

Smartphone holding styles and easy-to-reach zones on mobile map apps

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Abstract:

One of the most commonly used cartographic products today is the mobile map. Despite their popularity, empirical research on how users interact with map applications is still lacking (Roth et al. 2024). The aim of this study was to determine the most popular ways users hold their devices while performing map-related tasks and to indicate the possible consequences for cartographic communication.

The data for the analysis was collected from a homogeneous group of 111 people with similar experience using maps. The respondents were between 19 and 26 years old. During the experiment, users accessed any mobile map on the screen of their personal smartphones. Allowing participants to choose their own applications and use their own devices was intended to ensure user comfort, so that the way they held the device and interacted with the map was as natural as possible. The task lasted about 3 minutes and consisted of a series of simple map-related tasks, such as changing the scale, rotating the map, finding a selected object, changing the underlying layers, and indicating their own location. The data collector observed each user's behavior, smartphone grip, and methods of interacting with the device, and recorded the results. These observations were supplemented with photographic documentation of the users' hands while performing tasks with the map application.

The collected data was used to indicate the most popular holding styles during map tasks. Four main styles were classified: one-handed, bimanual, cradled, and a fourth mixed style, with no clear commonalities. The bimanual style turned out to be the most popular, being used by most of the respondents. The next styles according to popularity are one-handed and cradled. Other methods of holding are included in the last category. It is worth noting that among women, the most popular styles are bimanual and cradled, and among men, bimanual and one-handed.

As a result of observing user behavior, the probable zones of comfortable finger reach for each of the classified holding styles of the device were determined. This range varies significantly depending on the current grip. The smallest zone is in the case of a one-handed grip. This is due to the small range of movement of the thumb, which at the same time has to stabilize the device. Access to the extreme parts of the screen is limited by the length of your finger and the risk of loss of stability, which threatens to cause the device to fall. The bimanual grip provides better stabilization, and the use of two thumbs significantly increases the touch range. However, reaching the upper parts of the screen can still be difficult. The greatest touch range is provided by a cradled grip. In this case, one hand stabilizes the device, and the other can move freely over the entire screen. Despite the long finger reach, however, it is not the most popular style among users.

Mobile maps differ from other types of applications in their interface layout. The most important element is the cartographic content, which is positioned in the center of the screen and occupies the largest area. Users can interact directly with the map and perform actions such as scaling, rotating, and selecting features. These actions are available through touch gestures, such as pinch and tap, which typically require one or two fingers. Many features are also presented on the screen as Graphical User Interface (GUI) buttons. Because the map remains the dominant element in the center, the buttons must be placed in more peripheral areas. For the most common device grips, the likely touch range covers most buttons at the bottom of the screen. However, buttons at the top are easily accessible only when using the cradled grip.

Mismatching the interfaces with the ways the device is held can make it difficult for users to interact with the map. Gestures that require multiple fingers and buttons placed outside of easy reach can hinder app usability. This may require frequent changes in grip or excessive tilting of the smartphone, which increases the risk of dropping and damaging the device (Chang et al. 2015). As a result, users may experience frustration and decreased satisfaction (Bartling et al. 2021). The extra effort and attention needed to interact with the map can also negatively affect navigation performance for people using the app in spatial situations.

How you hold your device affects the accessibility of map features. Developers should include finger reach zones on the smartphone screen to design apps and interfaces that provide greater comfort and improve User Experience (UX). The results of this study can be used to raise awareness of how users interact with smartphone map apps. This work may serve as a starting point for further research on the relationship between users and mobile maps.

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