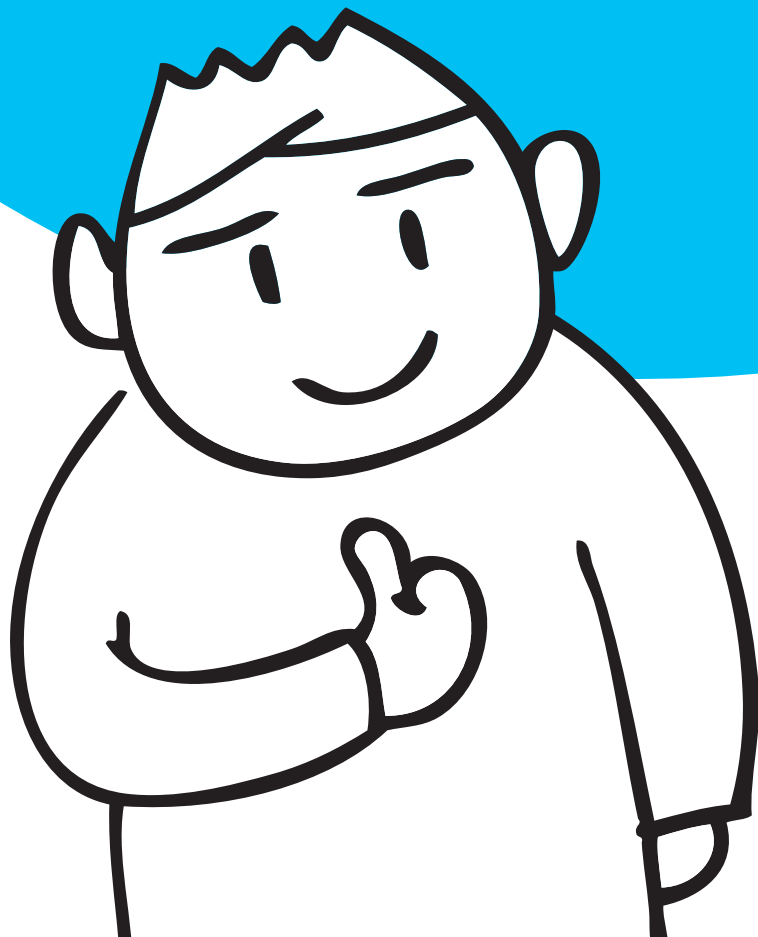


Thumbs up to gesture-controlled Consumer Electronics?

A cross-cultural study spanning 18 countries on spontaneous gesture behavior by UX Fellows



Thumbs up to gesture-controlled consumer electronics?

In just a few short years, we have all learned to use and love touchscreens. The interactions provided by touchscreens feel very natural and as the name implies involves a physical interaction with a device through touch. However, as technology continues to evolve, we are moving into an era where human-computer interactions can move beyond touch in the form of gesture control.

This type of technology has already been seen in sci-fi movies such as *Minority Report* and introduced to users through game consoles such as the Wii and Xbox Kinect. There are first-generation gesture controlled devices such as digital cameras and televisions currently available from manufacturers such as Samsung. In July 2013, the tool *Leap Motion* will be released, offering a completely new user experience based on gesture control, even for classic computers. Together, these products have the potential to trigger a wave of new gesture-based applications and programs.

Gesture control has typically been depicted as an experience where the hand (moving in three-dimensional space) replaces the mouse to control a graphical user interface, what we can call **pointing gestures**. A step beyond this is the use of what we call **semantic gestures** (i.e. gestures with an associated meaning) which are understood by machines without the need for an additional GUI.

Gestures are a natural and often unconscious aspect of our daily communication

and interaction with our friends, family and colleagues. Applying them to globally merchandized devices such as cameras and TVs potentially poses a huge challenge for user experience designers, as **gestures are presumably influenced by local cultures**. A gesture that is widely understood and acceptable in one culture may hold no meaning and/or be offensive to another. Also we know that some cultures are more predisposed to the use of gestures in their everyday communication than others.

As specialists in culture-specific user experience research, the UX Fellows network decided to investigate this interesting topic and **explore the gestures people from a variety of cultures would spontaneously use in order to control consumer electronic devices such as TVs**.

The key things we wanted to understand included:

- What are the most common gestures for typical TV-related commands?
- Do any of the chosen gestures have high international commonality? Which, if any, are particularly culture-specific?
- Do any common symbols or metaphors underpin the chosen gestures?
- Do any markets or regions differ from others? Is it possible to identify any clusters amongst regions?
- How difficult is it for potential users to imagine gestures that could be used as commands for controlling CE gestures?

About UX Fellows

UX Fellows is a network of **specialized user experience research agencies around the world**. What unites us is our enthusiasm for the digital world and our passion for hands-on, yet professional, UX research. Each partner is among the leading UX research and consulting specialists in their markets.

We have joined the forces of **23 partner companies** and established joint quality levels and processes to make global user experience and usability testing as easy as possible. Our desire to promote international UX studies propelled us to conduct this gesture study. Determined to play an integral research-based role in developing technologies, the UX Fellows team is proud to offer the support and insight that digital industries need.

The study

The UX Fellows gesture study concentrates on spontaneously generated **semantic hand gestures** for controlling typical TV functions as nominated by users. Importantly, these gestures are not associated with manipulating an on-screen menu, all gestures are intended to be independent of such an on-screen display. Pointing gestures, where users interact with a menu system where the hand is a mouse substitute were not examined.

Methodology

The study took the form of one-on-one interviews between a moderator and a participant. Each session was conducted in a room that contained a comfortable chair for the participant to be seated in and a switched off flat screen TV. Participants sat in front of the TV and were instructed to imagine that the TV was able to un-



derstand their gestures and asked to demonstrate the gestures that they would use in order to complete a series of commands associated with using the TV. The interviews took approximately 15 minutes to complete.

Participants were instructed that they could use one or both hands in order to demonstrate their preferred gestures. The moderators did not use any gestures themselves so that they could avoid influencing participants' choice of gestures. The participants were also asked to verbalize their thoughts as they imagined and produced each gesture to provide the moderator with some insight into how the chosen gestures were decided upon. Each participant was asked to assume they were using gestures to communicate in their own country, and if they felt that there was more than one possible gesture for a specific command they were instructed to choose the gesture they thought would be best understood by someone else. We told the participants that they didn't have to develop a coherent system of gestures, we were simply interested in the gestures they would choose for each command and that they were free to repeat gestures if they wanted.

Although consumer electronics (CE) gestures were of the most interest to us, we included everyday gestures as an integral part to our research. This is because:

- they warmed up the participant, helping them get into the swing of things during question time;
- we wanted to compare the similarities between everyday gestures and the gestures people would choose to control a device.

Test setting: The participant in front of a switched off TV

Examined consumer electronics commands

Our aim was to create a typical TV user journey: We asked the participant to start watching TV by switching it on, then turn the volume up or down and zap through various channels. We then asked the participant to search for a film in a video library and handle basic VOD (Video-on-demand) functions.

We increased the complexity of tasks towards the end of the session. We made sure inverted tasks (actions with direct opposites, such as changing channels up-

wards and downwards) didn't follow each other (so participants didn't necessarily use the same gesture automatically the other way around).

In addition to considering the hand gestures generated by participants, we wanted to identify how easy or difficult it was for participants to imagine them. Therefore, after participants had demonstrated their preferred gesture, we asked them to provide a rating on how easy it was to imagine (1 = Easy to 5 = Difficult). We recorded this data for both the everyday gestures and CE gestures used to control a TV.

GESTURE	INSTRUCTION
Switch on device	How would you switch on the TV?
Volume up	How do you turn up the volume?
Channel up	You are zapping through the TV programs: How do you change from channel 15 to channel 16 for example?
Context info for current program	How would you get more information for the running TV program (that is, a context information, e.g. where to find more information on the internet)
Channel down	You are zapping through the TV programs: How do you change from channel 16 to channel 15 for example?
Share current program	How would you share with your friends what you are currently watching or listening to?
Volume down	How do you turn down the volume?
Mute volume	How do you set the volume to "mute"?
Pause current program	How would you pause the current TV program?
Homepage	Now you want to go to the initial set of options - that means the first options you see when you switch on the device.
EPG (Electronic Program Guide)	You'd like to see an overview of tonight's TV programs of the main channels (EPG). How do you activate this function with a hand gesture?
Backwards navigation in menus	Imagine that you were looking for a film in an online video library. You have gone to the comedies section and have chosen the description of a single movie. Now you want to return to the previous set of options (all of the comedies). Which gesture would you use for that?
Confirm on-screen dialog (OK)	You have chosen a film from an online video library. The TV asks you "do you really want to buy the film?" How do you answer "yes"? (Pointing gestures to an on-screen popup menu were not accepted)
Deny on-screen dialog (cancel)	How do you express that you don't want to buy it? (Pointing gestures to an on-screen popup menu were not accepted)
Pause video-on-demand (VOD)	Now you are watching the film and you need to go to the kitchen. How do you pause viewing the film?
Restart VOD	How do you start it again?
Fast forward VOD	You are watching a boring scene, how do you fast-forward (with an image being shown)
Rewind VOD	How do you rewind (with an image being shown)
Skip chapter VOD	How would you skip to the next chapter of the film?
Previous chapter VOD	How would you return to the previous chapter of the film?
Stop VOD	How would you stop watching the film altogether (because you want to do something different)?
Switch off device	How would you switch off the TV?

Sample

We conducted **360 face-to-face interviews** with tech-savvy participants across 18 different countries (20 interviews per country):

- | | |
|-------------------|-------------------------|
| 1. Argentina (AR) | 10. Italy (IT) |
| 2. Australia (AU) | 11. South Korea (KR) |
| 3. Belgium (BE) | 12. Mexico (MX) |
| 4. Canada (CA) | 13. Netherlands (NL) |
| 5. China (CN) | 14. Russia (RU) |
| 6. Germany (DE) | 15. Spain (ES) |
| 7. Finland (FI) | 16. Turkey (TR) |
| 8. France (FR) | 17. United Kingdom (UK) |
| 9. India (IN) | 18. USA (US) |

People from all around the world have different experiences with technology. These people also have individual skills and knowledge when it comes to interacting with technology. It was important for this study to find participants who were able to imagine a potential scenario where they could control a TV via gestures.

For this reason, UX Fellows developed the following set of **recruitment criteria** that was applied across all countries:

- Regular usage of a recent HD flat TV (that was maximum 5-6 years of age)
- Regular usage of at least three CE devices and services (i.e. a Blu-Ray player, hard disk TV recorder, home media server, surround HiFi / home theater, video on demand / online video libraries, game consoles)
- Regular usage of a touch device (smartphone, tablet, portable touch media player)
- Exclusion of Xbox Kinect users and users with gesture-enabled TV experience
- High interest in consumer electronics and well informed about the latest gadgets and trends
- Potential buyers of CE devices from branded international “premium” brands (no national, retailer or “no name” brands)

Given these criteria, we can assume that all subjects had a similar socio-economic background, even if they lived in extremely different cultures. The mean age of the participants was 32 years (youngest 16, oldest 65 years), and 51% of the sample was male.

Results

Each UX Fellows partner agency evaluated the everyday and CE gestures generated in their own country in order to identify the most frequently occurring gestures. These findings were then aggregated and analyzed across all countries.

Everyday gestures

Many everyday gestures had a surprisingly high level of similarity between countries amongst our sample of participants. Perhaps unsurprisingly, counting with fingers from two to five was almost identical across all countries, only counting to three appeared to be slightly different; Argentines, Germans, French and Italians mostly use two fingers and a thumb, whereas the other countries tend to use three fingers (there is a scene in the Quentin Tarantino film “Inglorious Basterds” that makes reference to this difference).



The number three in most of the countries (left) and Germany, France, Italy and Argentina (right)

The “hush gesture”, signaling people to be quiet, turned out to be an internationally established gesture as well. So did the gesture to call someone on the phone:



‘Hush’ and ‘call me’ – used around the world

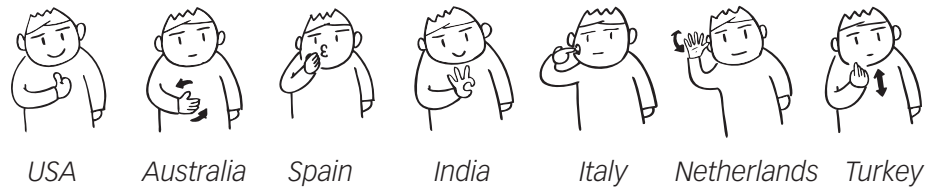
Another gesture that was well understood across all countries was “write an e-mail”, with 16 out of 18 countries using the same gesture, which is remarkable considering that writing emails only became a common task less than 20 years ago.



“Write an e-mail”: A universal gesture, but sometimes hard to imagine

As everyone who has travelled abroad can confirm, certain gestures can vary a great deal between certain countries. So did the way our subjects expressed "very tasty".

"Very tasty", for example in...



Another gesture that differed strongly across countries was that chosen to communicate "I can't hear you".



Gestures expressing "I can't hear you"

There were two clearly different but well-known hand gestures for the signal 'come closer'. It seemed to differ in East Asia compared to other regions:



"Come closer" in East Asia and in the rest of the world

Another gesture that also varies across countries with two clearly different but well-known hand gestures was the signal for "OK" – putting up a thumb (used in most European countries, except for Italy) or having the index finger and thumb meet in a circle, with all other fingers spread (used in East Asia, Russia and Australia).



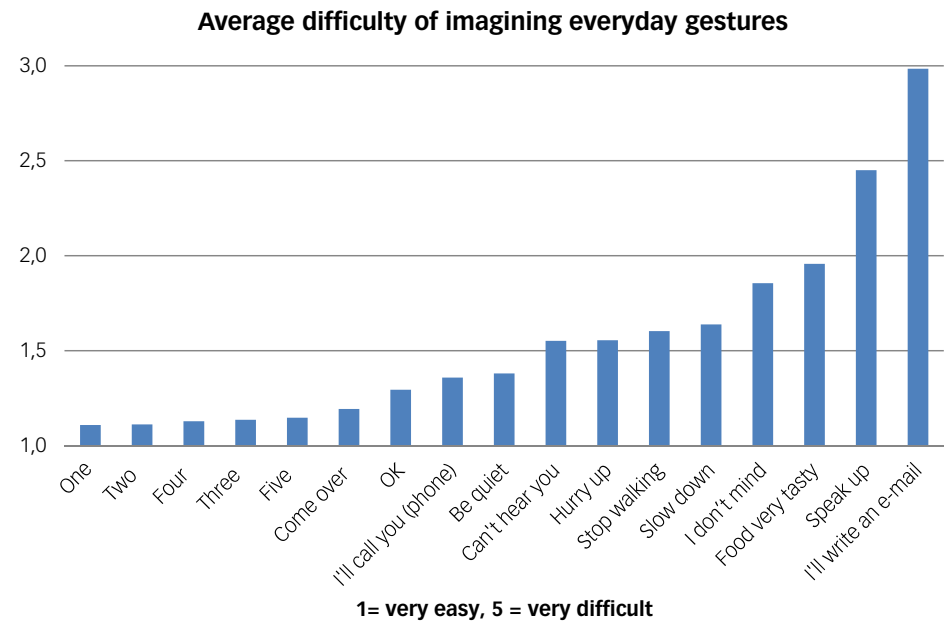
The two different ways of expressing "OK"

The Chinese gesture for "I don't mind" is different to those of most other countries:



"I don't mind" in China and most other countries

The easiest hand gestures to imagine relate to indicating numbers. The most difficult hand gestures to come up with are for more complex interactions, including "speak up" and "I'll write an e-mail" (despite having a high level of commonality between countries).





















Consumer Electronics (CE) gestures

Through the analysis of the CE gestures, it was possible to identify three broad classifications: Gestures with high intercultural commonality, gestures with medium intercultural commonality, and gestures with low intercultural commonality.

CE gestures with high international commonality

The country columns demonstrate gestures that deviated from the most commonly used gesture.

It is clear that there is a very high level of similarity across countries for gestures chosen for basic TV commands, such as pausing or stopping a program, volume up and down or rewinding and fast-forwarding movies.

COMMAND	Most frequent gesture	Mean difficulty	AR	AU	BE	CA	CN	DE	ES	FI	FR	IN	IT	KR	MX	NL	RU	TR	UK	US
Volume up		1.8																		
Volume down		1.5																		
Pause current program		2.0																		
Pause Video-on-demand		1.5																		
Confirm on-screen dialog (OK)		1.9																		
Fast forward Video-on-demand		1.9																		
Rewind Video-on-demand		1.7																		

Interestingly, the gesture chosen for the command "Confirm on screen-dialog (OK)" was exactly same as that chosen for "OK" from the everyday gestures:



Gestures chosen for both "OK" (Everyday) AND "Confirm on-screen dialog"(CE)

Russian and Australian participants used the thumb up gesture to signal "Confirm" when interacting with the TV (even though this gesture was rarely used when communicating with others).

To pause a program or a film, most countries used the same gesture that they had used to indicate "stop" when previously asked to select everyday gestures.




























































The gesture chosen for "Stop" (Everyday) and "Pause a program" (CE)

Overall, imagining gestures for basic TV functions was easy for most participants with gestures coming to mind quite naturally. This suggests that a universally recognized set of gestures already exists that most tech savvy people around the world could use to control **basic TV commands**.

CE gestures with medium international commonality

As commands increased in complexity (such as muting volume or canceling an on-screen dialog), commonality in the chosen gestures decreased. For certain

commands, everyday gestures were adopted; for example, to stop a video, participants used the 'stop' gesture (hand out with palm facing front), and muted the volume using the 'hush' gesture.

COMMAND	Most frequent gesture	Mean difficulty	AR	AU	BE	CA	CN	DE	ES	FI	FR	IN	IT	KR	MX	NL	RU	TR	UK	US
Channel up		1.8																		
Stop Video-on-demand		2.1																		
Channel down		1.6																		
Mute volume		2.0																		
Backwards navigation in menus		2.3																		
Deny on-screen dialog (cancel)		1.8																		
Skip chapter video-on-demand		2.2																		

Interestingly, Australian, Chinese and Mexican participants all used the same gesture to mute the TV (diverging from the majority). This is interesting given the differences in geographical location, language and cultures of these three countries.



"Mute volume" gesture in Australia, China and Mexico and the gesture in most other countries

Cancelling an on-screen dialog was communicated in most cases by using the opposite hand movement as confirming it: pointing one thumb down.



"Cancel" on-screen dialog

In addition to the use of everyday gestures, for this group of commands many participants used swiping movements, revealing a strong influence of touchscreen usage. Countries that most frequently chose gestures influenced by touchscreens are Australia, Spain, Finland, France, Mexico, Netherlands and UK.

Swiping gestures were mostly used for commands associated with navigating back or forward and whenever there was any kind of computer menu involved. The horizontal directions people used (i.e. left to right or right to left) varied from country to country.

CE gestures with low intercultural commonality

The following table demonstrates a very high degree of variability between chosen gestures. The commands that fall into this low commonality classification were

generally more advanced and/or abstract (e.g. finding information about the current program, sharing the program via social media and accessing an electronic program guide -EPG).

COMMAND	Most frequent gesture	Mean difficulty	AR	AU	BE	CA	CN	DE	ES	FI	FR	IN	IT	KR	MX	NL	RU	TR	UK	US
Switch on device		2.0																		
Previous chapter Video-on-demand		2.0																		
Restart Video-on-demand		2.0																	No common gesture	
Switch off device		2.9											No common gesture							
Share current program		3.2																	No common gesture	
Electronic program guide		2.8											No common gesture							
Context info for current program		2.8																		
Homepage		2.9											No common gesture							

It was particularly interesting to see that switching the device on and off had a very low level of international commonality, despite being an extremely basic command. Participants were rather creative in generating gestures for this command (e.g. snapping fingers, clapping hands or pushing a virtual button). We observed that the gesture participants chose typically also generated some kind of sound. Users seemed to think that they had to “wake up” the device, as though it was sleeping and it couldn’t ‘see’ their gestures.



Gestures for switching the device on and off

Whilst less than half of the countries represented in this study chose the same gesture for skipping to the previous or next chapter, participants typically found it relatively easy to generate this gesture (i.e. average score = 2.0). A number of countries (i.e. Argentina, Australia, Canada, Germany, Italy and Korea) chose a novel semantic gesture for this command (see example below), whilst others (i.e. Belgium, China, Spain, Finland, Mexico and the UK) drew on a convention associated with touch interfaces by using swiping gestures.

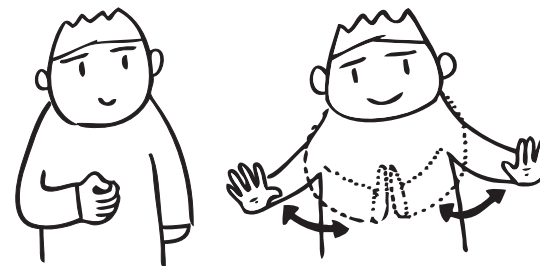


Returning to previous chapter of a film

In order to restart a paused film, most participants used the same gesture they had used for stopping or pausing the film. Interestingly, participants also found it difficult to identify unique gestures for activating the EPG and getting information about the current program, with the same gesture often used for both commands.

Many participants said that their gestures should be understood in context (i.e. if they are in a mode where they are selecting a chapter only certain gestures are recognized). This would potentially allow them to use the same gestures for different commands. This suggests a desire to reduce the cognitive effort required from the user in order to learn and remember gesture controls for interacting with a CE device. They also commented that given the nature of the environment in which they typically watch TV, the possible range of gestures is restricted (e.g. sitting in a relaxed position on a couch with other people on either side).

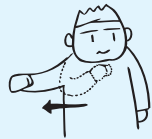
We observed that although they were told it was not necessary at the start of the session, many participants tried to adhere to a set of internally consistent logic when creating their gestures. Although people mostly used reverse gestures for inverted commands (i.e. those which have direct opposites of each other such as turning the volume up or down), they often chose different gestures for switching the TV on and off. For example, some participants preferred to switch the TV on by pushing a button on an imaginary remote control, but they would then switch it off by clapping their hands.



Different actions were used to switch the TV on and off

We repeatedly observed some rather creative approaches to advanced TV functions:

Share current program, Argentina



Share current program, China



Share current program, Korea



Electronic program guide, Belgium, UK
Context info for current program, UK



Context info for current program, Belgium



Context info for current program, Spain



Go to Homepage, Belgium



It is no surprise that these commands had the lowest intercultural commonality and some of the highest difficulty ratings as they were the most abstract in nature and therefore lacking an immediately analogous natural gesture.

Overall, we observed two kinds of gestures:

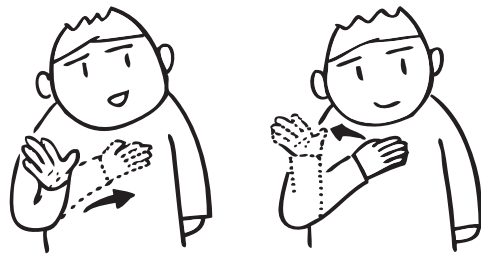
- **Direct gestures** where participants drew on real world relationships between their chosen gesture and the command (e.g. raising their arm to raise volume), versus
- **Abstract gestures** which have a basis in language or iconography, relying upon a more metaphorical relationship between their chosen gesture and the command (e.g. building a roof with both hands over their head to return to the homepage).

The choice of a direct gesture was typically associated with a command that has a strong conceptual relationship with the gesture. Examples include raising and lowering a hand to lower the volume, or swiping from right to left in order to move to the next chapter. The choice of abstract gestures were associated with more complex tasks that are typically more abstract nature and require a more metaphorical approach. Examples include opening the palms outwards to access an Electronic Program Guide to mimic opening a magazine to an index page, or drawing a question mark in the air to access more information.

Abstract gestures experienced lower intercultural commonality and were typically associated with more complex tasks. This raises the question of the viability of generating a readily understood and remembered set of semantic gestures for controlling complex tasks.

In general, most participants preferred using only one hand for gesturing. This reflects their current experience of operating a TV with one hand via a remote control and the environment they watch TV in (e.g. sitting with others on the couch, holding food or drinks in their other hand).

The prevalence of swiping actions for gestures with low and medium intercultural commonality suggests that our participants were strongly influenced by touchscreen technology which is not surprising given the nature of the individuals we recruited to participate in this research.



Swiping gestures

This indicates that interactions defined by manufacturers of touchscreen devices are normalized amongst our participants despite their different underlying cultures.

We had expected our results to identify clusters of countries that used the same or similar gestures for CE gestures, we thought that these clusters would be based on geographical proximity which potentially promotes similarities in culture and/or language. However, the data from this research suggests that this is not the case, particularly for more complex commands where the types of gestures chosen by our participants varied widely across countries despite geographical proximity and potential similarities in culture.

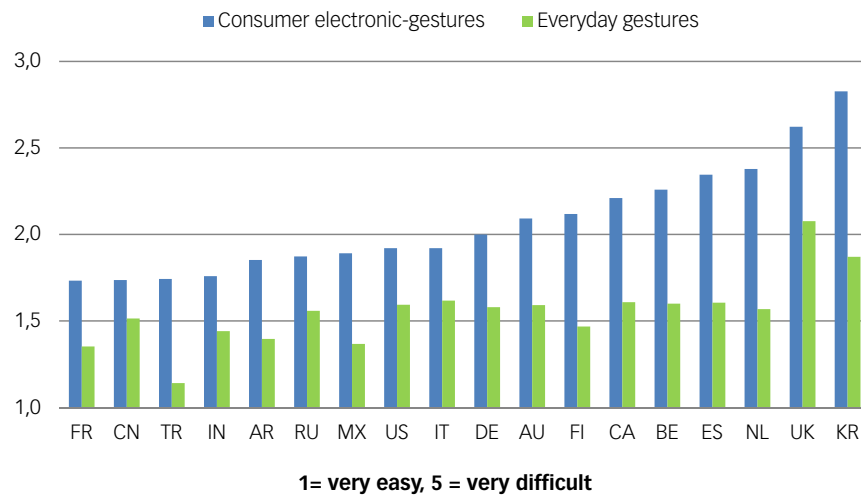
Difficulty in imagining gestures

Overall, participants found it more difficult to imagine CE gestures (average difficulty = 2.5) than everyday gestures (average difficulty = 1.5) which is not unexpected.

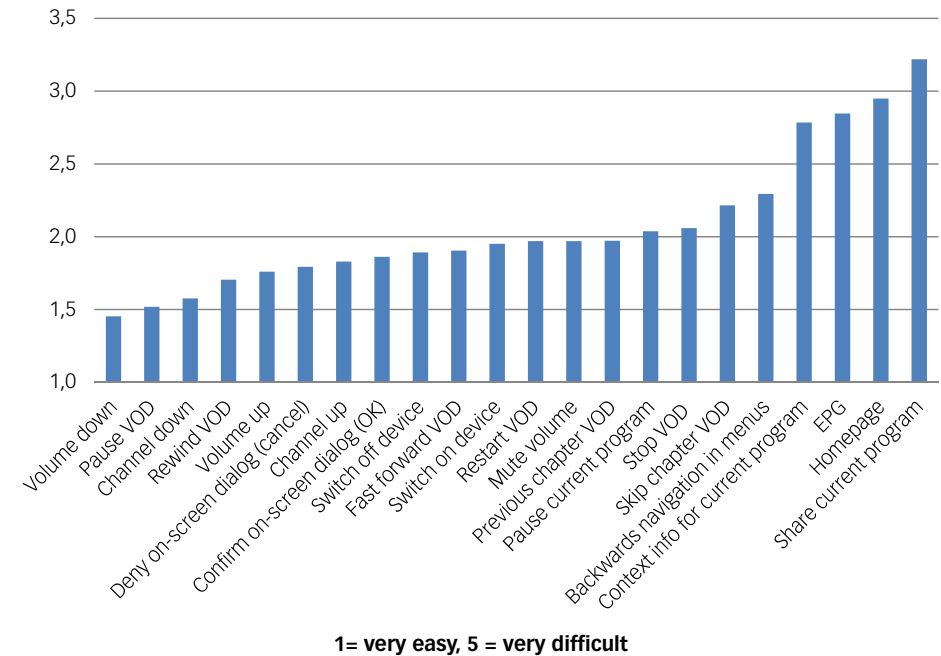
There was little correlation between neighboring countries in terms of gesture difficulty. For example, Korean subjects reported very different difficulty ratings than

their Chinese neighbors, the same applied to the UK and France. Some countries found it relatively easy to think of everyday gestures (e.g. Turkey, Mexico, Finland, Canada, Belgium, Spain and the Netherlands) but found it comparatively difficult to imagine CE gestures. Participants from China, Russia, US, Italy and UK typically found it more difficult to think of gestures, regardless of whether they were everyday gestures or CE gestures.

Average difficulty rating per country



Average difficulty of imagining consumer electronic-gestures



General findings

Our participants responded very positively to the idea of gesture input for TVs. Most of them suggested that gesture input for TV and audio equipment could be fun to use, convenient and felt that it had a certain *coolness factor*. Not requiring a remote control to operate your audio visual equipment was seen as a major benefit; gestures don't get lost, don't break and don't need batteries.

Voice control

Many participants felt that voice and sound input could be a good support for gesture input. During the interviews, some asked "Can the TV hear me?" or spontaneously provided verbal commands in addition to gestures. Also the choice of gestures for switching the TV on that involved finger snapping or clapping demonstrates a natural propensity to include sound as a supplement to gesture control.

Feedback

If they were to control CE devices with gestures, participants mentioned that they would also like to receive feedback via the device display (e.g. seeing a visual indicator of volume increasing/decreasing) resulting in a natural dialog between the user and the device.

Semantic vs Pointing Gestures

The findings of this research indicate that it should be possible to employ a set of semantic hand gestures to control basic TV functions that will be both recognizable and easily remembered across cultures. However, as the commands increase in complexity it becomes more difficult to apply a common set of semantic gestures.

This suggests the need to customize these gestures for each individual market, requiring research to understand what will be most appropriate and effective in each country, or alternatively to consider the use of pointing gestures in order to achieve these more complex tasks.

At the end of each interview, we asked participants if they had any preference for using semantic gestures or pointing gestures in order to control a TV. Whilst the majority chose semantic gestures in preference to pointing gestures, a reasonable number indicated an equal preference which is represented in the table below. In instances where participants indicated an equal preference they volunteered that they would prefer semantic gestures for more basic commands and pointing for more complex commands.

GESTURE TYPE PREFERENCE	Sum	AR	AU	BE	CA	CN	DE	ES	FI	FR	IN	IT	KR	MX	NL	RU	TR	UK	US
Pointing gestures	9	●	●			●		●				●		●	●	●		●	
Semantic gestures	15		●	●	●	●	●	●	●	●	●		●	●		●	●	●	●

This seems logical when we consider the usage context: Watching TV by using basic functions happens in a so-called *lean-back disposition*¹ of mind. With increased complexity of functions, the user gets more involved, or mentally *leaned forward* like when operating a classic PC with a GUI. In that situation pointing gestures appear more suitable. Therefore, many users would prefer switching between semantic gestures, pointing gestures and classic remote controls.

¹ The phrase "lean back" has been coined to describe the way in which users interact with ITVs, this is based on the assumption that the user is typically relaxing in a living room environment with their remote control in one hand (i.e. leaning back). This is in contrast to "lean forward" which describes the interactions that users have with a personal computer where they are using a keyboard and mouse to control what is happening on their computer screen (i.e. leaning forward).

Typical concerns of potential gesture control users:

- **Learning and retention of gestures:** Users expressed concern about having to learn a new “language” associated with this technology. However, our finding that a common gestural language appears to already exist for basic CE related commands should mitigate this concern to a certain degree, only requiring consumers to learn gestures for more complex commands.
- **Accuracy:** Participants questioned the range of the gesture recognition capability. How close would they need to be to the device and would they need to be sitting directly in front of it? They also questioned its ability to consistently differentiate between commands as well as between individuals.
- **Interference:** Participants also expressed concern about the possibility of devices responding to gestures being made by others in the room that are part of normal interpersonal interactions (e.g. someone speaking on the phone but moving their hands around could trigger the device).
- **Comfort:** Some participants expressed concern that they wouldn't be able to behave as they normally would in front of a TV if controlling it via gestures. They may normally lie down flat on the couch or sit off to the side and were concerned that they would need to sit upright and front on to the TV which would not be very comfortable. Finally, many participants commented that they consider watching TV to be an activity for winding down and relaxing and that using gestures to control their TV could make what is supposed to be a relaxing activity into something more strenuous. This is potentially of particular concern to the avid channel surfer who can't settle on any one channel.

Conclusion

The findings of this research suggest that at least tech savvy users would **embrace semantic gesture control for CE devices**.

It is clear that **a limited gestural language already exists across cultures** that could be used for basic commands associated with controlling CE devices. However, as the commands increase in complexity, cultural differences start to emerge in the choice of gestures.

Our **results do not support the idea of clustering amongst regions**. We observed differences in the type of gestures chosen amongst countries that are geographically close and could be considered to be culturally close. Therefore, it seems necessary to examine cultural differences when it comes to designing natural user interfaces at a market level.

It appears that the spontaneous choice of semantic CE gestures is **influenced by everyday gestures** in the various cultures, but also by **technology** like touchscreens. CE-savvy and touchscreen-familiar users in very different cultures obviously have experienced similar technology socialization.

It is clear that **advanced CE features** (like sharing the current program, looking up the EPG or context information for the current program) cannot be based on a set of universally recognized gestures. This suggests that it would either be necessary to establish a set of pre-defined gestures (the study highlights some good ideas to start from) which are consequently learned by users or **substituting** semantic gesture with **pointing gestures** for those commands that are more complex. However, it is important to keep in mind that users preferred to use semantic gestures over pointing gestures if possible.

The results of this study can be **generalized** to CE devices in general with participants indicating that they would like to use gestures to control devices in their living room and bedrooms other than the TV.

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