# Vehicle HMI mid-air gestures

These gestures have been formally user tested with 42 participants specifically for our automotive demos and assessed for their usability, reliability and comfort.

Hand Tap

Using a flat hand, the user "bounces" their hand down and up with a fast motion.

Examples of actions it could be used for:

- Yes
- Confirm
- Accept
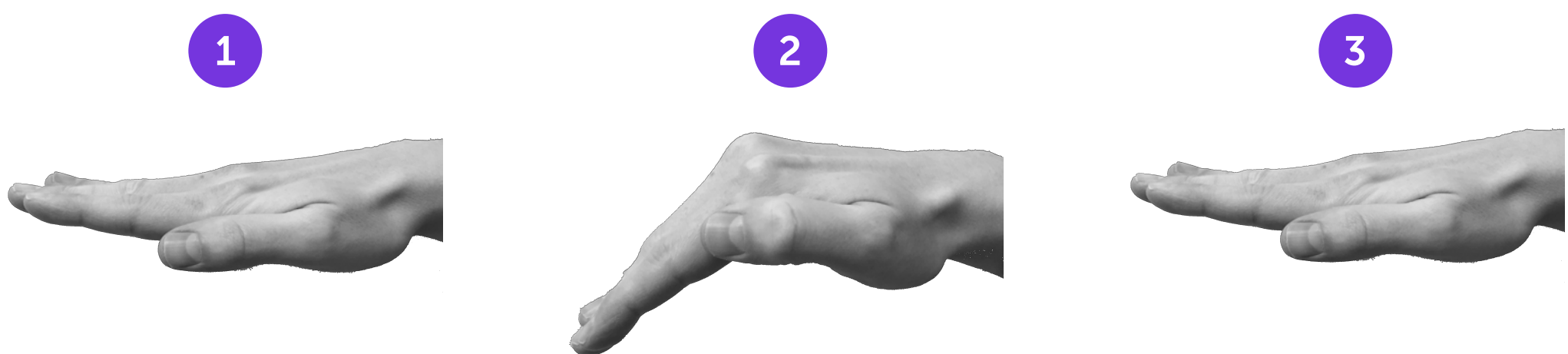- Play / Pause (Toggle)
- On / Off (Toggle)
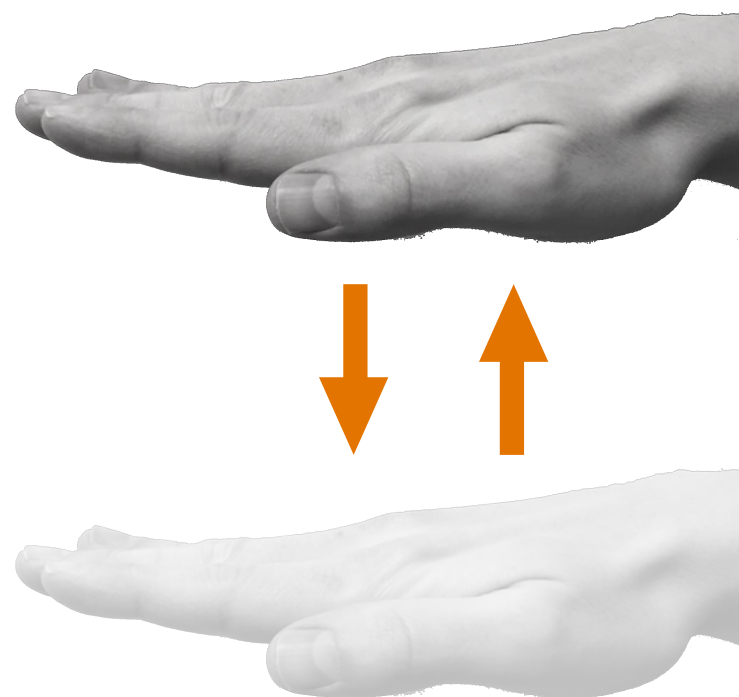
Note: This gesture is not recommended if the user controls a cursor because the downwards motion can be misinterpreted as cursor movement.

Usability: Medium | **Reliability:** Medium | **Comfort:** High

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Fingers Tap

Keeping their whole arm still, the user moves their fingers (or a single finger) down and up with a fast motion. Requires less physical effort than the Hand Tap gesture.

Examples of actions it could be used for:

- Select
- Yes
- Confirm
- Accept
- Play / Pause
- Toggle On / Off

Usability: Medium | **Reliability:** Medium | **Comfort:** Medium
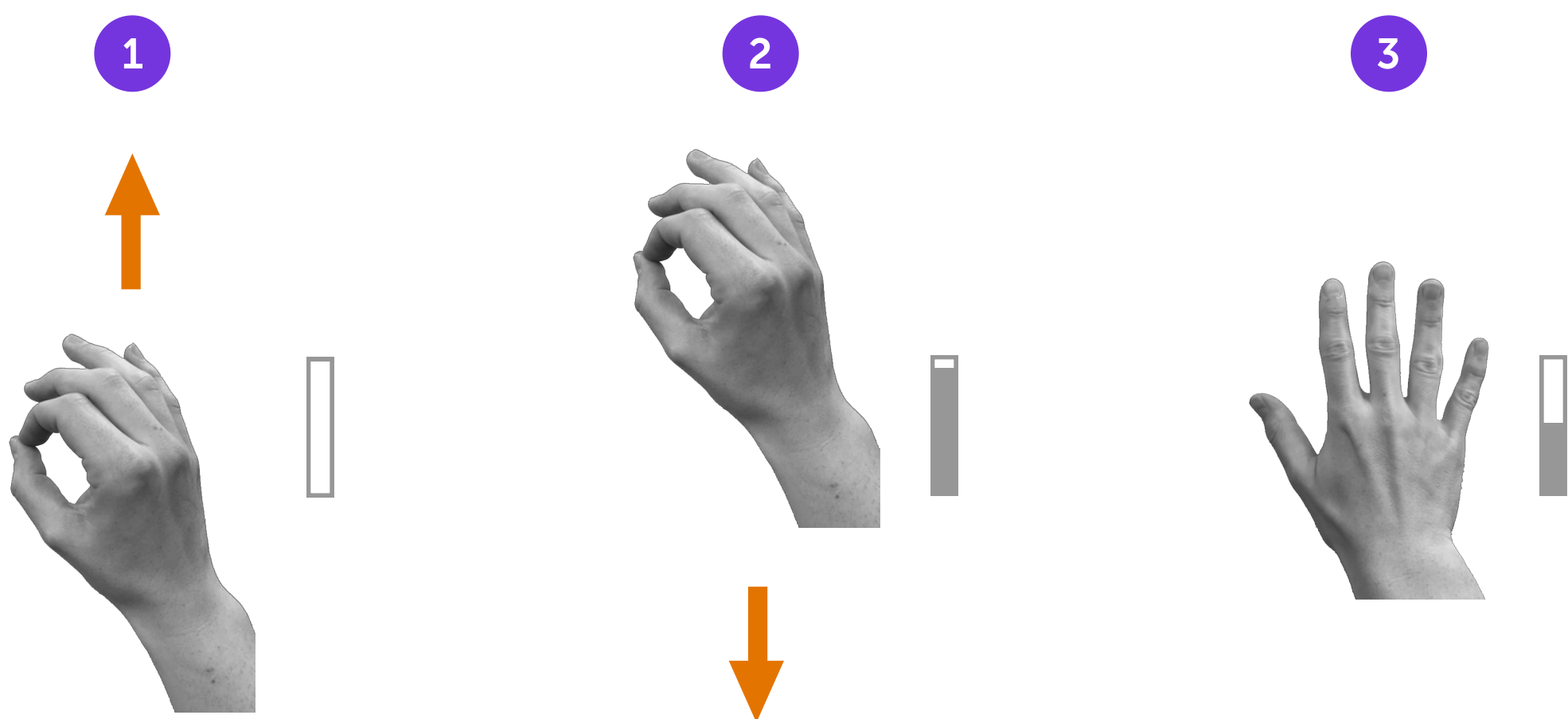
Pinch

(with arm movement)

User brings their index fingertip and thumb together whilst keeping their remaining fingers open (exposing their palm to feel mid-air haptic feedback).

It is the same as the universal sign for "OK", and can be either be held for adjusting values/objects, or performed quickly to serve as a mid-air button click for selecting an option with a cursor.

User moves their hand up whilst performing the pinch gesture to increase a value (e.g. volume), and down to decrease the value.

User opens their hand to confirm the desired value (or menu item, object position etc.).

This is just one example of movement with this gesture. User can also move their hand left/right and forwards/backwards to control sliders, cursors and objects.

Examples of actions the pinch gesture could be used for:

- Adjusting values (volume, temperature, etc.)
- Navigating a 2D or 3D menu
- Moving forwards/backwards through music or video
- Picking up and dropping objects in AR/VR
- Selecting a button that has been highlighted using a hand-controlled cursor

Usability: Medium | **Reliability:** High | **Comfort:** High

Grab-Release

User clenches their hand before opening it again. This is performed in one fluid motion.

1

2

3

Examples of actions it could be used for:

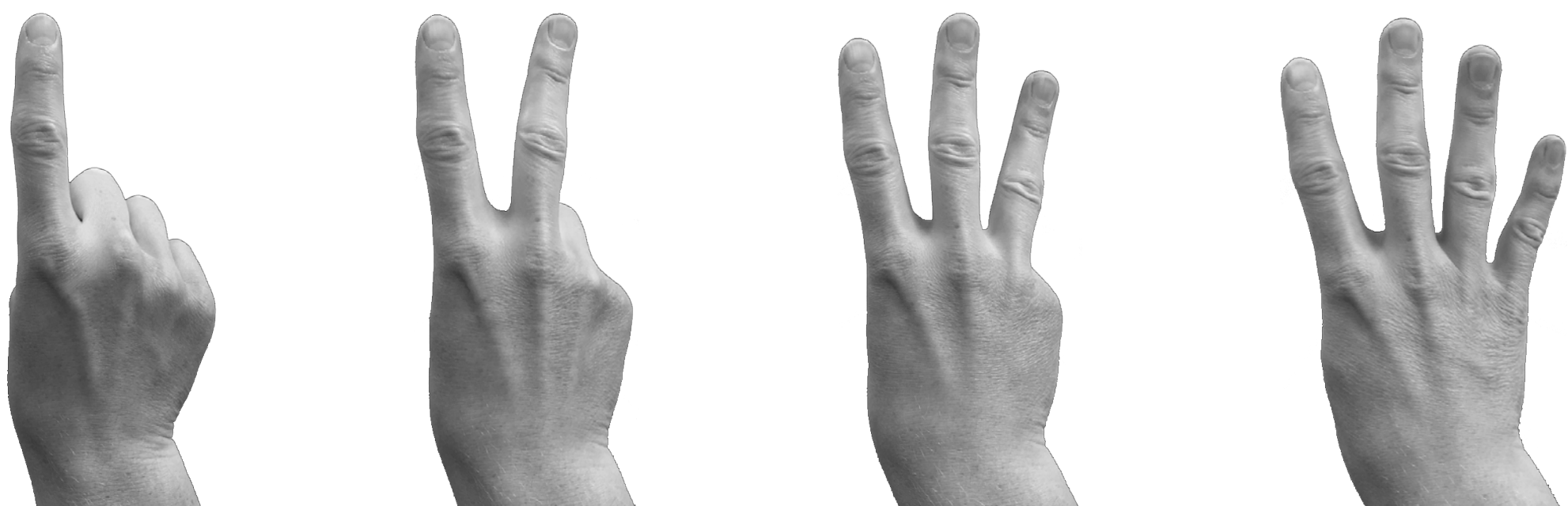- No
- Cancel
- Reject
- Close
- Reset
- Off

Usability: High | **Reliability:** Low | **Comfort:** High

Finger Poses

User simply shows a certain number of fingers to the hand tracking device. (Note that the reliability of these poses can depend on the size and shape of the user's hand.)

Examples of actions they could be used for:

- Selecting a particular feature or mode
- Choosing the desired amount of a particular item

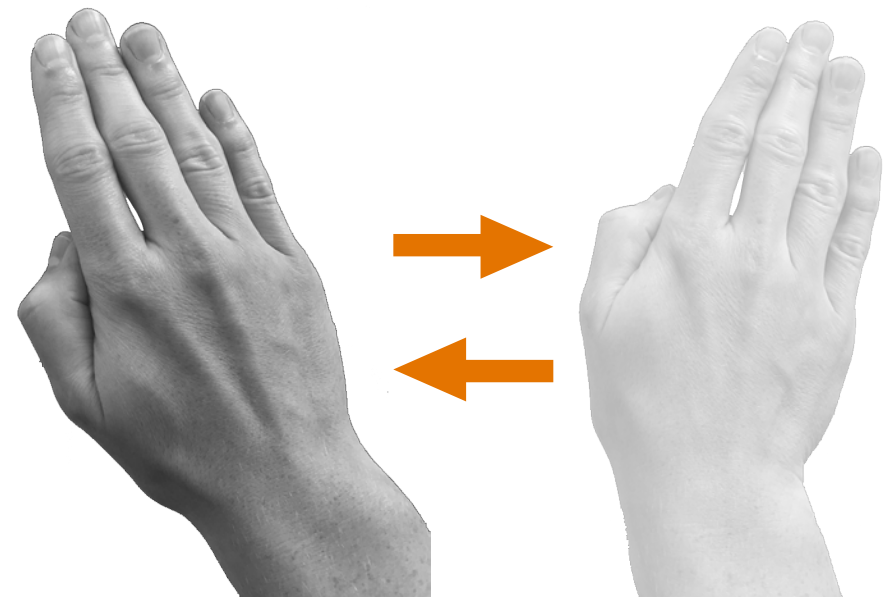**Usability:** High | **Reliability:** Medium | **Comfort:** Low

Subtle Swipe

User "flicks" their hand from left to right, then back again. The second (reverse) movement is performed as soon as the first movement has finished.

Only the forearm needs to move, rather than the whole arm.

Examples of actions it could be used for:

- Skipping a music track
- Toggling between feature modes

Usability: High | **Reliability:** Low | **Comfort:** Medium

Hand Twist

Starting with their hand open and palm facing down, user turns their hand over then back again in one fluid motion (hand rotates outwards rather than inwards).

Examples of actions it could be used for:

- Back to previous screen
- Cancel
- Go to beginning of currently playing track / video
- Play previous track / video

Usability: High | **Reliability:** High | **Comfort:** Medium

Gesture assessment summary

Terminology

Usability

Refers to how easy it is to learn, understand and remember the required form and movement of the gesture in order to perform it correctly. A gesture with high usability is considered easy to use relative to other gestures.

Reliability

Refers to the likeliness of the motion capture device correctly interpreting the gesture. A gesture with high reliability can be expected to be recognised the vast majority of the time.

Comfort

Refers to how physically difficult a gesture is to perform, and how much discomfort is experienced whilst performing the gesture. A gesture with high comfort can be performed easily with minimal effort.

Comparison

	Usability	Reliability	Comfort
Hand Tap	Medium	Medium	High
Fingers Tap	Medium	Medium	Medium
Pinch	Medium	High	High
Grab-Release	High	Low	High
Finger Poses	High	Medium	Low
Subtle Swipe	High	Low	Medium
Hand Twist	High	High	Medium

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