (Heavy to Light warning sound):**



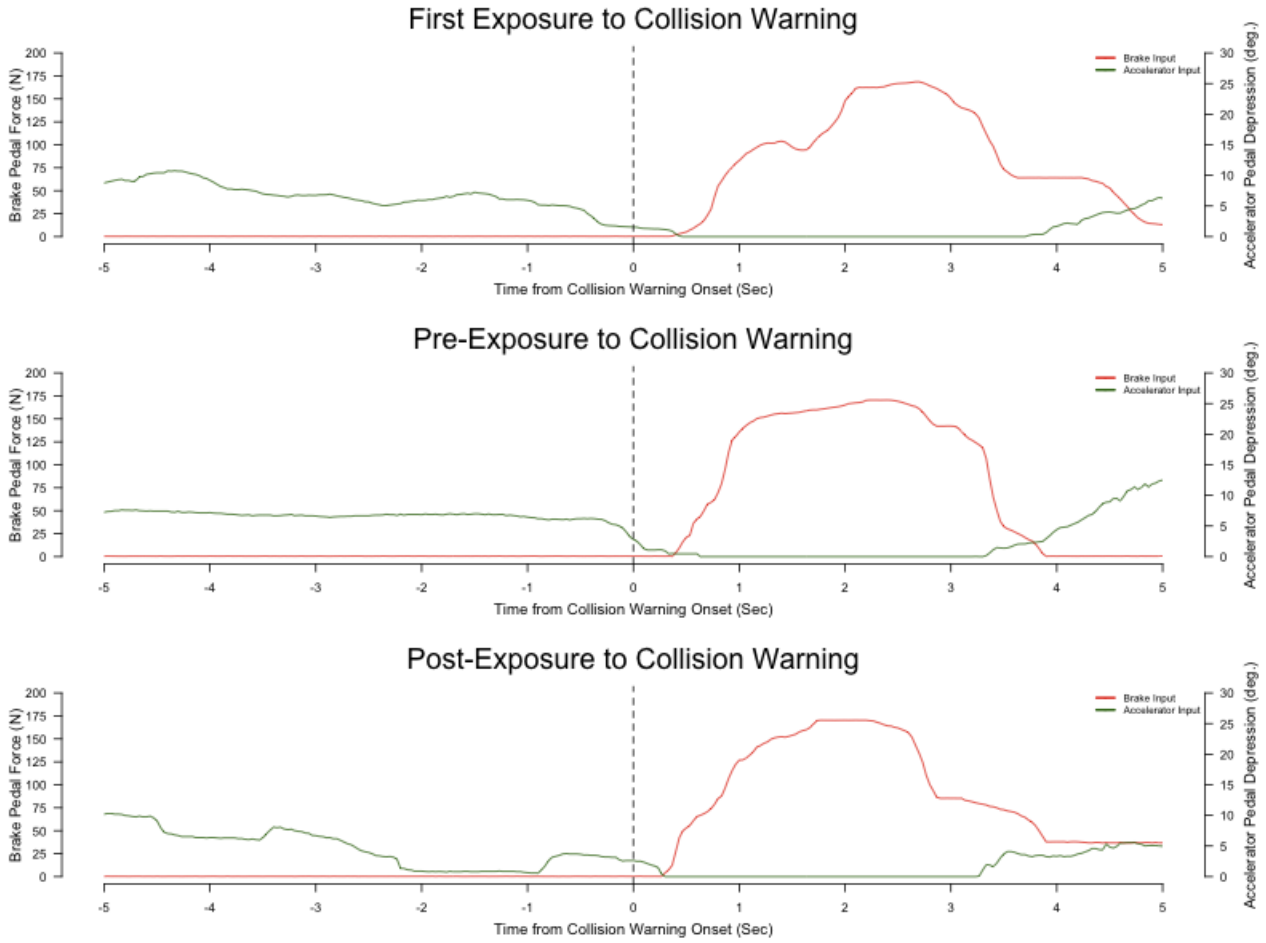
**Condition B. Experimental Switch Condition (Light to Heavy warning sound):**



**Condition C. Baseline – Control (No Switch – Heavy warning sound all drives):**



**Condition D. Baseline – Control (No-Switch – Light warning sound all drives):**



## *Appendix A6: Sound Comparison Reliability Analysis*

For the subset of comparisons given twice, Spearman rank correlations between comparisons are used to assess test-retest reliability. Prior to computing the correlations, 15 subjects were removed from the analysis because the magnitude of difference between at least one variable's test and retest score exceeded 3.5. The resulting means, medians, and Spearman rank correlations for the remaining 45 participants are presented below.

For each subject, the two instances of the test-retest comparisons were then averaged to form a single similarity rating for the pair.

| **Sound Pair** | **Mean 1** | **Mean 2** | **Median 1** | **Median 2** | ***ρ*** |
|---|---|---|---|---|---|
| Heavy X Light | 2.4787 | 2.2180 | 2.5200 | 2.3300 | 0.6823 |
| Heavy X Phone | 1.6051 | 1.5753 | 1.0000 | 1.4600 | 0.6707 |
| Light X Phone | 2.1982 | 2.2002 | 1.7100 | 1.7300 | 0.7819 |
| Heavy X Oil Warning | 2.0482 | 1.9573 | 2.1000 | 1.6000 | 0.5912 |
| Light X Oil Warning | 1.8169 | 1.8638 | 1.4800 | 1.5800 | 0.5721 |
| Heavy X Compressed Heavy | 5.7369 | 5.9889 | 6.3800 | 6.5600 | 0.7786 |
| Light X Compressed Light | 5.4336 | 5.5127 | 5.8200 | 6.0000 | 0.5655 |

# Appendix B: ACWS Status Display Comprehension Experiment

## *Appendix B1: Full Set of Vehicle Interior Photographs*

Buick Pre

Buick Startup 1

Buick Startup 2

Buick Startup 3

Buick En-Route 1

Buick En Route 2

Buick En Route 3

Infiniti Pre

Infiniti Startup 1

Infiniti Startup 2

Infiniti Startup 3

Infiniti En Route 1

Infiniti En Route 2

Infiniti En Route 3

Volvo Pre

Volvo Startup 1

Volvo Startup 2

Volvo Startup 3

Volvo En Route 1

Volvo En Route 2

Volvo En Route 3

## *Appendix B2: Glossary of Study Terms for Participants*

**Display Study Definitions**

- A collision ahead alert system warns the driver when following another vehicle too closely.

- An enhanced biofeedback reinforcer issues gentle electrical shocks to the driver in response to improper vehicle maneuvers or seatbelt nonuse.

- A front windshield defogger removes condensation from the inside of the front windshield.

- Hazard warning flashers cause the left and right turn signals to flash on and off simultaneously.

- A hidden sight alert system warns the driver when switching lanes while another vehicle is in the blind spot.

- A passenger airbag deploys an airbag cushion for the passenger in a frontal crash.

- A rollover prevention system lowers the vehicle chassis when an abrupt driving maneuver occurs to prevent a rollover.

- A smart brake system automatically activates and boosts braking when a crash is about to happen to reduce the impact.

- A smart cruise control system allows the vehicle to automatically adjust its speed to match the speed of the vehicle ahead.

- A stability control system automatically adjusts power to each wheel to help the driver steer in unstable or slippery road conditions.

- A stay in lane alert system warns the driver if the vehicle starts to drift out of its lane (for example, if the driver is drowsy or distracted).

## *Appendix B3: Experiment Questions*

*The following text shows the questions that participants answered during the experiment. The questions were the same for all participants, though the order of presentation was counterbalanced across participants. The text indicates which vehicle interior picture was used for each scenario. See Appendix B1 to view each photo. Bold text was shown to participants on the instruction screen at the beginning of each scenario. Correct answer are shown in parentheses after each question.*

Example 1 (PICTURE: RAV4 example.jpeg) ENTER CODE 1001

**Pretend that you have just started the vehicle. This is an example so feel free to ask questions.**

1) An alcohol detection device monitors the alcohol level of the driver through physiological responses and provides an alert if the alcohol level is above the specified limit. P/N/ and 1-10 confidence
    a. Where did you look for this information? Select zone.

Example 2 (PICTURE: RAV4 example.jpeg) ENTER CODE 1002

**Pretend that you have just started the vehicle. This is another example. Please proceed as you would during the real task and save questions until after the question is complete.**

1) A front windshield defogger removes condensation from the inside of the front windshield. P/N and 1-10 confidence
    a. Where did you look for this information? Select zone.

Pre-ignition Stage Questions (PICTURE: InfinitiPRE.jpg) ENTER CODE 2000

**You have just entered the vehicle and have not turned it on yet**. **Please answer the following questions and rate your confidence in your answer from 1-10 (1 = no confidence at all and 10 = complete confidence)**. **Remember that some features are present in this vehicle and some are not**.

1) A passenger airbag deploys an airbag cushion for the passenger in a frontal crash. P/NP and 1-10 confidence (1—Present)
    a. Where did you look for this information? Select zone.
2) An enhanced biofeedback reinforcer gives gentle electrical shocks to the driver in response to improper vehicle maneuvers or seatbelt nonuse. P/NP and 1-10 confidence (2—Not Present)
    a. Where did you look for this information? Select zone.
3) A collision ahead alert system warns the driver when following another vehicle too closely. P/NP and 1-10 confidence (3—Present)
    a. Where did you look for this information? Select zone.

4) A rollover prevention system lowers the vehicle chassis when an abrupt driving maneuver occurs to prevent a rollover. P/NP and 1-10 confidence (4—Not Present)
    a. Where did you look for this information? Select zone.
5) A smart cruise control system allows the vehicle to automatically adjust its speed to match the speed of the vehicle ahead. P/NP and 1-10 confidence. (5—Present)
    a. Where did you look for this information? Select zone.
6) A stay in lane alert system warns the driver if the vehicle starts to drift out of its lane unintentionally. P/NP and 1-10 confidence (6—Present)
    a. Where did you look for this information? Select zone.
7) A stability control system automatically adjusts power to each wheel to help the driver steer in unstable or slippery road conditions. P/N and 1-10 confidence (7—Present)
    a. Where did you look for this information? Select zone.
8) A smart brake system automatically activates and boosts braking when a crash is about to happen to reduce the impact. P/N and 1-10 confidence (8—Present)
    a. Where did you look for this information? Select zone.
9) A hidden sight alert system warns the driver when switching lanes while another vehicle is in the blind spot. P/N and 1-10 confidence (9—Not Present)
    a. Where did you look for this information? Select zone.
10) Hazard warning flashers cause the left and right turn signals to flash on and off simultaneously. P/N and 1-10 confidence (10—Present—note that it's not that clear on the dash)
    a. Where did you look for this information? Select zone.

<u>Start-up Stage Questions</u>

**For this set of questions you have just started the vehicle. The vehicle is still in Park and you have not started driving yet.**

<u>Scenario 1 (Lane Departure Warning and Forward Collision Warning not active at startup) (PICTURE: InfinitiSTART1.jpg)</u>. ENTER CODE 3000 **Pretend that you have just started the vehicle**.

1) Are any functions or features not working properly? Y/N and Confidence (1-10). NOTE: This question is to see what malfunction alerts first jump out at them. (11—YES—Note incorrect question about things turned off also—LDW/FCW are)
    a. Where was the first place you noticed this information? Select zone.
2) Is the passenger airbag enabled and working properly? Y/N//NA and Confidence (1-10).
    a. Where do you look for this information? Select zone. (12—YES)
3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (13—NO)
    a. Where do you look for this information? Select zone.
4) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (14—NO)

a. Where do you look for this information? Select zone.

5) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (15—No—could possibly be N/A or DK also—not activated in Park)
    a. Where do you look for this information? Select zone.
6) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10) (16—N/A)
    a. Where do you look for this information? Select zone.

Scenario 2 (Lane Departure Warning and Forward Collision Warning activated at startup) (PICTURE InfinitiSTART2.jpg). ENTER CODE 4000 **Pretend that you have just started the vehicle**.

1) Are any functions or features not working properly? Y/N and Confidence (1-10). NOTE: This question is to see what malfunction alerts first jump out at them. (17—No)
    a. Where was the first place you noticed this information? Select zone.
2) Is the passenger airbag enabled and working properly? Y/N//NA and Confidence (1-10). (18—YES)
    a. Where do you look for this information? Select zone.
3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (19—YES)
    a. Where do you look for this information? Select zone.
4) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (20—YES)
    a. Where do you look for this information? Select zone.
5) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (21—No—see note above)
    a. Where do you look for this information? Select zone.
6) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10) (22—N/A)
    a. Where do you look for this information? Select zone.

Scenario 3 (Lane Departure Warning and Forward Collision Warning active but not functioning properly at startup). (PICTURE: InfinitSTART3.jpg) ENTER CODE 5000 **Pretend that you have just started the vehicle**.

1) Are any functions or features not working properly? Y/N and Confidence (1-10). NOTE: This question is to see what malfunction alerts first jump out at them. (23—NO)
    a. Where was the first place you noticed this information? Select zone.
2) Is the passenger airbag enabled and working properly? Y/N//NA and Confidence (1-10). (24—YES)
    a. Where do you look for this information? Select zone.
3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (25—YES)

a. Where do you look for this information? Select zone.

4) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (26—NO)
    a. Where do you look for this information? Select zone.
5) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (27—NO—see note above)
    a. Where do you look for this information? Select zone.
6) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10) (28—N/A)
    a. Where do you look for this information? Select zone.

<u>En Route Stage Questions</u>

**You are now driving the vehicle on the road. Please think about these systems as they would be when the vehicle is moving**.

<u>Scenario 1 (Lane Departure Warning will not be operational, Forward Collision Warning will be—this question can get at individuals who understand the differences, but treat them as one system; ACC operational)</u>. (PICTURE: InfinitENROUTE1.jpg) ENTER CODE 6000 **Pretend that you are driving on the road**.

1) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (29—YES)
    a. Where do you look for this information? Select zone.
2) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (30—YES)
    a. Where do you look for this information? Select zone.
3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (31—YES)
    a. Where do you look for this information? Select zone.
4) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10). (32—N/A)
    a. Where do you look for this information? Select zone.

<u>Scenario 2 (Lane Departure Warning and Forward Collision Warning functioning properly and Adaptive Cruise Control not functioning properly)</u>. ENTER CODE 7000 (PICTURE: InfinitENROUTE2.jpg) **Pretend that you are driving on the road**.

1) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (33—YES)
    a. Where do you look for this information? Select zone.
2) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (34—NO)
    a. Where do you look for this information? Select zone.

3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (35—YES)
    a. Where do you look for this information? Select zone.
4) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10). (36—N/A)
    a. Where do you look for this information? Select zone.

Scenario 3 (Lane Departure Warning and Adaptive Cruise Control operational and functioning, Forward Collision Warning not functioning properly—through IBA OFF alert). ENTER CODE 8000 (PICTURE: InfinitiENROUTE3.jpg) **Pretend that you are driving on the road**.

1) Is the stay in lane alert system enabled and working properly? Y/N//NA and Confidence (1-10). (37—YES)
    a. Where do you look for this information? Select zone.
2) Is the smart cruise control system enabled and working properly? Y/N//NA and Confidence (1-10). (38—YES)
    a. Where do you look for this information? Select zone.
3) Is the collision ahead alert system enabled and working properly? Y/N//NA and Confidence (1-10). (39—NO)
    a. Where do you look for this information? Select zone.
4) Is the hidden sight alert system enabled and working properly? Y/N//NA and Confidence (1-10). (40—N/A)
    a. Where do you look for this information? Select zone.

## *Appendix B4: Statistical Analyses: Detailed Output*

This appendix presents the procedures used and output from statistical analyses conducted using SAS for the key ACWS systems addressed in the research.

### Appendix B4.1: Accuracy – All Key Systems

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | Correct |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 28 | 3 5 6 9 13 14 15 16 19 20 21 22 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 56 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 2856 |
| Number of Observations Used | 2856 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 3774.33971959 | |
| 1 | 2 | 3730.64958177 | 0.00000013 |
| 2 | 1 | 3730.64948306 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 0.009706 |
| Residual | | 0.2048 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 3730.6 |
| AIC (smaller is better) | 3734.6 |
| AICC (smaller is better) | 3734.7 |
| BIC (smaller is better) | 3739.9 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 43.69 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Phase | 2 | 2746 | 30.09 | <.0001 |
| Vehicle | 2 | 116 | 51.18 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **manual** | 2 | 117 | 7.50 | 0.0009 |
| **Vehicle*Phase** | 4 | 2746 | 8.84 | <.0001 |
| **Phase*manual** | 4 | 2746 | 0.32 | 0.8629 |
| **Vehicle*manual** | 4 | 92.7 | 0.41 | 0.8031 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 0.5717 | 0.02502 | 953 | 22.85 | <.0001 |
| **Phase** | | **2** | | 0.3674 | 0.01663 | 224 | 22.09 | <.0001 |
| **Phase** | | **3** | | 0.4300 | 0.01663 | 224 | 25.86 | <.0001 |
| **Vehicle** | **Buick** | | | 0.3155 | 0.02410 | 118 | 13.09 | <.0001 |
| **Vehicle** | **Infiniti** | | | 0.4089 | 0.02562 | 114 | 15.96 | <.0001 |
| **Vehicle** | **Volvo** | | | 0.6448 | 0.02341 | 118 | 27.54 | <.0001 |
| **manual** | | | **1** | 0.5366 | 0.02631 | 119 | 20.39 | <.0001 |
| **manual** | | | **2** | 0.4246 | 0.02096 | 119 | 20.26 | <.0001 |
| **manual** | | | **3** | 0.4079 | 0.02566 | 115 | 15.90 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 0.4045 | 0.04241 | 933 | 9.54 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 0.2479 | 0.02832 | 222 | 8.75 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 0.2939 | 0.02832 | 222 | 10.38 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 0.6169 | 0.04492 | 902 | 13.73 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 0.2209 | 0.03007 | 215 | 7.35 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 0.3889 | 0.03007 | 215 | 12.93 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 0.6938 | 0.04146 | 955 | 16.73 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **2** | | 0.6332 | 0.02759 | 226 | 22.96 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **3** | | 0.6072 | 0.02759 | 226 | 22.01 | <.0001 |
| **Phase*manual** | | **1** | **1** | 0.6553 | 0.04676 | 966 | 14.01 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Phase*manual | | 1 | 2 | 0.5506 | 0.03729 | 970 | 14.77 | <.0001 |
| Phase*manual | | 1 | 3 | 0.5092 | 0.04530 | 925 | 11.24 | <.0001 |
| Phase*manual | | 2 | 1 | 0.4571 | 0.03105 | 227 | 14.72 | <.0001 |
| Phase*manual | | 2 | 2 | 0.3306 | 0.02474 | 228 | 13.36 | <.0001 |
| Phase*manual | | 2 | 3 | 0.3144 | 0.03020 | 218 | 10.41 | <.0001 |
| Phase*manual | | 3 | 1 | 0.4974 | 0.03105 | 227 | 16.02 | <.0001 |
| Phase*manual | | 3 | 2 | 0.3926 | 0.02474 | 228 | 15.87 | <.0001 |
| Phase*manual | | 3 | 3 | 0.4001 | 0.03020 | 218 | 13.25 | <.0001 |
| Vehicle*manual | Buick | | 1 | 0.4014 | 0.04265 | 107 | 9.41 | <.0001 |
| Vehicle*manual | Buick | | 2 | 0.3053 | 0.03393 | 110 | 9.00 | <.0001 |
| Vehicle*manual | Buick | | 3 | 0.2397 | 0.04483 | 106 | 5.35 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 0.4934 | 0.04750 | 105 | 10.39 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 0.3729 | 0.03753 | 108 | 9.94 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 0.3604 | 0.04419 | 98.3 | 8.16 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 0.7150 | 0.04264 | 107 | 16.77 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 0.5956 | 0.03499 | 109 | 17.02 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 0.6236 | 0.04071 | 107 | 15.32 | <.0001 |

## Appendix B4.2: Accuracy – LDW

The Mixed Procedure

| Model Information | |
|---|---|
| Data Set | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| Dependent Variable | Correct |
| Covariance Structure | Compound Symmetry |
| Subject Effect | Part |
| Estimation Method | REML |

| Model Information | |
|---|---|
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 6 14 20 26 29 33 37 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| **Number of Observations Read** | 714 |
| **Number of Observations Used** | 714 |
| **Number of Observations Not Used** | 0 |

| Iteration History | | | |
|---|---|---|---|
| **Iteration** | **Evaluations** | **-2 Res Log Like** | **Criterion** |
| **0** | 1 | 915.51637412 | |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 1 | 2 | 890.26457824 | 0.00000001 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 0.02595 |
| Residual | | 0.1724 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 890.3 |
| AIC (smaller is better) | 894.3 |
| AICC (smaller is better) | 894.3 |
| BIC (smaller is better) | 899.5 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 25.25 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Phase | 2 | 603 | 16.92 | <.0001 |
| Vehicle | 2 | 119 | 12.07 | <.0001 |
| manual | 2 | 120 | 5.26 | 0.0065 |
| Vehicle*Phase | 4 | 603 | 9.63 | <.0001 |
| Phase*manual | 4 | 603 | 0.37 | 0.8303 |
| Vehicle*manual | 4 | 92.1 | 0.43 | 0.7841 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Phase | | 1 | | 0.7114 | 0.04513 | 611 | 15.76 | <.0001 |
| Phase | | 2 | | 0.5344 | 0.02934 | 233 | 18.21 | <.0001 |
| Phase | | 3 | | 0.7239 | 0.02934 | 233 | 24.67 | <.0001 |
| Vehicle | Buick | | | 0.6394 | 0.04184 | 120 | 15.28 | <.0001 |
| Vehicle | Infiniti | | | 0.5191 | 0.04445 | 116 | 11.68 | <.0001 |
| Vehicle | Volvo | | | 0.8113 | 0.04065 | 121 | 19.96 | <.0001 |
| manual | | | 1 | 0.7700 | 0.04569 | 121 | 16.85 | <.0001 |
| manual | | | 2 | 0.5876 | 0.03639 | 121 | 16.15 | <.0001 |
| manual | | | 3 | 0.6122 | 0.04451 | 117 | 13.75 | <.0001 |
| Vehicle*Phase | Buick | 1 | | 0.7245 | 0.07649 | 607 | 9.47 | <.0001 |
| Vehicle*Phase | Buick | 2 | | 0.4970 | 0.04996 | 231 | 9.95 | <.0001 |
| Vehicle*Phase | Buick | 3 | | 0.6965 | 0.04996 | 231 | 13.94 | <.0001 |
| Vehicle*Phase | Infiniti | 1 | | 0.5913 | 0.08098 | 599 | 7.30 | <.0001 |
| Vehicle*Phase | Infiniti | 2 | | 0.2646 | 0.05300 | 223 | 4.99 | <.0001 |
| Vehicle*Phase | Infiniti | 3 | | 0.7014 | 0.05300 | 223 | 13.24 | <.0001 |
| Vehicle*Phase | Volvo | 1 | | 0.8185 | 0.07480 | 612 | 10.94 | <.0001 |
| Vehicle*Phase | Volvo | 2 | | 0.8415 | 0.04867 | 234 | 17.29 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 0.7738 | 0.04867 | 234 | 15.90 | <.0001 |
| Phase*manual | | 1 | 1 | 0.8149 | 0.08437 | 614 | 9.66 | <.0001 |
| Phase*manual | | 1 | 2 | 0.6306 | 0.06728 | 615 | 9.37 | <.0001 |
| Phase*manual | | 1 | 3 | 0.6889 | 0.08168 | 605 | 8.43 | <.0001 |
| Phase*manual | | 2 | 1 | 0.6375 | 0.05479 | 236 | 11.64 | <.0001 |
| Phase*manual | | 2 | 2 | 0.4962 | 0.04366 | 237 | 11.36 | <.0001 |
| Phase*manual | | 2 | 3 | 0.4694 | 0.05324 | 227 | 8.82 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Phase*manual | | 3 | 1 | 0.8575 | 0.05479 | 236 | 15.65 | <.0001 |
| Phase*manual | | 3 | 2 | 0.6360 | 0.04366 | 237 | 14.56 | <.0001 |
| Phase*manual | | 3 | 3 | 0.6783 | 0.05324 | 227 | 12.74 | <.0001 |
| Vehicle*manual | Buick | | 1 | 0.7643 | 0.07382 | 108 | 10.35 | <.0001 |
| Vehicle*manual | Buick | | 2 | 0.5835 | 0.05878 | 111 | 9.93 | <.0001 |
| Vehicle*manual | Buick | | 3 | 0.5703 | 0.07758 | 107 | 7.35 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 0.6606 | 0.08219 | 106 | 8.04 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 0.4568 | 0.06499 | 110 | 7.03 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 0.4398 | 0.07628 | 97.9 | 5.77 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 0.8849 | 0.07381 | 108 | 11.99 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 0.7225 | 0.06061 | 110 | 11.92 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 0.8265 | 0.07048 | 109 | 11.73 | <.0001 |

## Appendix B4.3: Accuracy – FCW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | Correct |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 3 13 19 25 31 35 39 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 714 |
| Number of Observations Used | 714 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 699.17250593 | |
| 1 | 2 | 641.64324766 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 0.03080 |
| Residual | | 0.1153 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 641.6 |
| AIC (smaller is better) | 645.6 |
| AICC (smaller is better) | 645.7 |
| BIC (smaller is better) | 650.9 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 57.53 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 603 | 17.80 | <.0001 |
| **Vehicle** | 2 | 111 | 63.01 | <.0001 |
| **manual** | 2 | 111 | 3.08 | 0.0501 |
| **Vehicle*Phase** | 4 | 603 | 7.70 | <.0001 |
| **Phase*manual** | 4 | 603 | 1.25 | 0.2890 |
| **Vehicle*manual** | 4 | 91.8 | 2.07 | 0.0909 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 0.5678 | 0.03877 | 522 | 14.65 | <.0001 |
| **Phase** | | **2** | | 0.3380 | 0.02676 | 189 | 12.63 | <.0001 |
| **Phase** | | **3** | | 0.3581 | 0.02676 | 189 | 13.38 | <.0001 |
| **Vehicle** | **Buick** | | | 0.1305 | 0.03974 | 111 | 3.28 | 0.0014 |
| **Vehicle** | **Infiniti** | | | 0.3852 | 0.04231 | 109 | 9.10 | <.0001 |
| **Vehicle** | **Volvo** | | | 0.7482 | 0.03860 | 112 | 19.38 | <.0001 |
| **manual** | | | **1** | 0.5060 | 0.04338 | 112 | 11.67 | <.0001 |
| **manual** | | | **2** | 0.3855 | 0.03455 | 112 | 11.16 | <.0001 |
| **manual** | | | **3** | 0.3723 | 0.04236 | 110 | 8.79 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 0.2795 | 0.06574 | 516 | 4.25 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 0.05190 | 0.04559 | 187 | 1.14 | 0.2564 |
| **Vehicle*Phase** | **Buick** | **3** | | 0.06002 | 0.04559 | 187 | 1.32 | 0.1896 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 0.6939 | 0.06968 | 507 | 9.96 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 0.2023 | 0.04845 | 183 | 4.18 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 0.2592 | 0.04845 | 183 | 5.35 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 0.7299 | 0.06424 | 522 | 11.36 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 0.7596 | 0.04438 | 190 | 17.12 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 0.7550 | 0.04438 | 190 | 17.01 | <.0001 |
| Phase*manual | | 1 | 1 | 0.6605 | 0.07243 | 526 | 9.12 | <.0001 |
| Phase*manual | | 1 | 2 | 0.5317 | 0.05776 | 527 | 9.21 | <.0001 |
| Phase*manual | | 1 | 3 | 0.5112 | 0.07022 | 514 | 7.28 | <.0001 |
| Phase*manual | | 2 | 1 | 0.4632 | 0.04994 | 191 | 9.28 | <.0001 |
| Phase*manual | | 2 | 2 | 0.2925 | 0.03979 | 191 | 7.35 | <.0001 |
| Phase*manual | | 2 | 3 | 0.2582 | 0.04863 | 185 | 5.31 | <.0001 |
| Phase*manual | | 3 | 1 | 0.3944 | 0.04994 | 191 | 7.90 | <.0001 |
| Phase*manual | | 3 | 2 | 0.3323 | 0.03979 | 191 | 8.35 | <.0001 |
| Phase*manual | | 3 | 3 | 0.3475 | 0.04863 | 185 | 7.15 | <.0001 |
| Vehicle*manual | Buick | | 1 | 0.1448 | 0.07064 | 103 | 2.05 | 0.0428 |
| Vehicle*manual | Buick | | 2 | 0.1586 | 0.05614 | 105 | 2.82 | 0.0057 |
| Vehicle*manual | Buick | | 3 | 0.08803 | 0.07429 | 102 | 1.18 | 0.2388 |
| Vehicle*manual | Infiniti | | 1 | 0.5905 | 0.07873 | 102 | 7.50 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 0.3079 | 0.06213 | 104 | 4.96 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 0.2571 | 0.07346 | 96.7 | 3.50 | 0.0007 |
| Vehicle*manual | Volvo | | 1 | 0.7828 | 0.07063 | 103 | 11.08 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 0.6899 | 0.05791 | 105 | 11.91 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 0.7718 | 0.06741 | 103 | 11.45 | <.0001 |

## Appendix B4.4: Accuracy – BSW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | Correct |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 9 16 22 28 32 36 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 714 |
| Number of Observations Used | 714 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 882.56630068 | |
| 1 | 2 | 867.90626851 | 0.00000237 |
| 2 | 1 | 867.90578161 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 0.01769 |
| Residual | | 0.1708 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 867.9 |
| AIC (smaller is better) | 871.9 |
| AICC (smaller is better) | 871.9 |
| BIC (smaller is better) | 877.1 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 14.66 | 0.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 606 | 1.03 | 0.3565 |
| **Vehicle** | 2 | 127 | 37.15 | <.0001 |
| **manual** | 2 | 128 | 2.12 | 0.1242 |
| **Vehicle*Phase** | 4 | 606 | 1.67 | 0.1562 |
| **Phase*manual** | 4 | 606 | 0.60 | 0.6658 |
| **Vehicle*manual** | 4 | 94.2 | 2.45 | 0.0512 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 0.4075 | 0.04399 | 647 | 9.26 | <.0001 |
| **Phase** | | **2** | | 0.3385 | 0.02774 | 267 | 12.20 | <.0001 |
| **Phase** | | **3** | | 0.3508 | 0.02774 | 267 | 12.65 | <.0001 |
| **Vehicle** | **Buick** | | | 0.3997 | 0.03861 | 129 | 10.35 | <.0001 |
| **Vehicle** | **Infiniti** | | | 0.1100 | 0.04095 | 124 | 2.69 | 0.0082 |
| **Vehicle** | **Volvo** | | | 0.5870 | 0.03752 | 130 | 15.65 | <.0001 |
| **manual** | | | **1** | 0.4339 | 0.04218 | 130 | 10.29 | <.0001 |
| **manual** | | | **2** | 0.3381 | 0.03360 | 130 | 10.06 | <.0001 |
| **manual** | | | **3** | 0.3247 | 0.04103 | 124 | 7.91 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 0.4735 | 0.07453 | 644 | 6.35 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 0.3496 | 0.04722 | 265 | 7.40 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 0.3761 | 0.04722 | 265 | 7.96 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 0.2098 | 0.07886 | 638 | 2.66 | 0.0080 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 0.08484 | 0.05003 | 255 | 1.70 | 0.0911 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 0.03523 | 0.05003 | 255 | 0.70 | 0.4820 |
| **Vehicle*Phase** | **Volvo** | **1** | | 0.5390 | 0.07290 | 648 | 7.39 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 0.5810 | 0.04602 | 269 | 12.62 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 0.6410 | 0.04602 | 269 | 13.93 | <.0001 |
| Phase*manual | | 1 | 1 | 0.4778 | 0.08225 | 649 | 5.81 | <.0001 |
| Phase*manual | | 1 | 2 | 0.4233 | 0.06559 | 650 | 6.45 | <.0001 |
| Phase*manual | | 1 | 3 | 0.3213 | 0.07957 | 642 | 4.04 | <.0001 |
| Phase*manual | | 2 | 1 | 0.4023 | 0.05182 | 271 | 7.76 | <.0001 |
| Phase*manual | | 2 | 2 | 0.3084 | 0.04130 | 272 | 7.47 | <.0001 |
| Phase*manual | | 2 | 3 | 0.3047 | 0.05028 | 259 | 6.06 | <.0001 |
| Phase*manual | | 3 | 1 | 0.4217 | 0.05182 | 271 | 8.14 | <.0001 |
| Phase*manual | | 3 | 2 | 0.2825 | 0.04130 | 272 | 6.84 | <.0001 |
| Phase*manual | | 3 | 3 | 0.3480 | 0.05028 | 259 | 6.92 | <.0001 |
| Vehicle*manual | Buick | | 1 | 0.5216 | 0.06781 | 114 | 7.69 | <.0001 |
| Vehicle*manual | Buick | | 2 | 0.3995 | 0.05406 | 118 | 7.39 | <.0001 |
| Vehicle*manual | Buick | | 3 | 0.2780 | 0.07122 | 112 | 3.90 | 0.0002 |
| Vehicle*manual | Infiniti | | 1 | 0.06480 | 0.07544 | 112 | 0.86 | 0.3922 |
| Vehicle*manual | Infiniti | | 2 | 0.1398 | 0.05974 | 116 | 2.34 | 0.0210 |
| Vehicle*manual | Infiniti | | 3 | 0.1253 | 0.06974 | 100 | 1.80 | 0.0754 |
| Vehicle*manual | Volvo | | 1 | 0.7154 | 0.06779 | 114 | 10.55 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 0.4749 | 0.05572 | 117 | 8.52 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 0.5708 | 0.06475 | 114 | 8.82 | <.0001 |

## Appendix B4.5: Accuracy – ACC

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | Correct |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 5 15 21 27 30 34 38 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 714 |
| Number of Observations Used | 714 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 779.53789010 | |
| 1 | 2 | 770.24293127 | 0.00000001 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 0.01244 |
| Residual | | 0.1502 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 770.2 |
| AIC (smaller is better) | 774.2 |
| AICC (smaller is better) | 774.3 |
| BIC (smaller is better) | 779.5 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 9.29 | 0.0023 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 602 | 30.25 | <.0001 |
| **Vehicle** | 2 | 125 | 56.90 | <.0001 |
| **manual** | 2 | 126 | 2.27 | 0.1072 |
| **Vehicle*Phase** | 4 | 602 | 10.02 | <.0001 |
| **Phase*manual** | 4 | 602 | 0.70 | 0.5926 |
| **Vehicle*manual** | 4 | 90.4 | 1.08 | 0.3730 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 0.6006 | 0.04085 | 659 | 14.70 | <.0001 |
| **Phase** | | **2** | | 0.2591 | 0.02537 | 276 | 10.21 | <.0001 |
| **Phase** | | **3** | | 0.2878 | 0.02537 | 276 | 11.34 | <.0001 |
| **Vehicle** | **Buick** | | | 0.09225 | 0.03487 | 127 | 2.65 | 0.0092 |
| **Vehicle** | **Infiniti** | | | 0.6227 | 0.03696 | 121 | 16.85 | <.0001 |
| **Vehicle** | **Volvo** | | | 0.4325 | 0.03389 | 128 | 12.76 | <.0001 |
| **manual** | | | **1** | 0.4364 | 0.03810 | 129 | 11.46 | <.0001 |
| **manual** | | | **2** | 0.3873 | 0.03035 | 129 | 12.76 | <.0001 |
| **manual** | | | **3** | 0.3238 | 0.03703 | 122 | 8.74 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 0.1404 | 0.06920 | 656 | 2.03 | 0.0429 |
| **Vehicle*Phase** | **Buick** | **2** | | 0.09325 | 0.04319 | 274 | 2.16 | 0.0317 |
| **Vehicle*Phase** | **Buick** | **3** | | 0.04314 | 0.04319 | 274 | 1.00 | 0.3187 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 0.9737 | 0.07320 | 651 | 13.30 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 0.3333 | 0.04573 | 263 | 7.29 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 0.5611 | 0.04573 | 263 | 12.27 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 0.6878 | 0.06770 | 659 | 10.16 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 0.3507 | 0.04211 | 278 | 8.33 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 0.2591 | 0.04211 | 278 | 6.15 | <.0001 |
| Phase*manual | | 1 | 1 | 0.6682 | 0.07638 | 661 | 8.75 | <.0001 |
| Phase*manual | | 1 | 2 | 0.6169 | 0.06092 | 662 | 10.13 | <.0001 |
| Phase*manual | | 1 | 3 | 0.5169 | 0.07387 | 654 | 7.00 | <.0001 |
| Phase*manual | | 2 | 1 | 0.3254 | 0.04742 | 281 | 6.86 | <.0001 |
| Phase*manual | | 2 | 2 | 0.2254 | 0.03779 | 281 | 5.96 | <.0001 |
| Phase*manual | | 2 | 3 | 0.2265 | 0.04598 | 267 | 4.93 | <.0001 |
| Phase*manual | | 3 | 1 | 0.3158 | 0.04742 | 281 | 6.66 | <.0001 |
| Phase*manual | | 3 | 2 | 0.3196 | 0.03779 | 281 | 8.46 | <.0001 |
| Phase*manual | | 3 | 3 | 0.2279 | 0.04598 | 267 | 4.96 | <.0001 |
| Vehicle*manual | Buick | | 1 | 0.1748 | 0.06108 | 111 | 2.86 | 0.0050 |
| Vehicle*manual | Buick | | 2 | 0.07952 | 0.04873 | 115 | 1.63 | 0.1055 |
| Vehicle*manual | Buick | | 3 | 0.02246 | 0.06414 | 110 | 0.35 | 0.7268 |
| Vehicle*manual | Infiniti | | 1 | 0.6577 | 0.06792 | 109 | 9.68 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 0.5871 | 0.05383 | 113 | 10.91 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 0.6233 | 0.06265 | 96.1 | 9.95 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 0.4768 | 0.06106 | 111 | 7.81 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 0.4953 | 0.05022 | 114 | 9.86 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 0.3255 | 0.05833 | 112 | 5.58 | <.0001 |

## Appendix B4.6: Confidence Ratings – All Key Systems

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | confidence |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 28 | 3 5 6 9 13 14 15 16 19 20 21 22 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 44 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 2016 |
| Number of Observations Used | 2016 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 8394.01082362 | |
| 1 | 2 | 7712.02306259 | 0.00000081 |
| 2 | 1 | 7712.02140836 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 1.5739 |
| Residual | | 2.3564 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 7712.0 |
| AIC (smaller is better) | 7716.0 |
| AICC (smaller is better) | 7716.0 |
| BIC (smaller is better) | 7721.3 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 681.99 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 1912 | 15.39 | <.0001 |
| **Vehicle** | 2 | 93.6 | 2.03 | 0.1369 |
| **manual** | 2 | 93.7 | 1.45 | 0.2399 |
| **Vehicle*Phase** | 4 | 1912 | 2.37 | 0.0505 |
| **Phase*manual** | 4 | 1911 | 2.28 | 0.0586 |
| **Vehicle*manual** | 4 | 90.8 | 0.60 | 0.6664 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 7.7842 | 0.1562 | 169 | 49.85 | <.0001 |
| **Phase** | | **2** | | 8.2297 | 0.1411 | 113 | 58.34 | <.0001 |
| **Phase** | | **3** | | 8.3566 | 0.1392 | 107 | 60.05 | <.0001 |
| **Vehicle** | **Buick** | | | 7.8402 | 0.2314 | 95.3 | 33.88 | <.0001 |
| **Vehicle** | **Infiniti** | | | 8.0568 | 0.2458 | 94 | 32.77 | <.0001 |
| **Vehicle** | **Volvo** | | | 8.4735 | 0.2214 | 91.4 | 38.28 | <.0001 |
| **manual** | | | **1** | 8.4079 | 0.2488 | 91.6 | 33.80 | <.0001 |
| **manual** | | | **2** | 8.1500 | 0.1993 | 93.8 | 40.89 | <.0001 |
| **manual** | | | **3** | 7.8126 | 0.2478 | 95.8 | 31.53 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 7.5621 | 0.2682 | 171 | 28.19 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 7.9739 | 0.2425 | 115 | 32.88 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 7.9845 | 0.2393 | 109 | 33.37 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 7.8100 | 0.2832 | 165 | 27.57 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 7.9734 | 0.2605 | 118 | 30.61 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 8.3870 | 0.2539 | 107 | 33.03 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 7.9803 | 0.2571 | 165 | 31.04 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 8.7419 | 0.2278 | 102 | 38.37 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.6982 | 0.2289 | 104 | 37.99 | <.0001 |
| Phase*manual | | 1 | 1 | 8.3333 | 0.2866 | 160 | 29.08 | <.0001 |
| Phase*manual | | 1 | 2 | 7.6737 | 0.2324 | 172 | 33.03 | <.0001 |
| Phase*manual | | 1 | 3 | 7.3454 | 0.2886 | 175 | 25.45 | <.0001 |
| Phase*manual | | 2 | 1 | 8.4015 | 0.2588 | 107 | 32.46 | <.0001 |
| Phase*manual | | 2 | 2 | 8.2789 | 0.2081 | 111 | 39.78 | <.0001 |
| Phase*manual | | 2 | 3 | 8.0089 | 0.2610 | 117 | 30.69 | <.0001 |
| Phase*manual | | 3 | 1 | 8.4890 | 0.2572 | 105 | 33.00 | <.0001 |
| Phase*manual | | 3 | 2 | 8.4973 | 0.2075 | 110 | 40.94 | <.0001 |
| Phase*manual | | 3 | 3 | 8.0834 | 0.2549 | 108 | 31.71 | <.0001 |
| Vehicle*manual | Buick | | 1 | 8.0700 | 0.4140 | 91.6 | 19.49 | <.0001 |
| Vehicle*manual | Buick | | 2 | 7.5696 | 0.3284 | 92.7 | 23.05 | <.0001 |
| Vehicle*manual | Buick | | 3 | 7.8809 | 0.4467 | 97.3 | 17.64 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 8.4892 | 0.4612 | 90.2 | 18.41 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 8.1497 | 0.3654 | 93.8 | 22.30 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 7.5315 | 0.4410 | 95.2 | 17.08 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 8.6645 | 0.4114 | 89.3 | 21.06 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 8.7306 | 0.3380 | 91.5 | 25.83 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 8.0254 | 0.3928 | 89.8 | 20.43 | <.0001 |

## Appendix B4.7: Confidence Ratings – LDW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | confidence |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 6 14 20 26 29 33 37 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 12 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 599 |
| Number of Observations Used | 599 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 2417.47727929 | |
| 1 | 2 | 2268.84743324 | 0.00000019 |
| 2 | 1 | 2268.84732149 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 1.4714 |
| Residual | | 2.0008 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 2268.8 |
| AIC (smaller is better) | 2272.8 |
| AICC (smaller is better) | 2272.9 |
| BIC (smaller is better) | 2278.1 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 148.63 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 497 | 2.52 | 0.0816 |
| **Vehicle** | 2 | 102 | 3.74 | 0.0271 |
| **manual** | 2 | 103 | 2.95 | 0.0566 |
| **Vehicle*Phase** | 4 | 497 | 3.27 | 0.0115 |
| **Phase*manual** | 4 | 497 | 3.21 | 0.0128 |
| **Vehicle*manual** | 4 | 90.4 | 0.30 | 0.8781 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 8.2390 | 0.2078 | 348 | 39.65 | <.0001 |
| **Phase** | | **2** | | 8.3892 | 0.1589 | 150 | 52.80 | <.0001 |
| **Phase** | | **3** | | 8.6050 | 0.1519 | 129 | 56.64 | <.0001 |
| **Vehicle** | **Buick** | | | 8.2528 | 0.2468 | 105 | 33.44 | <.0001 |
| **Vehicle** | **Infiniti** | | | 8.0393 | 0.2642 | 106 | 30.43 | <.0001 |
| **Vehicle** | **Volvo** | | | 8.9411 | 0.2335 | 97.4 | 38.29 | <.0001 |
| **manual** | | | **1** | 8.8033 | 0.2621 | 97.2 | 33.58 | <.0001 |
| **manual** | | | **2** | 8.5155 | 0.2124 | 104 | 40.09 | <.0001 |
| **manual** | | | **3** | 7.9144 | 0.2675 | 108 | 29.59 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 8.2899 | 0.3538 | 343 | 23.43 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 8.2607 | 0.2735 | 153 | 30.20 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 8.2076 | 0.2617 | 133 | 31.37 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 7.4825 | 0.3857 | 359 | 19.40 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 7.9519 | 0.2959 | 160 | 26.88 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 8.6835 | 0.2754 | 126 | 31.53 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 8.9447 | 0.3336 | 328 | 26.81 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 8.9549 | 0.2510 | 129 | 35.68 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.9238 | 0.2510 | 129 | 35.55 | <.0001 |
| Phase*manual | | 1 | 1 | 9.1577 | 0.3725 | 323 | 24.59 | <.0001 |
| Phase*manual | | 1 | 2 | 8.0627 | 0.3120 | 363 | 25.85 | <.0001 |
| Phase*manual | | 1 | 3 | 7.4967 | 0.3884 | 360 | 19.30 | <.0001 |
| Phase*manual | | 2 | 1 | 8.3632 | 0.2844 | 133 | 29.41 | <.0001 |
| Phase*manual | | 2 | 2 | 8.7393 | 0.2327 | 146 | 37.56 | <.0001 |
| Phase*manual | | 2 | 3 | 8.0650 | 0.3016 | 167 | 26.74 | <.0001 |
| Phase*manual | | 3 | 1 | 8.8890 | 0.2804 | 127 | 31.70 | <.0001 |
| Phase*manual | | 3 | 2 | 8.7446 | 0.2282 | 136 | 38.32 | <.0001 |
| Phase*manual | | 3 | 3 | 8.1814 | 0.2776 | 128 | 29.47 | <.0001 |
| Vehicle*manual | Buick | | 1 | 8.4425 | 0.4330 | 94 | 19.50 | <.0001 |
| Vehicle*manual | Buick | | 2 | 8.3097 | 0.3456 | 97.7 | 24.04 | <.0001 |
| Vehicle*manual | Buick | | 3 | 8.0060 | 0.4764 | 105 | 16.81 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 8.6878 | 0.4793 | 90.9 | 18.13 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 8.1646 | 0.3863 | 101 | 21.13 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 7.2655 | 0.4779 | 107 | 15.20 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 9.2796 | 0.4301 | 92 | 21.58 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 9.0722 | 0.3571 | 97.4 | 25.40 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 8.4715 | 0.4083 | 90.5 | 20.75 | <.0001 |

## Appendix B4.8: Confidence Ratings – FCW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | confidence |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 97 | BB10 BB2 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 3 13 19 25 31 35 39 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 97 |
| **Max Obs Per Subject** | 9 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 470 |
| Number of Observations Used | 470 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 2000.90076201 | |
| 1 | 2 | 1867.79437836 | 0.00002829 |
| 2 | 1 | 1867.77932725 | 0.00000004 |
| 3 | 1 | 1867.77930662 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 2.2256 |
| Residual | | 2.3272 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 1867.8 |
| AIC (smaller is better) | 1871.8 |
| AICC (smaller is better) | 1871.8 |
| BIC (smaller is better) | 1876.9 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 133.12 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 397 | 2.74 | 0.0659 |
| **Vehicle** | 2 | 90.2 | 4.10 | 0.0198 |
| **manual** | 2 | 90.8 | 0.61 | 0.5450 |
| **Vehicle*Phase** | 4 | 396 | 0.13 | 0.9702 |
| **Phase*manual** | 4 | 390 | 0.81 | 0.5225 |
| **Vehicle*manual** | 4 | 85.6 | 0.94 | 0.4469 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 7.4343 | 0.2433 | 252 | 30.56 | <.0001 |
| **Phase** | | **2** | | 7.9354 | 0.2041 | 136 | 38.87 | <.0001 |
| **Phase** | | **3** | | 7.9288 | 0.2054 | 138 | 38.61 | <.0001 |
| **Vehicle** | **Buick** | | | 7.3160 | 0.3211 | 90.1 | 22.79 | <.0001 |
| **Vehicle** | **Infiniti** | | | 7.5315 | 0.3327 | 99 | 22.64 | <.0001 |
| **Vehicle** | **Volvo** | | | 8.4510 | 0.2829 | 81.5 | 29.87 | <.0001 |
| **manual** | | | **1** | 7.9631 | 0.3342 | 85.9 | 23.83 | <.0001 |
| **manual** | | | **2** | 7.8606 | 0.2641 | 89.8 | 29.77 | <.0001 |
| **manual** | | | **3** | 7.4748 | 0.3353 | 96.7 | 22.30 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 6.9927 | 0.4372 | 260 | 15.99 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 7.4268 | 0.3608 | 129 | 20.58 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 7.5284 | 0.3635 | 132 | 20.71 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 7.1807 | 0.4358 | 246 | 16.48 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 7.6915 | 0.3924 | 168 | 19.60 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 7.7224 | 0.3921 | 166 | 19.70 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 8.1295 | 0.3851 | 241 | 21.11 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 8.6878 | 0.2970 | 100 | 29.25 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.5355 | 0.3041 | 107 | 28.07 | <.0001 |
| Phase*manual | | 1 | 1 | 7.8171 | 0.4513 | 246 | 17.32 | <.0001 |
| Phase*manual | | 1 | 2 | 7.5781 | 0.3610 | 260 | 20.99 | <.0001 |
| Phase*manual | | 1 | 3 | 6.9076 | 0.4447 | 253 | 15.53 | <.0001 |
| Phase*manual | | 2 | 1 | 8.1787 | 0.3666 | 120 | 22.31 | <.0001 |
| Phase*manual | | 2 | 2 | 7.8870 | 0.2898 | 124 | 27.22 | <.0001 |
| Phase*manual | | 2 | 3 | 7.7405 | 0.3851 | 150 | 20.10 | <.0001 |
| Phase*manual | | 3 | 1 | 7.8935 | 0.3717 | 126 | 21.23 | <.0001 |
| Phase*manual | | 3 | 2 | 8.1166 | 0.3016 | 140 | 26.91 | <.0001 |
| Phase*manual | | 3 | 3 | 7.7763 | 0.3785 | 140 | 20.54 | <.0001 |
| Vehicle*manual | Buick | | 1 | 7.4129 | 0.6042 | 87.6 | 12.27 | <.0001 |
| Vehicle*manual | Buick | | 2 | 6.8949 | 0.4294 | 89.3 | 16.06 | <.0001 |
| Vehicle*manual | Buick | | 3 | 7.6400 | 0.6097 | 87.6 | 12.53 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 7.9333 | 0.5920 | 83.2 | 13.40 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 7.9243 | 0.4999 | 91.2 | 15.85 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 6.7370 | 0.6294 | 122 | 10.70 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 8.5431 | 0.5271 | 79.1 | 16.21 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 8.7624 | 0.4330 | 81.9 | 20.24 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 8.0474 | 0.4920 | 75.4 | 16.36 | <.0001 |

## Appendix B4.9: Confidence Ratings – BSW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | confidence |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 98 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI5 NI6 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 9 16 22 28 32 36 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 98 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 448 |
| Number of Observations Used | 448 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 1858.95406267 | |
| 1 | 2 | 1764.90204219 | 0.00000593 |
| 2 | 1 | 1764.89911614 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 1.7261 |
| Residual | | 2.3153 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 1764.9 |
| AIC (smaller is better) | 1768.9 |
| AICC (smaller is better) | 1768.9 |
| BIC (smaller is better) | 1774.1 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 94.05 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 364 | 13.21 | <.0001 |
| **Vehicle** | 2 | 87.8 | 1.34 | 0.2665 |
| **manual** | 2 | 88.3 | 0.95 | 0.3912 |
| **Vehicle*Phase** | 4 | 364 | 2.49 | 0.0430 |
| **Phase*manual** | 4 | 362 | 1.72 | 0.1457 |
| **Vehicle*manual** | 4 | 81.5 | 1.16 | 0.3363 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 7.1394 | 0.2321 | 276 | 30.76 | <.0001 |
| **Phase** | | **2** | | 8.1718 | 0.1901 | 146 | 42.98 | <.0001 |
| **Phase** | | **3** | | 8.2432 | 0.1863 | 134 | 44.25 | <.0001 |
| **Vehicle** | **Buick** | | | 7.8059 | 0.2767 | 90.5 | 28.21 | <.0001 |
| **Vehicle** | **Infiniti** | | | 7.5488 | 0.3172 | 91 | 23.80 | <.0001 |
| **Vehicle** | **Volvo** | | | 8.1997 | 0.2584 | 81.4 | 31.74 | <.0001 |
| **manual** | | | **1** | 8.1656 | 0.2935 | 83.2 | 27.82 | <.0001 |
| **manual** | | | **2** | 7.6584 | 0.2459 | 92.6 | 31.14 | <.0001 |
| **manual** | | | **3** | 7.7303 | 0.3119 | 90 | 24.79 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 6.9691 | 0.3917 | 280 | 17.79 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 8.0870 | 0.3227 | 154 | 25.06 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 8.3617 | 0.3091 | 133 | 27.05 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 7.3946 | 0.4312 | 260 | 17.15 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 7.7459 | 0.3711 | 156 | 20.87 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 7.5058 | 0.3721 | 150 | 20.17 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 7.0544 | 0.3799 | 289 | 18.57 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 8.6825 | 0.2857 | 119 | 30.39 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.8621 | 0.2801 | 110 | 31.64 | <.0001 |
| Phase*manual | | 1 | 1 | 7.8448 | 0.4093 | 261 | 19.16 | <.0001 |
| Phase*manual | | 1 | 2 | 6.7226 | 0.3564 | 296 | 18.86 | <.0001 |
| Phase*manual | | 1 | 3 | 6.8507 | 0.4382 | 279 | 15.63 | <.0001 |
| Phase*manual | | 2 | 1 | 8.4657 | 0.3370 | 137 | 25.12 | <.0001 |
| Phase*manual | | 2 | 2 | 7.9618 | 0.2785 | 148 | 28.59 | <.0001 |
| Phase*manual | | 2 | 3 | 8.0879 | 0.3618 | 148 | 22.35 | <.0001 |
| Phase*manual | | 3 | 1 | 8.1864 | 0.3275 | 126 | 25.00 | <.0001 |
| Phase*manual | | 3 | 2 | 8.2908 | 0.2826 | 145 | 29.34 | <.0001 |
| Phase*manual | | 3 | 3 | 8.2524 | 0.3480 | 127 | 23.72 | <.0001 |
| Vehicle*manual | Buick | | 1 | 8.0811 | 0.4788 | 77.5 | 16.88 | <.0001 |
| Vehicle*manual | Buick | | 2 | 7.0697 | 0.3868 | 83.9 | 18.28 | <.0001 |
| Vehicle*manual | Buick | | 3 | 8.2669 | 0.5491 | 99.3 | 15.06 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 7.8237 | 0.5599 | 88.6 | 13.97 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 7.5906 | 0.4782 | 99.7 | 15.87 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 7.2320 | 0.5997 | 84.4 | 12.06 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 8.5921 | 0.4728 | 75 | 18.17 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 8.3148 | 0.3979 | 82.3 | 20.90 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 7.6921 | 0.4528 | 76.3 | 16.99 | <.0001 |

## Appendix B4.10: Confidence Ratings – ACC

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | ANALYSES.CWIMSTATUSONLYQUIZREMOVED090710 |
| **Dependent Variable** | confidence |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 99 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 5 15 21 27 30 34 38 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 99 |
| **Max Obs Per Subject** | 9 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 499 |
| Number of Observations Used | 499 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 1989.98109078 | |
| 1 | 2 | 1811.94709682 | 0.00000987 |
| 2 | 1 | 1811.94244552 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 1.7076 |
| Residual | | 1.5924 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 1811.9 |
| AIC (smaller is better) | 1815.9 |
| AICC (smaller is better) | 1816.0 |
| BIC (smaller is better) | 1821.1 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 178.04 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 408 | 1.05 | 0.3501 |
| **Vehicle** | 2 | 92.8 | 2.20 | 0.1162 |
| **manual** | 2 | 92.4 | 1.45 | 0.2398 |
| **Vehicle*Phase** | 4 | 408 | 4.23 | 0.0023 |
| **Phase*manual** | 4 | 407 | 0.51 | 0.7300 |
| **Vehicle*manual** | 4 | 89.3 | 0.67 | 0.6145 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 8.0983 | 0.1933 | 229 | 41.90 | <.0001 |
| **Phase** | | **2** | | 8.3371 | 0.1673 | 138 | 49.84 | <.0001 |
| **Phase** | | **3** | | 8.3036 | 0.1660 | 132 | 50.04 | <.0001 |
| **Vehicle** | **Buick** | | | 7.8642 | 0.2612 | 91.4 | 30.11 | <.0001 |
| **Vehicle** | **Infiniti** | | | 8.6478 | 0.2673 | 88.2 | 32.35 | <.0001 |
| **Vehicle** | **Volvo** | | | 8.2271 | 0.2524 | 100 | 32.60 | <.0001 |
| **manual** | | | **1** | 8.4448 | 0.2740 | 90.2 | 30.82 | <.0001 |
| **manual** | | | **2** | 8.4216 | 0.2238 | 94 | 37.63 | <.0001 |
| **manual** | | | **3** | 7.8726 | 0.2790 | 94 | 28.22 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 7.7982 | 0.3312 | 218 | 23.55 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 8.0530 | 0.2937 | 139 | 27.42 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 7.7413 | 0.2856 | 126 | 27.11 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 8.7820 | 0.3377 | 208 | 26.00 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 8.2999 | 0.3046 | 143 | 27.25 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 8.8615 | 0.2800 | 106 | 31.65 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 7.7149 | 0.3294 | 250 | 23.42 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 8.6584 | 0.2684 | 129 | 32.26 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.3081 | 0.2957 | 169 | 28.10 | <.0001 |
| Phase*manual | | 1 | 1 | 8.4173 | 0.3521 | 223 | 23.91 | <.0001 |
| Phase*manual | | 1 | 2 | 8.1737 | 0.2838 | 224 | 28.80 | <.0001 |
| Phase*manual | | 1 | 3 | 7.7041 | 0.3635 | 238 | 21.19 | <.0001 |
| Phase*manual | | 2 | 1 | 8.5435 | 0.3048 | 134 | 28.03 | <.0001 |
| Phase*manual | | 2 | 2 | 8.4685 | 0.2513 | 143 | 33.70 | <.0001 |
| Phase*manual | | 2 | 3 | 7.9993 | 0.3082 | 137 | 25.96 | <.0001 |
| Phase*manual | | 3 | 1 | 8.3737 | 0.2999 | 126 | 27.92 | <.0001 |
| Phase*manual | | 3 | 2 | 8.6228 | 0.2509 | 140 | 34.37 | <.0001 |
| Phase*manual | | 3 | 3 | 7.9143 | 0.3048 | 130 | 25.97 | <.0001 |
| Vehicle*manual | Buick | | 1 | 8.0655 | 0.4545 | 89.1 | 17.75 | <.0001 |
| Vehicle*manual | Buick | | 2 | 7.7923 | 0.3857 | 97.8 | 20.20 | <.0001 |
| Vehicle*manual | Buick | | 3 | 7.7347 | 0.5062 | 87.2 | 15.28 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 9.1142 | 0.5031 | 85.7 | 18.12 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 8.6597 | 0.3973 | 87.9 | 21.80 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 8.1695 | 0.4743 | 85.7 | 17.22 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 8.1548 | 0.4586 | 91.4 | 17.78 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 8.8129 | 0.3786 | 95.1 | 23.28 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 7.7136 | 0.4613 | 107 | 16.72 | <.0001 |

## Appendix B4.11: Decision Time – All Key Systems

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | WORK._TMP_0 |
| **Dependent Variable** | decisiontimeresponse |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 28 | 3 5 6 9 13 14 15 16 19 20 21 22 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 51 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 2718 |
| Number of Observations Used | 2718 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 20213.46987640 | |
| 1 | 2 | 20034.30477616 | 0.00000015 |
| 2 | 1 | 20034.30364345 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 12.7768 |
| Residual | | 89.5579 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 20034.3 |
| AIC (smaller is better) | 20038.3 |
| AICC (smaller is better) | 20038.3 |
| BIC (smaller is better) | 20043.5 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 179.17 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 2610 | 133.33 | <.0001 |
| **Vehicle** | 2 | 104 | 3.80 | 0.0256 |
| **manual** | 2 | 104 | 2.25 | 0.1108 |
| **Vehicle*Phase** | 4 | 2609 | 2.85 | 0.0225 |
| **Phase*manual** | 4 | 2609 | 2.81 | 0.0242 |
| **Vehicle*manual** | 4 | 91 | 1.01 | 0.4052 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 20.3567 | 0.6287 | 471 | 32.38 | <.0001 |
| **Phase** | | **2** | | 14.8923 | 0.4617 | 146 | 32.25 | <.0001 |
| **Phase** | | **3** | | 11.1238 | 0.4629 | 147 | 24.03 | <.0001 |
| **Vehicle** | **Buick** | | | 15.5264 | 0.7251 | 104 | 21.41 | <.0001 |
| **Vehicle** | **Infiniti** | | | 16.8575 | 0.7767 | 105 | 21.70 | <.0001 |
| **Vehicle** | **Volvo** | | | 13.9889 | 0.7019 | 103 | 19.93 | <.0001 |
| **manual** | | | **1** | 14.2996 | 0.7890 | 104 | 18.12 | <.0001 |
| **manual** | | | **2** | 15.4255 | 0.6288 | 104 | 24.53 | <.0001 |
| **manual** | | | **3** | 16.6477 | 0.7784 | 106 | 21.39 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 19.5586 | 1.0662 | 460 | 18.34 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 16.1497 | 0.7846 | 143 | 20.58 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 10.8709 | 0.7882 | 145 | 13.79 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 22.3505 | 1.1439 | 462 | 19.54 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 15.7955 | 0.8414 | 144 | 18.77 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 12.4265 | 0.8432 | 145 | 14.74 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 19.1610 | 1.0298 | 453 | 18.61 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 12.7319 | 0.7641 | 145 | 16.66 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 10.0738 | 0.7638 | 145 | 13.19 | <.0001 |
| Phase*manual | | 1 | 1 | 18.3025 | 1.1559 | 451 | 15.83 | <.0001 |
| Phase*manual | | 1 | 2 | 20.6421 | 0.9322 | 472 | 22.14 | <.0001 |
| Phase*manual | | 1 | 3 | 22.1255 | 1.1597 | 486 | 19.08 | <.0001 |
| Phase*manual | | 2 | 1 | 13.3919 | 0.8618 | 147 | 15.54 | <.0001 |
| Phase*manual | | 2 | 2 | 14.7694 | 0.6834 | 145 | 21.61 | <.0001 |
| Phase*manual | | 2 | 3 | 16.5158 | 0.8412 | 144 | 19.63 | <.0001 |
| Phase*manual | | 3 | 1 | 11.2044 | 0.8639 | 149 | 12.97 | <.0001 |
| Phase*manual | | 3 | 2 | 10.8650 | 0.6820 | 144 | 15.93 | <.0001 |
| Phase*manual | | 3 | 3 | 11.3019 | 0.8460 | 147 | 13.36 | <.0001 |
| Vehicle*manual | Buick | | 1 | 15.3580 | 1.2945 | 98 | 11.86 | <.0001 |
| Vehicle*manual | Buick | | 2 | 16.0619 | 1.0251 | 98.7 | 15.67 | <.0001 |
| Vehicle*manual | Buick | | 3 | 15.1593 | 1.3674 | 98.9 | 11.09 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 15.3970 | 1.4466 | 97.7 | 10.64 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 15.9751 | 1.1390 | 99.3 | 14.03 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 19.2004 | 1.3676 | 98.5 | 14.04 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 12.1438 | 1.2923 | 97.3 | 9.40 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 14.2395 | 1.0578 | 98.4 | 13.46 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 15.5834 | 1.2353 | 98.4 | 12.61 | <.0001 |

## Appendix B4.12: Decision Time – LDW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | WORK._TMP_0 |
| **Dependent Variable** | decisiontimeresponse |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 6 14 20 26 29 33 37 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 13 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 679 |
| Number of Observations Used | 679 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 4773.74944215 | |
| 1 | 2 | 4760.94269647 | 0.00000026 |
| 2 | 1 | 4760.94223380 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 7.2734 |
| Residual | | 65.9786 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 4760.9 |
| AIC (smaller is better) | 4764.9 |
| AICC (smaller is better) | 4765.0 |
| BIC (smaller is better) | 4770.2 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 12.81 | 0.0003 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 573 | 21.88 | <.0001 |
| **Vehicle** | 2 | 118 | 14.62 | <.0001 |
| **manual** | 2 | 119 | 1.32 | 0.2701 |
| **Vehicle*Phase** | 4 | 572 | 12.94 | <.0001 |
| **Phase*manual** | 4 | 572 | 1.16 | 0.3288 |
| **Vehicle*manual** | 4 | 87.3 | 0.61 | 0.6579 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 16.5395 | 0.8949 | 616 | 18.48 | <.0001 |
| **Phase** | | **2** | | 11.8626 | 0.5602 | 247 | 21.18 | <.0001 |
| **Phase** | | **3** | | 10.0227 | 0.5691 | 252 | 17.61 | <.0001 |
| **Vehicle** | **Buick** | | | 12.0026 | 0.7787 | 117 | 15.41 | <.0001 |
| **Vehicle** | **Infiniti** | | | 16.2382 | 0.8497 | 123 | 19.11 | <.0001 |
| **Vehicle** | **Volvo** | | | 10.1840 | 0.7525 | 116 | 13.53 | <.0001 |
| **manual** | | | **1** | 11.7865 | 0.8561 | 120 | 13.77 | <.0001 |
| **manual** | | | **2** | 12.9121 | 0.6804 | 121 | 18.98 | <.0001 |
| **manual** | | | **3** | 13.7262 | 0.8373 | 117 | 16.39 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 12.7889 | 1.4943 | 609 | 8.56 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 13.6831 | 0.9446 | 239 | 14.49 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 9.5357 | 0.9591 | 249 | 9.94 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 25.5917 | 1.6564 | 615 | 15.45 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 12.8378 | 1.0215 | 242 | 12.57 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 10.2852 | 1.0465 | 247 | 9.83 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 11.2381 | 1.4537 | 611 | 7.73 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 9.0668 | 0.9249 | 246 | 9.80 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 10.2470 | 0.9222 | 244 | 11.11 | <.0001 |
| Phase*manual | | 1 | 1 | 14.2715 | 1.6493 | 614 | 8.65 | <.0001 |
| Phase*manual | | 1 | 2 | 16.6351 | 1.3430 | 621 | 12.39 | <.0001 |
| Phase*manual | | 1 | 3 | 18.7120 | 1.6256 | 612 | 11.51 | <.0001 |
| Phase*manual | | 2 | 1 | 11.2879 | 1.0481 | 252 | 10.77 | <.0001 |
| Phase*manual | | 2 | 2 | 11.4707 | 0.8258 | 245 | 13.89 | <.0001 |
| Phase*manual | | 2 | 3 | 12.8292 | 1.0201 | 242 | 12.58 | <.0001 |
| Phase*manual | | 3 | 1 | 9.8000 | 1.0810 | 265 | 9.07 | <.0001 |
| Phase*manual | | 3 | 2 | 10.6305 | 0.8204 | 240 | 12.96 | <.0001 |
| Phase*manual | | 3 | 3 | 9.6375 | 1.0321 | 245 | 9.34 | <.0001 |
| Vehicle*manual | Buick | | 1 | 11.1426 | 1.3900 | 109 | 8.02 | <.0001 |
| Vehicle*manual | Buick | | 2 | 12.8830 | 1.0768 | 102 | 11.96 | <.0001 |
| Vehicle*manual | Buick | | 3 | 11.9821 | 1.4292 | 100 | 8.38 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 15.6609 | 1.5490 | 106 | 10.11 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 15.2775 | 1.2189 | 110 | 12.53 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 17.7763 | 1.4687 | 104 | 12.10 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 8.5559 | 1.3594 | 101 | 6.29 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 10.5757 | 1.1261 | 107 | 9.39 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 11.4204 | 1.2973 | 102 | 8.80 | <.0001 |

## Appendix B4.13: Decision Time – FCW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | WORK._TMP_0 |
| **Dependent Variable** | decisiontimeresponse |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 3 13 19 25 31 35 39 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 14 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 685 |
| Number of Observations Used | 685 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 4913.39894994 | |
| 1 | 2 | 4865.94212409 | 0.00000013 |
| 2 | 1 | 4865.94188074 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 17.1692 |
| Residual | | 68.2406 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 4865.9 |
| AIC (smaller is better) | 4869.9 |
| AICC (smaller is better) | 4870.0 |
| BIC (smaller is better) | 4875.2 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 47.46 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Phase | 2 | 577 | 56.83 | <.0001 |
| Vehicle | 2 | 114 | 11.35 | <.0001 |
| manual | 2 | 114 | 3.62 | 0.0299 |
| Vehicle*Phase | 4 | 577 | 3.80 | 0.0046 |
| Phase*manual | 4 | 577 | 2.24 | 0.0633 |
| Vehicle*manual | 4 | 90 | 1.02 | 0.4010 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Phase | | 1 | | 21.4024 | 0.9905 | 547 | 21.61 | <.0001 |
| Phase | | 2 | | 14.1937 | 0.6499 | 190 | 21.84 | <.0001 |
| Phase | | 3 | | 10.6429 | 0.6497 | 190 | 16.38 | <.0001 |
| Vehicle | Buick | | | 16.4431 | 0.9642 | 112 | 17.05 | <.0001 |
| Vehicle | Infiniti | | | 18.0531 | 1.0459 | 117 | 17.26 | <.0001 |
| Vehicle | Volvo | | | 11.7428 | 0.9386 | 113 | 12.51 | <.0001 |
| manual | | | 1 | 13.6275 | 1.0618 | 116 | 12.83 | <.0001 |
| manual | | | 2 | 15.0692 | 0.8433 | 116 | 17.87 | <.0001 |
| manual | | | 3 | 17.5423 | 1.0332 | 112 | 16.98 | <.0001 |
| Vehicle*Phase | Buick | 1 | | 23.9499 | 1.6492 | 532 | 14.52 | <.0001 |
| Vehicle*Phase | Buick | 2 | | 15.9965 | 1.1030 | 187 | 14.50 | <.0001 |
| Vehicle*Phase | Buick | 3 | | 9.3828 | 1.1083 | 190 | 8.47 | <.0001 |
| Vehicle*Phase | Infiniti | 1 | | 23.6427 | 1.8467 | 556 | 12.80 | <.0001 |
| Vehicle*Phase | Infiniti | 2 | | 16.7402 | 1.1728 | 182 | 14.27 | <.0001 |
| Vehicle*Phase | Infiniti | 3 | | 13.7764 | 1.1750 | 183 | 11.72 | <.0001 |
| Vehicle*Phase | Volvo | 1 | | 16.6145 | 1.6045 | 532 | 10.36 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 9.8443 | 1.0844 | 194 | 9.08 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 8.7697 | 1.0756 | 190 | 8.15 | <.0001 |
| Phase*manual | | 1 | 1 | 18.9129 | 1.8458 | 547 | 10.25 | <.0001 |
| Phase*manual | | 1 | 2 | 20.5430 | 1.4802 | 554 | 13.88 | <.0001 |
| Phase*manual | | 1 | 3 | 24.7511 | 1.7840 | 537 | 13.87 | <.0001 |
| Phase*manual | | 2 | 1 | 11.3923 | 1.2187 | 195 | 9.35 | <.0001 |
| Phase*manual | | 2 | 2 | 14.5356 | 0.9618 | 190 | 15.11 | <.0001 |
| Phase*manual | | 2 | 3 | 16.6531 | 1.1791 | 186 | 14.12 | <.0001 |
| Phase*manual | | 3 | 1 | 10.5772 | 1.2157 | 194 | 8.70 | <.0001 |
| Phase*manual | | 3 | 2 | 10.1289 | 0.9577 | 188 | 10.58 | <.0001 |
| Phase*manual | | 3 | 3 | 11.2228 | 1.1852 | 189 | 9.47 | <.0001 |
| Vehicle*manual | Buick | | 1 | 14.4254 | 1.6940 | 99.3 | 8.52 | <.0001 |
| Vehicle*manual | Buick | | 2 | 17.6931 | 1.3633 | 106 | 12.98 | <.0001 |
| Vehicle*manual | Buick | | 3 | 17.2107 | 1.8059 | 104 | 9.53 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 16.0079 | 1.9219 | 104 | 8.33 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 16.2630 | 1.5221 | 109 | 10.68 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 21.8884 | 1.7935 | 99.4 | 12.20 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 10.4492 | 1.7392 | 107 | 6.01 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 11.2513 | 1.3897 | 101 | 8.10 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 13.5279 | 1.6222 | 101 | 8.34 | <.0001 |

## Appendix B4.14: Decision Time – BSW

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | WORK._TMP_0 |
| **Dependent Variable** | decisiontimeresponse |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 9 16 22 28 32 36 40 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 12 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 671 |
| Number of Observations Used | 671 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 4996.55750837 | |
| 1 | 2 | 4930.03932897 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 27.9832 |
| Residual | | 85.8145 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 4930.0 |
| AIC (smaller is better) | 4934.0 |
| AICC (smaller is better) | 4934.1 |
| BIC (smaller is better) | 4939.3 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 66.52 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 566 | 51.56 | <.0001 |
| **Vehicle** | 2 | 117 | 5.46 | 0.0054 |
| **manual** | 2 | 118 | 0.62 | 0.5420 |
| **Vehicle*Phase** | 4 | 565 | 5.02 | 0.0006 |
| **Phase*manual** | 4 | 566 | 1.78 | 0.1309 |
| **Vehicle*manual** | 4 | 90.9 | 1.76 | 0.1433 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 26.0017 | 1.2115 | 534 | 21.46 | <.0001 |
| **Phase** | | **2** | | 16.5953 | 0.7755 | 173 | 21.40 | <.0001 |
| **Phase** | | **3** | | 13.6522 | 0.7757 | 174 | 17.60 | <.0001 |
| **Vehicle** | **Buick** | | | 17.0419 | 1.2114 | 124 | 14.07 | <.0001 |
| **Vehicle** | **Infiniti** | | | 22.1095 | 1.2802 | 116 | 17.27 | <.0001 |
| **Vehicle** | **Volvo** | | | 17.0978 | 1.1439 | 112 | 14.95 | <.0001 |
| **manual** | | | **1** | 17.6853 | 1.2993 | 116 | 13.61 | <.0001 |
| **manual** | | | **2** | 18.8502 | 1.0276 | 113 | 18.34 | <.0001 |
| **manual** | | | **3** | 19.7137 | 1.3003 | 124 | 15.16 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 20.8518 | 2.1220 | 551 | 9.83 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 16.9453 | 1.3128 | 169 | 12.91 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 13.3286 | 1.3182 | 171 | 10.11 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 31.1573 | 2.1696 | 517 | 14.36 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 17.4330 | 1.4142 | 171 | 12.33 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 17.7382 | 1.4154 | 173 | 12.53 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 25.9959 | 1.9111 | 504 | 13.60 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 15.4078 | 1.2822 | 173 | 12.02 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 9.8897 | 1.2759 | 170 | 7.75 | <.0001 |
| Phase*manual | | 1 | 1 | 24.2425 | 2.2005 | 519 | 11.02 | <.0001 |
| Phase*manual | | 1 | 2 | 27.3613 | 1.7404 | 517 | 15.72 | <.0001 |
| Phase*manual | | 1 | 3 | 26.4012 | 2.3015 | 556 | 11.47 | <.0001 |
| Phase*manual | | 2 | 1 | 14.5227 | 1.4562 | 178 | 9.97 | <.0001 |
| Phase*manual | | 2 | 2 | 16.6504 | 1.1454 | 172 | 14.54 | <.0001 |
| Phase*manual | | 2 | 3 | 18.6130 | 1.4054 | 169 | 13.24 | <.0001 |
| Phase*manual | | 3 | 1 | 14.2909 | 1.4493 | 176 | 9.86 | <.0001 |
| Phase*manual | | 3 | 2 | 12.5388 | 1.1400 | 169 | 11.00 | <.0001 |
| Phase*manual | | 3 | 3 | 14.1269 | 1.4181 | 175 | 9.96 | <.0001 |
| Vehicle*manual | Buick | | 1 | 18.1598 | 2.1227 | 109 | 8.56 | <.0001 |
| Vehicle*manual | Buick | | 2 | 17.9743 | 1.6558 | 103 | 10.86 | <.0001 |
| Vehicle*manual | Buick | | 3 | 14.9916 | 2.2615 | 113 | 6.63 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 21.3653 | 2.3542 | 103 | 9.08 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 20.5795 | 1.8527 | 106 | 11.11 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 24.3837 | 2.2295 | 105 | 10.94 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 13.5308 | 2.0819 | 101 | 6.50 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 17.9967 | 1.7135 | 104 | 10.50 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 19.7658 | 2.0024 | 104 | 9.87 | <.0001 |

## Appendix B4.15: Decision Time – ACC

The Mixed Procedure

| Model Information | |
|---|---|
| **Data Set** | WORK._TMP_0 |
| **Dependent Variable** | decisiontimeresponse |
| **Covariance Structure** | Compound Symmetry |
| **Subject Effect** | Part |
| **Estimation Method** | REML |
| **Residual Variance Method** | Profile |
| **Fixed Effects SE Method** | Model-Based |
| **Degrees of Freedom Method** | Satterthwaite |

| Class Level Information | | |
|---|---|---|
| **Class** | **Levels** | **Values** |
| **Part** | 101 | BB1 BB10 BB2 BB3 BB4 BB5 BB6 BB7 BB8 BB9 BI1 BI3 BI4 BI6 BI7 BI8 BI9 BV1 BV10 BV2 BV3 BV4 BV6 BV7 IB1 IB2 IB4 IB5 IB7 IB8 IB9 II1 II2 II3 II4 II6 II7 II8 II9 IV1 IV10 IV3 IV4 IV6 IV7 IV8 IV9 NB1 NB2 NB3 NB4 NB5 NB6 NB7 NB8 NB9 NI1 NI2 NI3 NI4 NI5 NI6 NI7 NI8 NI9 NV1 NV10 NV11 NV2 NV3 NV4 NV5 NV6 NV7 NV8 NV9 VB1 VB2 VB3 VB4 VB5 VB6 VB7 VB8 VB9 VI1 VI2 VI3 VI6 VI7 VI8 VV1 VV10 VV11 VV3 VV4 VV5 VV6 VV7 VV8 VV9 |
| **Item** | 7 | 5 15 21 27 30 34 38 |
| **Vehicle** | 3 | Buick Infiniti Volvo |
| **Phase** | 3 | 1 2 3 |
| **manual** | 3 | 1 2 3 |

| Dimensions | |
|---|---|
| **Covariance Parameters** | 2 |
| **Columns in X** | 37 |
| **Columns in Z** | 0 |
| **Subjects** | 101 |
| **Max Obs Per Subject** | 12 |

| Number of Observations | |
|---|---|
| Number of Observations Read | 683 |
| Number of Observations Used | 683 |
| Number of Observations Not Used | 0 |

| Iteration History | | | |
|---|---|---|---|
| Iteration | Evaluations | -2 Res Log Like | Criterion |
| 0 | 1 | 5048.64641321 | |
| 1 | 2 | 5007.37626256 | 0.00000001 |
| 2 | 1 | 5007.37623518 | 0.00000000 |

Convergence criteria met.

| Covariance Parameter Estimates | | |
|---|---|---|
| Cov Parm | Subject | Estimate |
| CS | Part | 19.6565 |
| Residual | | 87.0492 |

| Fit Statistics | |
|---|---|
| -2 Res Log Likelihood | 5007.4 |
| AIC (smaller is better) | 5011.4 |
| AICC (smaller is better) | 5011.4 |
| BIC (smaller is better) | 5016.6 |

| Null Model Likelihood Ratio Test | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 1 | 41.27 | <.0001 |

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effect** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| **Phase** | 2 | 576 | 45.29 | <.0001 |
| **Vehicle** | 2 | 115 | 7.11 | 0.0012 |
| **manual** | 2 | 116 | 0.40 | 0.6710 |
| **Vehicle*Phase** | 4 | 575 | 4.93 | 0.0006 |
| **Phase*manual** | 4 | 576 | 0.63 | 0.6405 |
| **Vehicle*manual** | 4 | 91 | 0.53 | 0.7109 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Effect** | **Vehicle** | **Phase (pre-startup, startup, enroute)** | **1=same, 2=diff, 3=no** | **Estimate** | **Standard Error** | **DF** | **t Value** | **Pr > \|t\|** |
| **Phase** | | **1** | | 18.5369 | 1.0906 | 554 | 17.00 | <.0001 |
| **Phase** | | **2** | | 16.8167 | 0.7166 | 199 | 23.47 | <.0001 |
| **Phase** | | **3** | | 10.2569 | 0.7217 | 204 | 14.21 | <.0001 |
| **Vehicle** | **Buick** | | | 16.5574 | 1.0575 | 115 | 15.66 | <.0001 |
| **Vehicle** | **Infiniti** | | | 11.8541 | 1.1205 | 111 | 10.58 | <.0001 |
| **Vehicle** | **Volvo** | | | 17.1990 | 1.0370 | 120 | 16.59 | <.0001 |
| **manual** | | | **1** | 14.4003 | 1.1383 | 110 | 12.65 | <.0001 |
| **manual** | | | **2** | 15.4521 | 0.9196 | 116 | 16.80 | <.0001 |
| **manual** | | | **3** | 15.7581 | 1.1483 | 121 | 13.72 | <.0001 |
| **Vehicle*Phase** | **Buick** | **1** | | 20.5047 | 1.8443 | 549 | 11.12 | <.0001 |
| **Vehicle*Phase** | **Buick** | **2** | | 17.9384 | 1.2161 | 195 | 14.75 | <.0001 |
| **Vehicle*Phase** | **Buick** | **3** | | 11.2290 | 1.2289 | 202 | 9.14 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **1** | | 11.2702 | 1.9121 | 527 | 5.89 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **2** | | 16.0197 | 1.3106 | 198 | 12.22 | <.0001 |
| **Vehicle*Phase** | **Infiniti** | **3** | | 8.2725 | 1.3079 | 198 | 6.33 | <.0001 |
| **Vehicle*Phase** | **Volvo** | **1** | | 23.8356 | 1.8584 | 570 | 12.83 | <.0001 |

| Least Squares Means | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Effect | Vehicle | Phase (pre-startup, startup, enroute) | 1=same, 2=diff, 3=no | Estimate | Standard Error | DF | t Value | Pr > \|t\| |
| Vehicle*Phase | Volvo | 2 | | 16.4921 | 1.1765 | 194 | 14.02 | <.0001 |
| Vehicle*Phase | Volvo | 3 | | 11.2691 | 1.1918 | 202 | 9.46 | <.0001 |
| Phase*manual | | 1 | 1 | 16.3897 | 1.9576 | 535 | 8.37 | <.0001 |
| Phase*manual | | 1 | 2 | 19.7712 | 1.6267 | 559 | 12.15 | <.0001 |
| Phase*manual | | 1 | 3 | 19.4497 | 2.0579 | 569 | 9.45 | <.0001 |
| Phase*manual | | 2 | 1 | 16.3537 | 1.3302 | 198 | 12.29 | <.0001 |
| Phase*manual | | 2 | 2 | 16.5128 | 1.0622 | 200 | 15.55 | <.0001 |
| Phase*manual | | 2 | 3 | 17.5837 | 1.3098 | 198 | 13.42 | <.0001 |
| Phase*manual | | 3 | 1 | 10.4576 | 1.3336 | 199 | 7.84 | <.0001 |
| Phase*manual | | 3 | 2 | 10.0722 | 1.0639 | 201 | 9.47 | <.0001 |
| Phase*manual | | 3 | 3 | 10.2408 | 1.3319 | 211 | 7.69 | <.0001 |
| Vehicle*manual | Buick | | 1 | 17.4443 | 1.8517 | 101 | 9.42 | <.0001 |
| Vehicle*manual | Buick | | 2 | 16.0099 | 1.4958 | 109 | 10.70 | <.0001 |
| Vehicle*manual | Buick | | 3 | 16.2180 | 1.9785 | 106 | 8.20 | <.0001 |
| Vehicle*manual | Infiniti | | 1 | 9.7734 | 2.0642 | 99.5 | 4.73 | <.0001 |
| Vehicle*manual | Infiniti | | 2 | 12.6594 | 1.6314 | 102 | 7.76 | <.0001 |
| Vehicle*manual | Infiniti | | 3 | 13.1296 | 1.9721 | 103 | 6.66 | <.0001 |
| Vehicle*manual | Volvo | | 1 | 15.9833 | 1.8520 | 101 | 8.63 | <.0001 |
| Vehicle*manual | Volvo | | 2 | 17.6870 | 1.5395 | 108 | 11.49 | <.0001 |
| Vehicle*manual | Volvo | | 3 | 17.9266 | 1.8232 | 113 | 9.83 | <.0001 |

## *Appendix B5: Group Discussion Summary*

This appendix summarizes the findings of the group discussions that were conducted with study participants after the experiment portion of the study. The experimenter moderated an unstructured discussion to learn more about participants' reactions to the displays and controls that they experienced, and to better understand the reasons that certain elements were confusing or clear to participants. The summary is organized by the vehicle displays to which participants were exposed. Each section includes images of displays or controls relevant to the feature that is being discussed. For full images of all vehicle interiors, see Appendix B1.

### Infiniti

*Forward collision warning*


Many participants did not realize that the acronym FCW means forward collision warning, and therefore had trouble figuring out how to turn the FCW system on and off. Participants also wondered why the FCW and LDW features shared a button. Many were confused as to whether the amber color of the button's indicator light mean that the system was on and working, or not functioning correctly. Many suggested that the button should illuminate green if the system is on and working properly. Participants also noted that there was no dashboard indicator to show whether the FCW system was on, so most assumed that the system was working correctly unless there was a dashboard indication to the contrary. Most participants were also unsure whether or not the FCW system will automatically brake the vehicle if a crash is imminent.

*Lane departure warning and prevention*


Most participants understood that the orange LDW icon on the dashboard meant that the LDW system was turned on, but not functioning properly. Very few participants, however, realized that when the icon was green that it indicated that the LDP feature was active. In fact, few participants were aware that the vehicle had a LDP feature. None of the vehicle's controls or displays clearly indicates the presence of this feature to drivers without prior knowledge of the vehicle, and because this feature was not available in the other vehicles used for this study, participants would only have

been aware of the presence of the feature by reading the vehicle's quick start guide or manual. Even so, most participants who read the quick start guide before their session still did not recall that the vehicle had a LDP feature in addition to LDW.

The button to turn LDW on and off also confused many participants. Unless participants understood the meaning of the LDW acronym, they were unlikely to realize the function of the button. Most participants felt that an icon would be easier to understand than the LDW acronym. Further confusion arose because of the amber color of the indicator light on the button. Many participants were unsure whether the light meant that the LDW feature was on, or whether the color might indicate a malfunction.

Participants overwhelmingly agreed that the LDP on/off button on the steering wheel does not adequately indicate the LDP feature. Many participants wondered why the icon on the button bears no resemblance to the dashboard icon, and why the LDP and LDW buttons are in different locations rather than in the same place. Participants felt that the dashboard icon was much clearer than the LDP button icon. Some participant also noted that the button icon seems to indicate some type of 360-degree protection around the vehicle, an impact sensor, or blind spot information system. One participant suggested that the LDP button should glow green when activated to match the dashboard icon.

*Cruise control*




While all participants realized that this vehicle had cruise control, many did not realize that it also included ACC, or did not understand how ACC differs from typical cruise control. For instance, one participant thought that ACC will slow the vehicle when necessary, but that it will not automatically accelerate again when possible. Many participants were confused about cruise control status. Participants were often unsure of the distinction between the word CRUISE on the dashboard LCD display and the same word illuminated in orange just above the LCD display. The orange color of the word CRUISE made some participants wonder if it is indicating that the system is not functioning correctly. Many participants were also unsure whether the word SET and the icon below it meant that cruise control is currently set, or that it is available to be set. Many participants were confused by the ACC distance setting icon below the word CRUISE. One participant stated that it looks like a table lamp. Some participants also noted that the ACC button on the steering wheel shows a car above the distance settings, whereas the dashboard icon does not, and that the dashboard icon would be clearer if it also showed the car icon. Many participants did not understand the icon on this button; some guessed that it indicated a rear sensor on the vehicle, or perhaps emergency brake assist, or traction control.

Participants also had some generally criticisms of the display area between the speedometer and the tachometer. Some participants noted that the space is crowded with information. Some did not like the red and black color scheme.

*The black buttons to the left of the steering wheel.*


Nearly all participants disliked the design of this set of buttons. Most participants did not know what the acronyms on these buttons meant, nor were many able to venture guesses that were on the right track. One participant said that the acronyms reminded him of airport codes. A few participants were able to guess the meanings of FCW (forward collision warning) and LDW (lane departure warning) based on their experience during the study, but almost none were able to figure out the meanings of IBA, VDC, and DCA. Some participants noted that the acronyms might make more sense if they were standardized across vehicles. Many participants noted the different styles of the buttons: one has a light, two read "off," and the DCA button (shown in a different photo) has neither. The amber color of the light on the FCW LDW button confused many participants. While the presence of the light seemed to indicate that the feature was turned on, many participants wondered if the amber color of the light might actually indicate that the feature is off or not working properly. A few participants concluded that the amber light meant that the feature was on because red was a dominant color in the vehicle's display scheme. Many participants were confused by the blank buttons, though some realized that they were placeholders for features not available in this car. Some participants felt that the low position of these buttons would encourage drivers to take their eyes off the road in an unsafe way, while others felt that this was appropriate because these are buttons that are probably not often used. One participant felt that the low button position was fine as long as the buttons are associated with status indicators on the dashboard.

*Other features*. Some participants commented that they did not like that red was a dominant color in the dashboard display because red is typically a warning color. The prevalence of red information could make actual red warnings less noticeable. Some participants thought that the airbag on/off indicator meant that the airbag could be turned on and off by occupants.

*Other confusions*. Some participants assumed that this vehicle had a "hidden sight alert." Many of these individuals thought that the LDW icon on the dashboard was related to blind spot because it appeared to show a car changing lanes, indicating that there is some lack of clarity regarding what

the icon shows. One participant further thought that the hidden sight system included a rear backing camera. This confusion may have been related to the term "hidden sight" which was used instead of "blind spot" to describe the feature.

*Quick reference guide and manual.*

Participants generally agreed that reading the Infiniti quick reference guide helped them to understand what features were present in the vehicle, though many participants were still unsure which features the vehicle had, and stated that the guide did not do a particularly good job of making features understandable. Some participants thought that the quick reference guide indicated that system status information would be shown in the large LCD screen. Some participants, however, acknowledged that this vehicle had so many novel features that it would be impossible to understand it all just by reading about them; it takes time driving with the car to really get used to the features.

*Overall impressions.*

Many participants noted that this vehicle has many more controls and displays than their own vehicles have. Some were overwhelmed by the number of features. One participant said that he felt "like a guy on a spaceship." Another said that "There's too much!" and that she doesn't want to have a car that tells her what to do. Regarding the number of features and settings drivers have at their disposal, one participant said that "This is a luxury vehicle, but you're doing more work to use it." Some participants felt that the dashboard area was too crowded with information. One participant stated that there are too many "idiot lights" and unneeded displays, and that only driving-critical information should be displayed. On the same note, another participant stated that "You don't need to know when everything is working right. You just need to know when something is not working." Some participants, however, liked the design of the interior. One called it "elegant" and another thought that the design was nearly perfect, and that it would become easy to interact with after some time to learn how it works.

Participants disagreed about having controls on the steering wheel. Some liked having many controls on the steering wheel because it keeps them closer to the driver's line of sight, while others felt that the steering wheel was cluttered, and that it would be too easy to accidentally press buttons on the wheel.

One participant suggested that this vehicle needs "more of a minimalist approach." One participant suggested putting all vehicle controls in a large touch screen display so all features can be accessed in the same location. Another participant suggested reducing the size of the speedometer and tachometer to make more room for other indicators. Other suggestions included an in-vehicle tutorial mode to help drivers get oriented to the features, and voice feedback to indicate the status of vehicle features. Despite these critiques, many participants said that they could get used to the vehicle displays and controls if they had some time to experience driving it.

## Volvo

*Forward collision warning*


Most participants correctly identified the FCW button, but there were some confusions. Some participants thought that the button might refer to ACC because it shows a gap between two cars, and because it shows a two-way arrow that looks the same as the time setting button for ACC. One participant thought that the button was for a backing camera because the icon looks like it could be one car backing toward another. A few participants also wondered what the letter "i" means, and if it is related to the blue "i" that appears on the dashboard. While some participants were not sure if FCW was active and available because there was no dashboard indication, most assumed that the system was working properly as long as there was no indication to the contrary.

Most participants assumed that FCW would not automatically brake the vehicle, but few were certain about this. One participant thought that the "auto brake was activated" message on the dashboard meant that ACC automatically slowed the vehicle.

*Lane departure warning and prevention*


Most participants were able to identify the LDW button by its icon, though some thought that the LDW icon might also refer to the blind spot warning because it appears to show a car changing lanes. One participant thought that the LDW button had something to do with traction control because it looked like a car losing control.

*Cruise control*


Most participants were able to locate the cruise control buttons on the steering wheel, though many were confused about what the buttons actually do. A few participants, however, noted that they did not initially recognize the controls because they are accustomed to the cruise control features being

located on a stalk near the steering wheel. A few participants also thought that the ACC controls might be related to FCW. Some participants found it difficult to figure out whether cruise control was working correctly because of the lack of dashboard indications. In fact, the ACC feature was not activated during study, so participants did not see any indications other than the roadway icon inside the speedometer that represents the ACC time interval setting. Few participants initially recognized it as a roadway icon at all. The image reminded one participant of an "old-school video game." Some participants thought that the icon was related to FCW. After being told that the icon is related to ACC, one participant guessed that it indicated whether the road ahead was clear enough to use cruise control. Once participants were told that the icon's bars represent car-following time, many commented that they did not like the use of bars because it did not give a concrete sense of following distance. One said "What does it mean that I'm three lines away [from the car ahead of me]?" Another said "The picture doesn't tell you enough." It is noteworthy that many participants assumed that the bars represented distance rather than time, which might lead to an incorrect understanding of how ACC functions. It is possible that a different representation of following time might help people to conjure a more accurate mental model. Some participants suggested that actual following distance/time be reported in numbers, while some others suggested that some indication of the safety of the following distance should be shown (e.g., red for short following times, green for long following times) to help drivers understand the implications of the options. One participant felt that the icon would be clearer if it showed a car on each end of the bars. One participant also wondered if the following time is reset to a default for every drive; he felt that this would be a good idea because if the vehicle has more than one driver, one driver might leave the following time too short for the other driver's comfort. Some participants also thought that the trip odometer number was somehow related to the following time setting because of their proximity on the dashboard.

Most participants were able to identify the location of the ACC controls on the left side of the steering wheel, but some were confused about the functions of the controls. Many participants correctly identified the top right button as the one that sets cruise control to standby mode, but others were confused. Some recognized that the button showed a speedometer and a car, but did not associate this with cruise control. Some thought the icon showed a clock. A few participants suggested using the word "cruise" instead of the icon for this button. Many participants did not know that the two buttons with the double-sided arrows increased or decreased following time. When this was explained to participants, some suggested that the icons would better fit their mental models if the arrows pointed up-down rather than left-right, and some suggested that a car icon should be shown at one or both ends of the arrow to indicate that it represents the distance between two cars. Some participants were also confused because the button used to decrease following time has arrows pointing outward, which seems to indicate an increase in following time.

*Blind spot information system*


Participants overwhelmingly agreed that the acronym BLIS is difficult to figure out, particularly for people who are unfamiliar with this vehicle. Some participants assumed that the LDW button was the one that activated BLIS because it seemed to show a car changing lanes. Many noted that BLIS

is not a logical acronym for "blind spot information system." One suggested that BSIS would be more logical. Nearly all participants, however, would prefer an icon on the button rather than the acronym. Participants were not sure why an acronym was used given that the other advanced feature buttons adjacent to it use icons, and the BLIS indicators next to the side mirrors show icons in addition to the acronym. A few participants thought that BLIS would provide warnings about blind spots behind the car as well, perhaps because of the generic term "hidden sight system" that was used to describe this feature.

Most participants reacted positively to the BLIS indicators on the side view mirrors. They felt that the location of the light was good because drivers will see it when they look at their side mirrors, and because it avoids adding more information to the dashboard and console which are already crowded. A few participants suggested putting the light on the mirror itself and one suggested moving the light closer to the side mirror, but still inside the vehicle. A few also thought that the alert could be placed on the dashboard. Another said that the light would have to be bright to be noticeable on a bright day. Another participant was concerned that if the BLIS light illuminates often on a busy road that she, as the driver, might start to ignore it. She felt that using BLIS "is almost like taking the intelligence from the driver." Participants generally agreed that they would not rely on BLIS and would continue to check their blind spots before changing lanes.

*Other features*

Many participants liked the smart key technology that can be used for each driver of a vehicle to preserve all of their preferred settings. Participants found this especially useful in this Volvo because there are so many safety, comfort, and convenience features that can customized.

No participants initially understood the meaning of the button to the right of the BLIS button, which lowers the rear headrests to improve rear visibility. Many participants said that this button is out of place adjacent to the other safety features.

*Other confusions*

Nearly all participants realized that a green light illuminated on a button meant that the feature was turned on, but not necessarily that it was functional, and that a "service required" messages on the dashboard indicates that the feature is not functioning correctly, even if it is turned on. One participant suggested that the light on a system's on/off button should turn red if the feature is unavailable or not functioning properly. Another participant suggested that there should be a dashboard icon for each safety system so drivers can more easily tell whether a feature is on or off.

While most participants found the "service required" messages on the dashboard for the various features to be clear, some participants noted that "service required" does not actually indicate whether or not the system is currently functioning. The message could just mean that the feature could use a tune-up, or that some aspect of it needs service but the system as a whole is functioning. One participant drew an analogy to an oil change: if you are overdue for an oil change, then your vehicle requires service, but it is still operating properly. Some participants also wondered what would happen if more than one vehicle feature required service: would multiple messages be shown on the dashboard or would the second message not be shown until the first service condition is remedied? One participant was also confused because the punctuation and formatting of the message "Blind spot syst. Service required" seemed to suggest that there were two separate messages separated by a period.

Many participants did not initially realize that the "i" icon in the center of the dashboard is related to the service messages. One participant said that "It makes you nervous but provides no other information." Some participants also wondered why the "i" icon was used to draw attention to the service messages, because the service messages themselves were large, clear, and attention-getting. One said that the "i" actually "competes" with the service messages for attention.

One participant suggested that rather than showing a message to indicate that a system is not functioning properly, there should be one location that shows the current status of all vehicle safety systems.

*Quick guide and manual*

The Volvo quick guide is shorter than the quick guides for the other two vehicles used in this study, and does not include any information about the advanced features that were the focus of this study other than a short paragraph about fault conditions for the BLIS system.

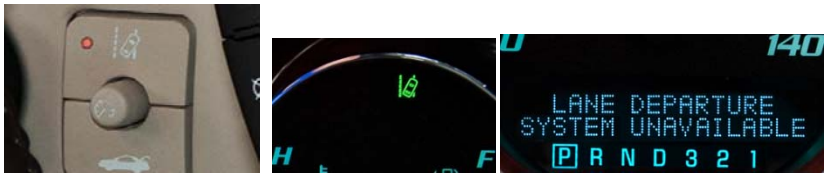
*Overall impressions*

Although many participants were initially overwhelmed by the number of controls and displays in the vehicle, most participants felt that, overall, the controls and displays were nicely designed and that they could get used to them with some practice. One said that he would have to read the manual to fully understand everything because "You're dealing with a computer system now." Similarly, another participant said that all the features in this vehicle might appeal to "techies," but that she herself would probably ignore and not use many of the advanced features. A few participants felt that the number of controls and displays in the car could lead to distraction (e.g., "[The features are] there for safety, but I think they will cause safety problems"). Another thought that this car had so many warning systems that the driver would be receiving alerts constantly. A few participants were also concerned that with so many electronic features, that there are more opportunities for components to fail and need repair.

A few participants noted that the controls for FCW, LDW, and BLIS were positioned low and very close to the climate controls, which might cause drivers to accidentally press the wrong button, and suggested that the safety system controls might be placed slightly lower to reduce the risk of accidental button presses. A few participants did not like having so many controls on the steering wheel and were concerned about accidental button presses. A few participants also felt that the dashboard area was too cluttered, and that some information such as outside temperature and vehicle gear state do not need to be there. One tall participant also noted that because of his height, his vision of the dashboard is often blocked by the steering wheel, so he does not like when important information is shown on the dashboard. Some participants also felt that the climate controls took up too much space on the console, particularly because of the large image of the seated occupant.

## Buick

*Lane departure warning system*




Most participants were able to locate the button to turn the LDW system on and off, and recognized that when the light on the button was on, the system was turned on, though some participants thought that the button might control the SBZA or park assist feature instead. Many participants did not like the location of the LDW button because it was physically separated from similar features and because it was collocated with unrelated controls (interior light control and trunk open). Most participants recognized that the system was functioning properly when the green LDW dashboard icon was illuminated, but none realized that the icon would only appear when the vehicle is travelling at a minimum speed. Some participants noted that they did not like the icon's location in the dashboard because it is in a place where system error and warning messages are usually shown, so seeing an icon appear there would be distracting and worrying. Participants acknowledged that the green color of the icon helps to distinguish it from red warning messages.

*Side blind zone alert*


No participants were able to figure out how to turn the SBZA system on or off because there is no direct control for the system; it is one of multiple features controlled using the driver information center controls to the left of the dashboard, which itself was poorly comprehended by participants. Participants were also unsure how to tell if the system is on or not. Participants had mixed feelings about the alert on the mirror. Some liked the location, but others felt that it might be hard to see on a bright day, if there is glare on the mirror, or if ice and snow are covering the mirror. Some also noted that not all drivers check their mirrors before changing lanes, so they might not see the alert. One thought that the icon was not conspicuous enough and suggested an exclamation point inside a triangle instead. Others thought that it would significantly add to the cost to replace a damaged mirror. A few thought that the icon might be too hard to see and suggested the addition of an audible beep when the system detects a vehicle in the blind spot. Some participants suggested that the alert should be moved to the dashboard area.

*Driver information center controls*

No participants figured out the meanings or uses of the driver information center buttons to the left of the dashboard. Some participants thought that the button on the left was related to FCW or LDW. One participant thought that the second button from the left showed a person standing next to a car (it is actually a small "i" next to the car). Another participant noted that there is also an "i" on the audio system controls, which led her to believe that these two buttons were somehow related. A few participants thought that the two buttons on the right with the check marks seemed to indicate something related to voting. After the experimenter explained the meanings and uses of these buttons, some participants felt that it is a decent interface, but very unintuitive for a novice user (e.g., "I couldn't get in the car and automatically know what to do with it"). Many participants also felt that it did not make sense to have to cycle through multiple features to set an option or check a system's status, but some felt that younger or more technologically-oriented individuals might like this interface.

*Cruise control*


Some participants were unsure whether the cruise control was turned on during the study, noting that they never saw the light below the cruise control button illuminate. Most participants were confused about the button with the steering wheel and wavy lines. Some guessed that it might be related to skid prevention, lane departure warning, or have something to do with wind. Some participants were also unsure about the meaning of the cruise control cancel button (circle with the "X" through it).

*Overall impressions*

Some participants felt that the dashboard was poorly arranged with various displays placed with no clear organization. They noted that safety and convenience information were intermingled and that a simpler, more organized display would be better. Participants generally felt that system status displays were presented effectively using text on the dashboard.

## Overall findings

A number of themes emerged across all vehicles during the group discussions. Many participants expressed frustration with unfamiliar icons and acronyms. Participants noted that they had little trouble understanding the symbols that are common across vehicles, but had substantial trouble understanding some of the novel icons used in the study vehicles. Some participants suggested that icons should be supplemented by text to maximize comprehension. Few of the icons and acronyms that were new to participants were understood. Many participants suggested that universal symbols should be developed that can be used in all vehicles to aid in comprehension.

Many participants also noted that their own personal cars do not have nearly as many controls and displays, or any of the advanced features, found on the vehicles in this study. While many were initially overwhelmed by study vehicles' interiors, most said that their comprehension of the features increased during the course of the study as they were exposed to more features and displays

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