



AAA CENTER FOR DRIVING SAFETY & TECHNOLOGY



2018 MAZDA CX-5 GRAND TOURING



INFOTAINMENT SYSTEM* DEMAND RATING

Very High Demand



The 2018 Mazda CX-5 Mazda Connect infotainment system* placed very high demand** on drivers in the study. Drivers' eyes were often diverted from the forward roadway, generating high visual (eyes-off-road) demand across all tasks.

Standard and Optional Features in the 2018 Mazda CX-5

○ Optional

● Standard

	Sport	Touring	Grand Touring
Android Auto			
Apple CarPlay			
Mobile App Support			
Text Messaging	●	●	●
Navigation		○	●
Touch Screen	●	●	●
Gesture Control			
Heads-Up Display			
Voice Commands	●	●	●
Console Control	●	●	●

ABOUT THE STUDY

Researchers evaluated 2017 & 2018 vehicles' infotainment systems* to measure overall demand** placed on a driver when using voice command, touch screen and other interactive technologies to make a call, send a text message, tune the radio or program navigation, all while driving.

STRENGTHS

- When the vehicle is in motion, text message content is replaced by a safety message.

WEAKNESSES

- Voice commands and center console controls placed very high overall demand on drivers.
- Visual feedback on the center stack display diverts drivers' eyes from the forward roadway.

+* Infotainment System: Vehicle system that combines entertainment and information content

** Overall demand measured: visual (eyes-off-road), cognitive (mental), and time-on-task

+ Compared to a recommended maximum of 24 seconds

^ Researchers with expertise about how humans interact with technology evaluated the usability of the infotainment system in stationary vehicle

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INFOTAINMENT SYSTEM

The 2018 Mazda CX-5 Mazda Connect In-Vehicle Infotainment System offers the following features:

CALLING AND DIALING



Phones and Bluetooth devices can be paired to the 2018 Mazda CX-5 Mazda Connect system using the rotary wheel while the vehicle is in park. If the driver tries to pair a phone using the voice command system or attempts to use phone functions before a phone is paired, the system will prompt the driver and facilitate the phone pairing process. A new phone cannot be paired while the vehicle is in motion.

Drivers can call contacts and dial numbers using the voice command system as well as the rotary wheel. Limited phone functions can be accessed using the steering wheel, such as call pickup, hang-up and call history.

Overall, using voice commands and the rotary wheel both placed high levels of demand on drivers. Center console tasks took an average of 19 seconds⁺ while placing calls using the voice commands averaged 21 seconds⁺. Cognitive (mental) demand was very high during phone interactions, regardless of the method used to place the calls. Frequent errors in interpretation increased the attention needed from drivers when dialing numbers via voice commands.

TEXT MESSAGING



The system allows the driver to read and respond to text messages on a connected phone via the touch screen and rotary wheel when the vehicle is stationary. The rotary wheel can select text messages from the communication menu to view and reply to. When the vehicle is in motion, the message content is replaced by a safety message. However, drivers can use the voice command system or center console controls to have text messages read aloud to them. The driver can reply to messages in the inbox by selecting from 15 predefined message responses, all of which are customizable. Up to three messages can be selected and combined to complete a suitable reply.

When used to send text messages, the center console placed high demand on drivers for an average of 24 seconds⁺. High cognitive (mental) demand was generated while sending text messages, as the ability to combine multiple responses into a single response required extra steps and focus. Unlimited access to the inbox, a large collection of potential responses and the safety warning that replaced message content when in motion (often longer than the message itself) diverted drivers' eyes from the road, requiring high levels of visual (eyes-off-road) demand while scrolling through options.

Similar levels of visual demand were generated while using the voice commands, as drivers were presented with the same inbox view and preset options to scroll through. Drivers were placed under very high cognitive demand when replying to text messages using voice commands. This difference may have been exacerbated by the layered interaction process, which required drivers to reactivate the voice recognition system multiple times to complete the process. It was very difficult for drivers to correct mistakes, often leading them to restart the task if a command was misheard or given incorrectly. In addition to placing drivers under high visual demand and very high cognitive demand, replying to messages using voice commands averaged 49 seconds⁺.

AUDIO ENTERTAINMENT



Audio entertainment functions can be accessed in a variety of ways in the 2018 Mazda CX-5. The voice command system and center console controls provide access to two USB connections, Bluetooth Audio and auxiliary connection, along with FM, AM and Sirius XM radio. An audio entertainment shortcut key located near the center console controller allows the

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driver to quickly access the current audio source. The steering wheel allows the driver to cycle through songs and radio presets and use “seek” to locate stations corresponding with the current source. The touch screen can also be used to interact with audio entertainment functions, but only when the vehicle is in park.

Similar to phone functions, audio entertainment placed very high cognitive demand and high visual demand on drivers for moderate lengths of time. Voice command interactions lasted 21 seconds⁺ on average, while changing music via the center console took approximately 19 seconds⁺. The center console provides several methods to change music, all of which are nested in the audio menu. Although the system offers a shortcut to access preset radio stations, there are few ways to quickly change the music using the center console. Locating functions within the menu structure requires very high mental demand when trying to adjust the audio.

Although the Mazda Connect utilizes intuitive voice commands, very high cognitive (mental) demand is still necessary when changing the radio or selecting music from a connected media source. Researchers[^] noted this may be due to the specificity of commands, as drivers must include verbiage like “Tune to” and then the corresponding radio source. Inconsistencies in recognition abilities contributed as well, since the Mazda Connect system will understand album, artist and genre commands but cannot interpret a song title. When selecting songs from the media source, drivers must scroll through the entire song list, using the command “Page down,” which requires attention and forces drivers to search through media displayed on the screen, pulling their attention away from the roadway.

NAVIGATION



The system allows drivers to navigate to points of interest and specific locations while the vehicle is in motion. From the center console, the driver can search for points of interest and filter out search options by a specific category and location. The category menu is very large, providing the driver with many different categories and subcategories from which to choose. Search locations can be filtered by nearby points of interest or the driver can set the search area to a specific city. Once the driver has selected a category and search area, the list of available options can be sorted by proximity to the vehicle or alphabetically by name.

The voice command system utilizes a multistep, layered menu design that allows the driver to select a point of interest from a general category like “fast food” or a specific location by name (i.e., McDonald’s). Drivers can also complete manual address input via the voice command system; however, this feature, as well as the ability to filter search options by name, is only available via the center console and the touch screen while the vehicle is parked.

Completing navigation tasks via voice commands and the center console generated very high overall demand from drivers for an average of 36 seconds⁺ for both interactions. The filtering design of the navigation system was difficult for drivers to grasp and the system requirement to select “Search” after selecting a category often created confusion. Navigating the large category directory placed drivers under very high levels of cognitive load, as many of the categories were not intuitive and subcategories were located in unusual menus. For example, to locate a library, a search in the “community” category yields no match; instead, it could be found under the general “leisure” menu.

Voice commands reduced mental demand slightly, as drivers were able to say the desired category rather than looking for it. However, high cognitive (mental) demand was still required during the process. Frequent misinterpretations required drivers to sustain attention at great lengths, and a lack of visible navigation prompts forced the driver to rely on their memory. Going backward in the layered menu structure was difficult, and the system does not reset after a cancellation. As a result, drivers can become stuck in menus they do not want for prolonged periods of time. Occasionally, drivers must change to the center console controls to return home to begin a new voice interaction if they become stuck.

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VEHICLE CONTROLS AND DISPLAYS

VOICE COMMANDS

The 2018 Mazda CX-5 comes equipped with a voice command system that allows drivers to access audio entertainment, call contacts and dial numbers, send predetermined text messages, and set navigation guidance. The voice command system is initiated by an activation button on the steering wheel and plays back a female voice.

Drivers can access a help dialogue by giving the command “Help,” and command examples are displayed on the touch screen as well.

INSTRUMENT CLUSTER

The instrument cluster in the 2018 Mazda CX-5 is displayed in three large circular divisions. The left gauge displays the tachometer, gear state and standard warning lights. The speedometer and other warning lights are located in the center circle. The division on the right houses a small LCD screen, with an “info button,” that provides advanced driver assistance system (ADAS) information, trip information, service reminders, and navigation information (directions and miles left on the fuel tank).

STEERING WHEEL CONTROLS

The steering wheel features two rocking and two standard buttons on each side, which give access to IVIS functions, volume, the voice command system, phone pickup and hang-up buttons, cruise control functions, audio entertainment and the forward display.

CENTER STACK

The center stack in the 2018 Mazda CX-5 comes equipped with a 7-inch touch screen that locks the driver out while the vehicle is in motion. The home screen gives access to five menus: applications, entertainment, communication, navigation and settings. The screen always displays the connected phone information and the time in the top right-hand corner. When the vehicle is in motion, drivers must use the rotary wheel and cluster of manual buttons located in the center console to interact with the center stack display.

There are 14 buttons located below the infotainment screen which regulate HVAC functions. Two floating buttons control the driver’s and passenger’s seat temperature. Knobs on the left and right of the button cluster allow for dual temperature climate control while the driver’s temperature dial also acts as a button that turns on the auto feature, and the button on the passenger’s dial switches dual controls on and off. The two rows of buttons located between the dials are universal for both sides of the vehicle. Buttons on the top row control air flow, AC, front and rear defrost and the bottom row of buttons controls fan speed, vent direction and HVAC on/off.

CENTER CONSOLE

The center console controls in the 2018 Mazda CX-5 consist of a rotary wheel and five surrounding buttons. The rotary wheel can be rocked forward, backward, left and right to navigate through icons and menu options, while the entire

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wheel can be pressed down like a large button to make selections. The rotary wheel can also be rotated like a tuning knob to scroll or navigate menu options. The center console controls access to audio and radio presets take drivers to a navigation menu with favorite contacts and favorite navigation points of interest.

The rotary wheel is surrounded by four physical buttons and one knob. A back and home button allow the driver to navigate the menu structure, and the remaining three buttons yield access to IVIS functions: current audio entertainment (labeled with a music note), navigation options (labeled NAV) and a presets menu with favorite contacts, radio stations and destinations (labeled with a star).

VEHICLE SALES SUMMARY

The 2018 Mazda CX-5 is the 30th bestselling vehicle in the United States, with 150,622 vehicles sold during 2018¹.

¹ Source: Auto sales data and statistics at goodcarbadcar.net; – data updated to 1/4/2019

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