

What is a good controller user experience for GLOW?

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The paddle axis.....	Fout! Bladwijzer niet gedefinieerd.
Which input fits the bill?	Fout! Bladwijzer niet gedefinieerd.
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What is a good controller user experience for GLOW?

At FHICT, I was this semester part of a group centered on developing a game for GLOW. A crucial aspect of this project is ensuring an optimal user experience, with a specific focus on the game controller. My research aimed to address the question, "What is a good controller user experience for GLOW?" To answer this, I undertook several research steps.

Firstly, I identified the target audience to understand their preferences and expectations. This involved analyzing demographic data and search trends to determine who would most likely participate in the GLOW event. And asking people who went to GLOW what demographic they had experienced at GLOW. Next, I investigated the types of inputs that these users are familiar and comfortable with, ensuring that the controller design would be intuitive and accessible.

Following this, I examined the specific input requirements of the game, PLONG. This step was crucial in aligning the game's functional needs with the user's input capabilities. I then explored the range of possible inputs that could be integrated into PLONG, considering the requirements the project had for the controller.

Finally, I evaluated which of these potential inputs would provide the best user experience in the context of GLOW. This was done by looking into which inputs would fit the requirements the best. And which input would also be compatible with the users.

Through this structured research process, I aimed to develop a controller that not only meets the technical requirements of PLONG but also enhances the overall user experience for participants at GLOW. The findings from this study provide valuable insights into user-centered design practices for interactive installations at public events.

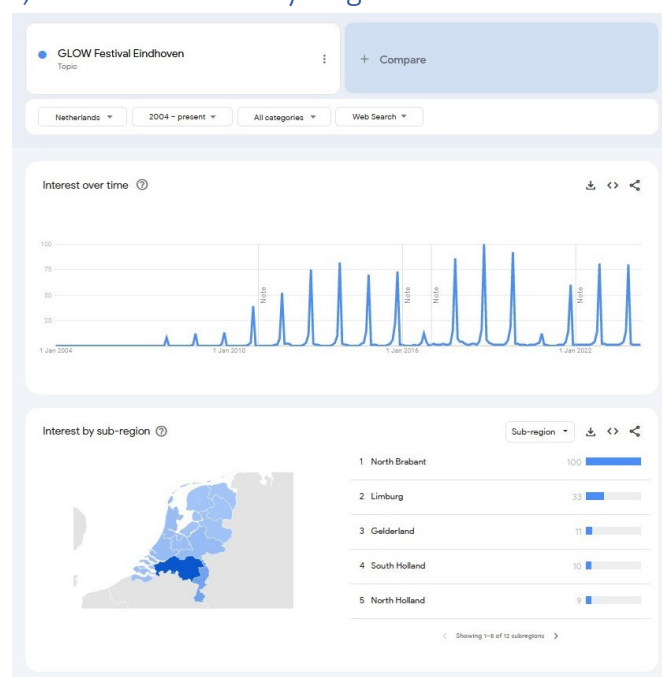
Who is the target audience?

GLOW is a public festival in Eindhoven and the surrounding area's. It is a festival about light and technology, of which the city of Eindhoven has a rich history. Being that the tech company Philips originated out of the city, while now companies as ASML call it their home. Business, artist and students provide GLOW with art installations based on the theme they provide.

GLOW has grown to be a big festival for the city of Eindhoven. From its humble beginnings in 2006 to its popularity in 2023. A lot of people go to GLOW. Based on the estimates they have given in [2021 580.000](#) people have visited the festival. The festival seems to have a broad appeal to a lot of people. But who are these people exactly?

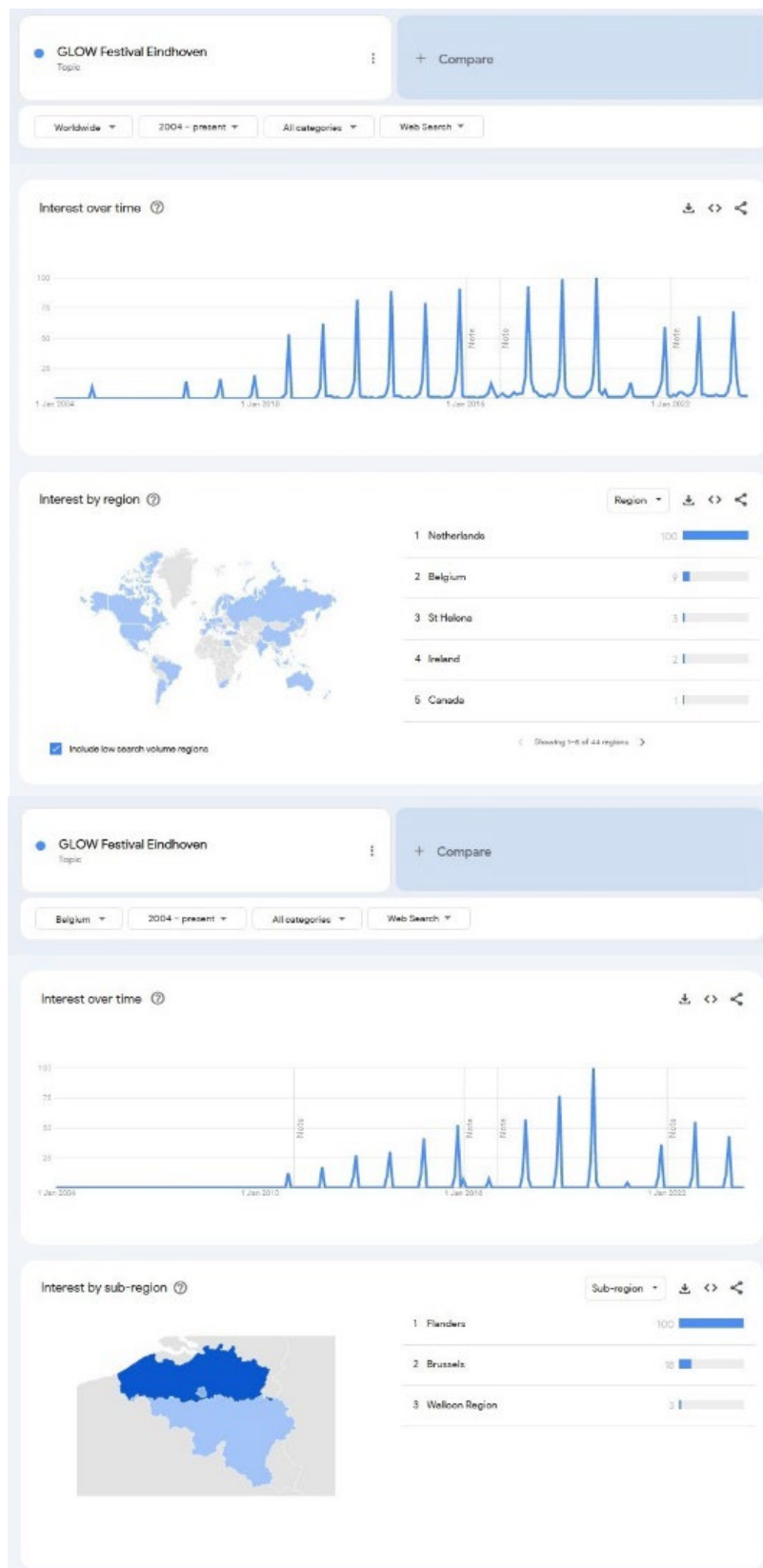
What is the search traffic for GLOW, and where do they originate from?

Going into trend research, GLOW is a hot topic when it is around. From Google Trends the topic 'GLOW Festival Eindhoven' peaks at the dates it is held in November. What it also shows is a consistent hot trend for the majority of the time the festival has been around, having lower numbers in the beginning and around 2016 and 2020. In 2016 there was a terrorist threat, being the year that the airport in Zaventem was attacked in march. In 2020 the Corona epidemic started, causing lockdowns all throughout the Netherlands. These could be reasons GLOW was less searched then other years



Looking at the location demographics, the province North Brabant has the most searches of the topic, followed by the southern neighbour, Limburg. Other provinces, like Gelderland and the two Hollands also share interest, but on a more lower scale.

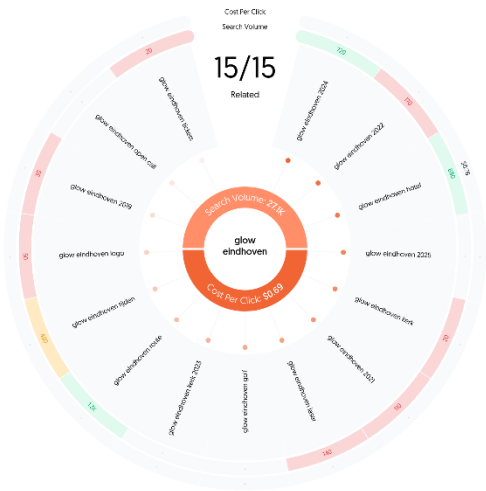
Looking internationally, the most interest comes from the Netherlands itself. But people out of Belgium also show interest. Looking locally at Belgium, people out of Flanders searched GLOW the most. I also looked into Germany, but their searches were very low.



With the online tool 'Answer The Public' I have looked into search terms for the topic 'Glow Eindhoven'. Most people where interested in the route of GLOW, following by ' GLOW Eindhoven hotel' and 'GLOW Eindhoven 2024'. The overall search volume is 27.1k, which is quite high in context of the overall search volume of Eindhoven, being 165 thousand. In the list regarding searches around Eindhoven, GLOW is hanging in the lower top 10.

KEY INDICATORS
Highly Searched
Avg. Searched
Lowest Searched
All CPC data are in USD

Answer ThePublic
by NP digital



Search Volume [?]
165,000

Low

Medium

Good

0 - 1,6001,601 - 3,6003,601 - 165,000

Cost Per Click [CPC] [?]
\$0.53

Cheap

Medium

Expensive

0 - \$0.52\$0.53 - \$1.17\$1.18 - \$4.26

WHEELS

LIST

TABLES

Phrases: All

Modifiers: All

CPC: All

Search Vol: All

Sort By: Volume [↓]

Keyword	Modifiers	Search Vol	CPC	Action
eindhoven airport	related	165K	\$0.98	⊖
eindhoven airport	alphabeticals/a	165K	\$0.98	⊖
eindhoven restaurant	alphabeticals/r	40.5K	\$0.38	⊖
eindhoven fc	alphabeticals/f	33.1K	\$0.08	⊖
eindhoven centraal	alphabeticals/c	27.1K	\$0.72	⊖
eindhoven glow	alphabeticals/g	27.1K	\$0.65	⊖
eindhoven station	alphabeticals/s	27.1K	\$0.91	⊖
eindhoven vliegveld	alphabeticals/v	22.2K	\$0.89	⊖
eindhoven marathon	related	14.8K	-	⊖
eindhoven marathon	alphabeticals/m	14.8K	-	⊖

The demographics of the visitors

From the trends I can conclude there is quite a appeal to GLOW. But who are the people who visit GLOW? From the numbers from Google trends I can see a Demographic majorly residing in The Netherlands, of which most visit from the home province of North Brabant.

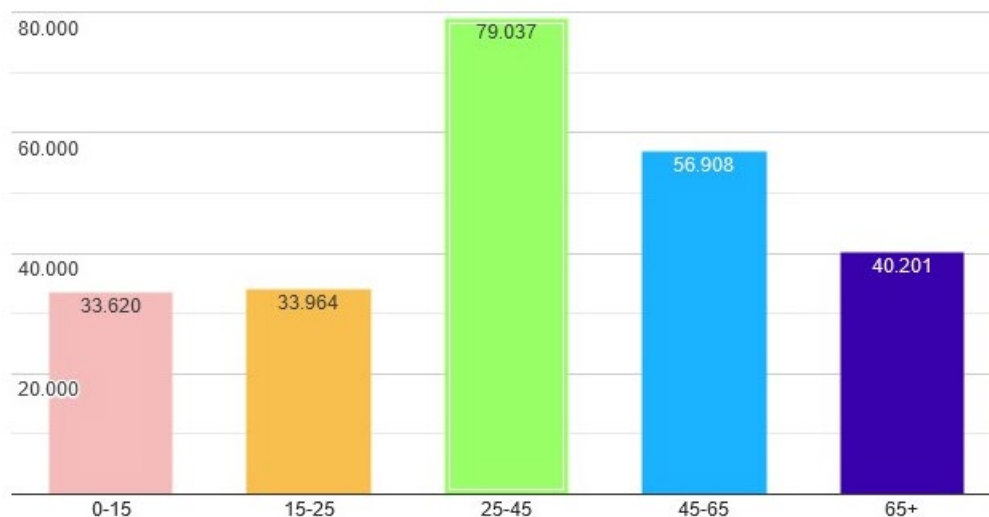
GLOW doesn't publish any insight into what demographics visit GLOW. As far as I have looked there is also no easily accessible data available that gives insight into the demographics of visitors. As such, I cannot concisely conclude there is a certain person that visits GLOW.

I have spoken with people who went to GLOW, they all have same thing to say. The visitors of GLOW are mostly from in and outside of Eindhoven. They are all of all ages and backgrounds. There a people with kids, couples going on date and youngster going out with their friends.

Berry Sanders and X are a teacher and student at Fontys ICT. They both have made a project and visited GLOW. When I asked who visited GLOW, they said it was a very general public. There is not really a niche of people who visit GLOW, as to say as a convention for comics or any other topic. The festival has a low bar to visit, so anyone could visit GLOW if they are able to get to Eindhoven.

A friend of mine, Ryan Are who is a student Industrial Design Engineering at Fontys in Venlo, also showed a project at GLOW. He also had to say that the public is quite general. Mostly people from in and out of Eindhoven. He said however that there were quite a lot of technical students who visited his project. Further it was people with kids and the general public.

Inwoners naar leeftijd in de gemeente Eindhoven [↗](#)

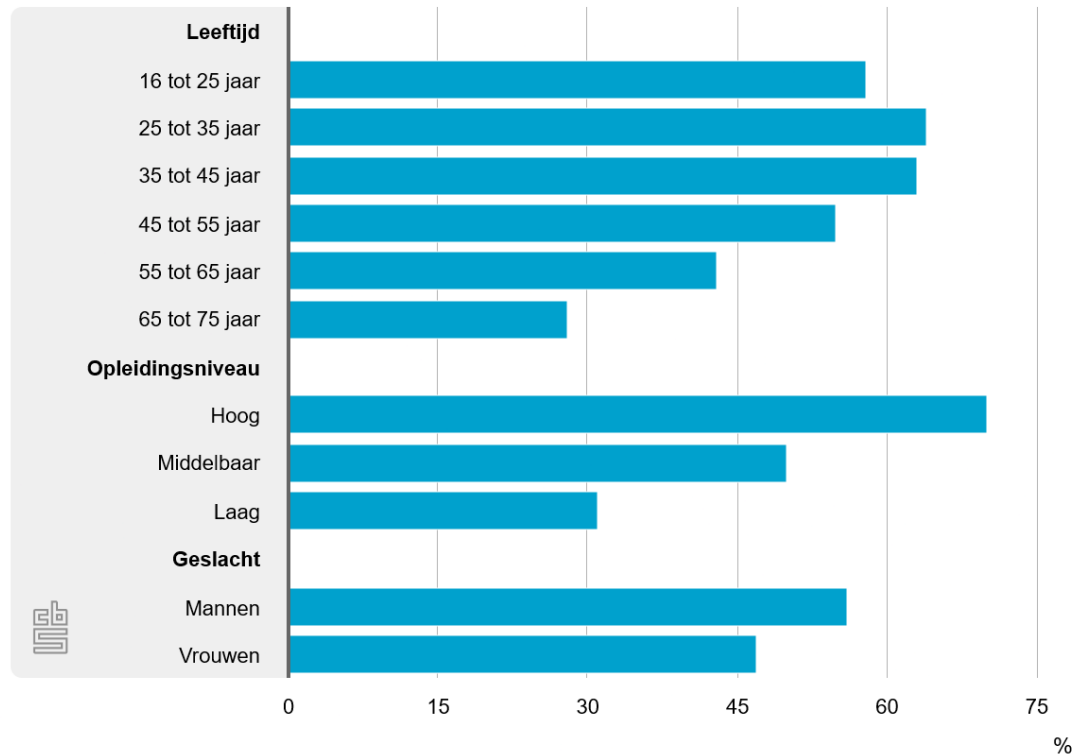


Bevolking, leeftijdsgroepen: aantal inwoners op 1 januari 2023 per leeftijdsgroep.

If we look at the graph above, which I have got from the site allecijfers.nl, it shows that the demographic of Eindhoven is quite varied by age. The middle group of 25 to 45 stands out to me, as they are quite young.

If we compare that the graph made by [Centraal Bureau Statistiek](#), which is based on the research from [Eurostat](#), we can see that the group of people between 25 and 45 has more than 60% people who are more then able to do basic digital tasks,

Meer dan basisvaardigheden van Nederlanders, 2021



Bron: CBS, Eurostat

Based on these statistics, we could say that our main age group is well adapted to computer interfaces. That means that we could build basic interfaces and rely on our visitors, if the controls are simple, to understand the concept of our user interface. This is because most within the major age group has at least basic digital skills to interface with a digital product.

Conclusion

From this I conclude that the public at GLOW is too general to really cater to a specific target audience. The trends point to a broad appeal on the regional and national appeal, while also peaking some interest over the border. Search trends around GLOW and Eindhoven suggest that as well.

From people who have been and had a project at GLOW, I also can conclude that there is a very broad appeal for GLOW. With these insights I can conclude that the target audience is the general public. Anyone from a kid to an elderly person can visit GLOW. So we have to take in account a broad public while designing Plong.

If we look into the demographics of Eindhoven, it is clear that a big group of people between the age of 25 through 45 lives there. If we look into the statistics of the digital skill level of this

group, it is clear they know how to at least interface with a digital UI. So we can rely on that fairly simple interfaces should be able to be used by the majority of people. To conclude, according to the statistics we should keep in mind that our audience is quite broad, but knows their way around simple digital interfaces.

What inputs are the people of GLOW comfortable with?

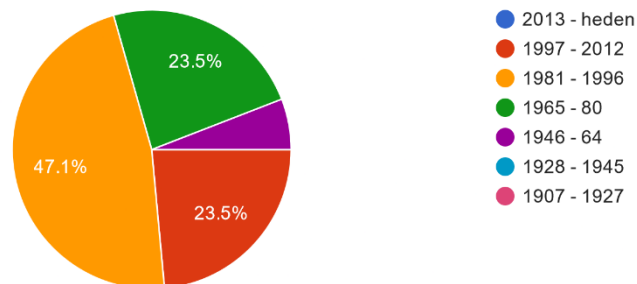
We are making Plong for the people who come to GLOW. Because the group of people is very diverse, we need to make sure as much of people could interact with the game. In the last paragraph we looked into who the people who visit GLOW where. Now we are going to find out what inputs they can, and cannot interact with.

The survey

Me and Donovan send out an [survey](#) to answer question about people's festival experience and the experiences they had with certain types of input. In total we had 17 responses ranging from baby boomers to people that fall within gen-z. In this sub paragraph we will discuss the results regarding the experience these people had with all kinds of inputs.

In welke van deze leeftijdsgroepen valt u?

17 responses



Which inputs do you have experience with?

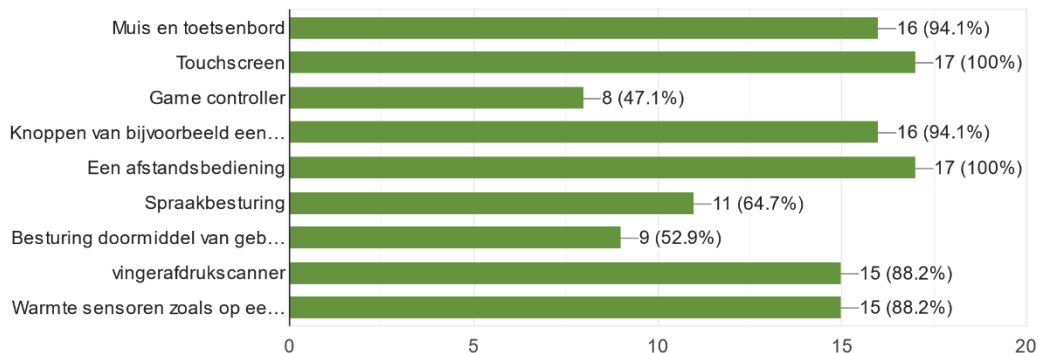
In this question I had the goal to get insight which inputs the target audience had experience with already. I made a grid question where I listed to following possible answers:

- Mouse and keyboard
- Touchscreen
- Game controller
- Buttons on appliances like washing machines
- A remote
- Voice control
- Motion controls
- Fingerprint scanners
- Touch sensors as on an induction stove

From it I had gotten the following results:

Met welke inputs heb jij ervaring mee?

17 responses



What I conclude from this, is that a lot of people have experience with the normal input types like touchscreens, keyboard and remotes. These inputs are so widespread that in normal circumstances, anyone would have atleast encountered and used one of these inputs once in their life.

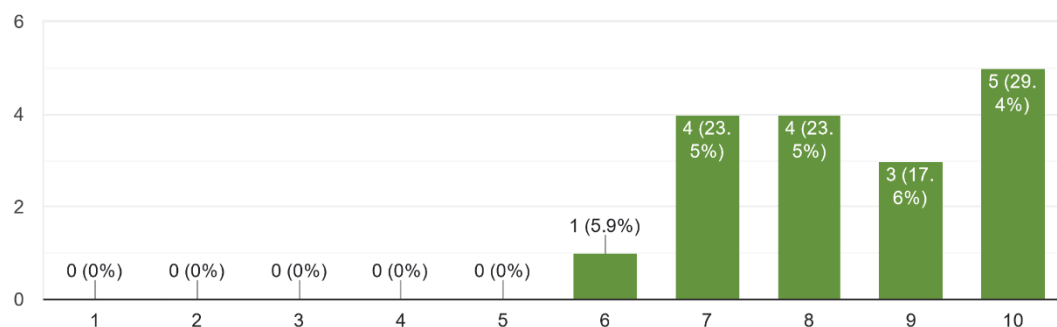
More exotic controls, such as motion controls and voice controls aren't yet as widespread. As such not many people have used them. Surprisingly, the game controller has the least amount of people that have experience with them. This could be because they might not fall into the group of people who also play videogames. It could be then that they don't see fit to fill in that they have experience with the game controller.

How much experience do you have with...

The next subset of questions I asked the survey takers how much experience they have with a certain control type. The results can be found below:

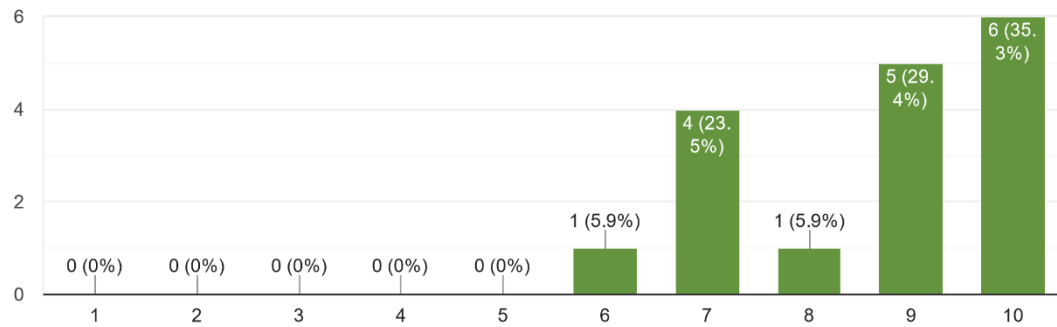
Op een schaal van 1 tot 10, hoe goed kan jij overweg met een muis en toetsenbord?

17 responses



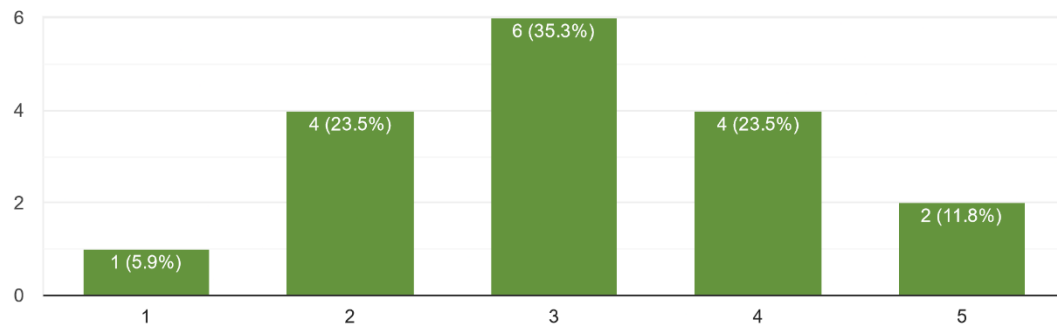
Op een schaal van 1 tot 10, hoe goed kan jij overweg met een touchscreen

17 responses



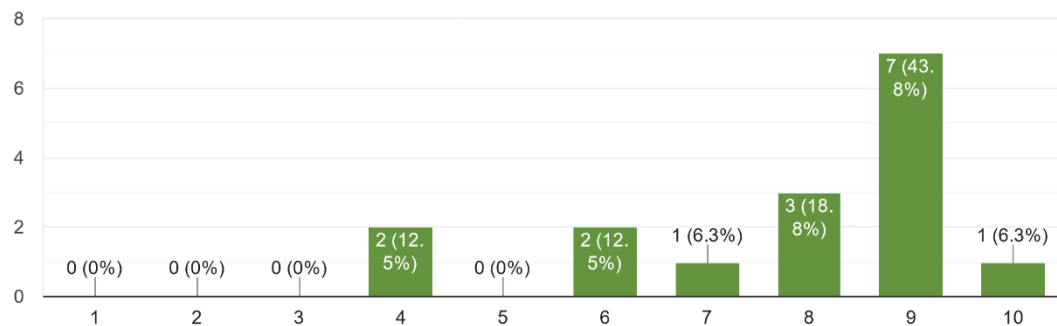
Op een schaal van 1 tot 5, hoe goed kan jij overweg met een game controller

17 responses



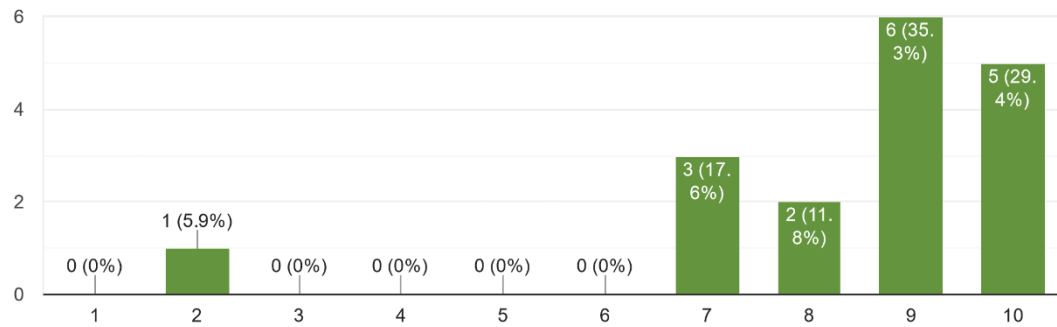
Op een schaal van 1 tot 10, hoe goed kan jij overweg met knoppen van bijvoorbeeld een wasmachine

16 responses



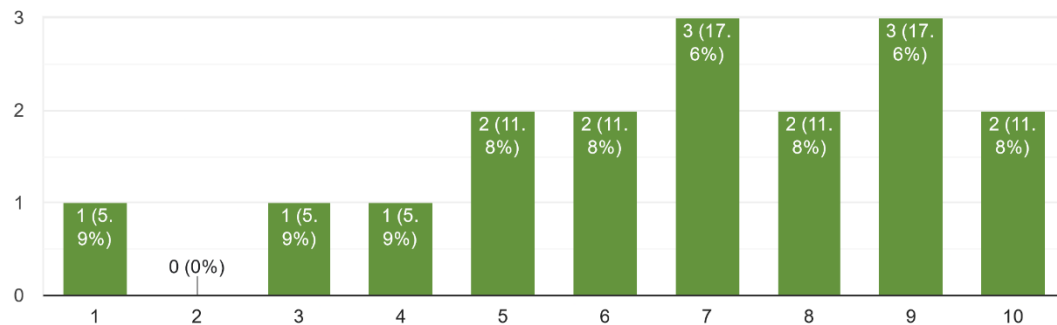
Op een schaal van 1 tot 10, hoe goed kan jij overweg met een afstandsbediening

17 responses



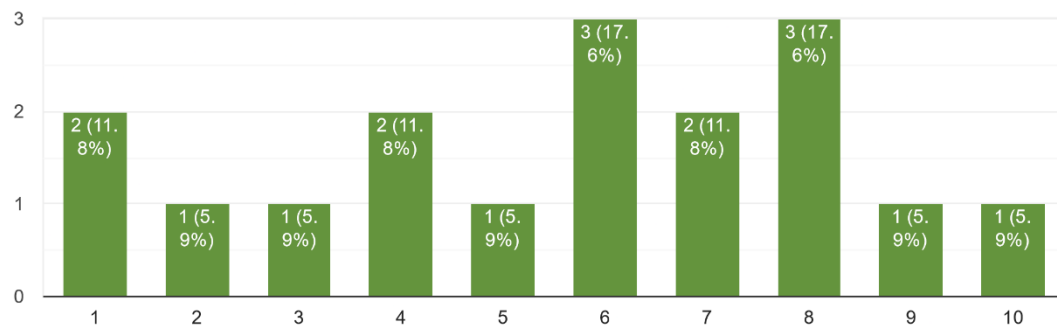
Op een schaal van 1 tot 10, hoe goed kan jij overweg met spraakbesturing

17 responses



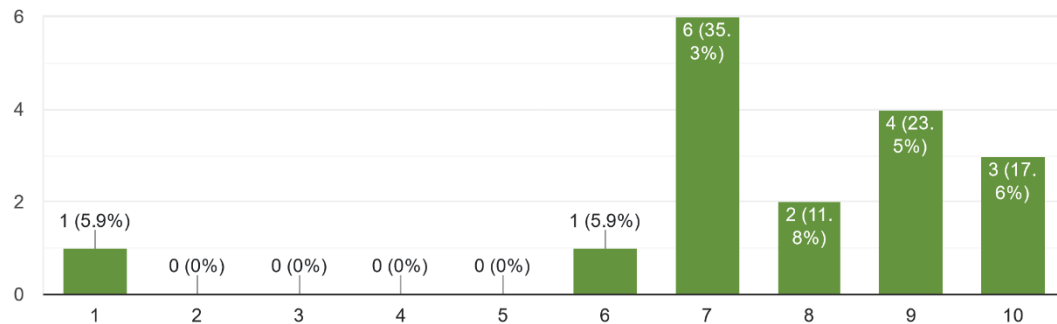
Op een schaal van 1 tot 10, hoe goed kan jij overweg met besturing doormiddel van gebaren (Zoals kinect of wii)

17 responses



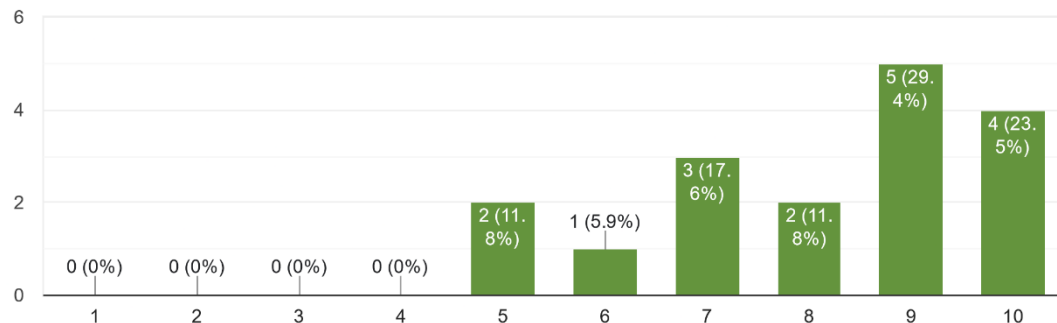
Op een schaal van 1 tot 10, hoe goed kan jij overweg met een vingerafdrukscanner

17 responses



Op een schaal van 1 tot 10, hoe goed kan jij overweg met aanraaksensoren zoals op een elektrische kookplaat.

17 responses



Again, the more common interfaces are the ones most people have a better experience with. These are the mouse and keyboard, touchscreens and button interfaces from home appliances. These interfaces are common in the day to day life of people. As such, people are more confident when use the inputs on these interfaces.

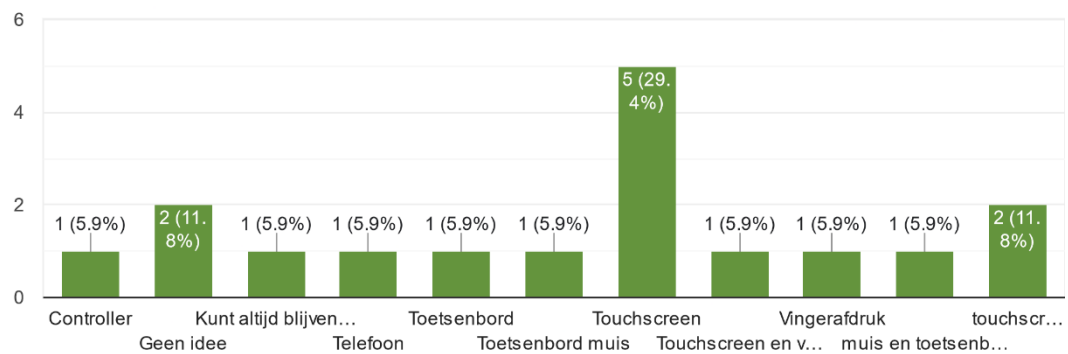
People are however more divided over the more exotic control interfaces. Inputs as seen on a game controller, motion controls and voice controls have people who are very unconfident with them. These interfaces are either very specific to a activity, or are not adopted by a lot of people yet. This means that if we want to use the controls, we need to keep in mind a big group of the target audience might need an hand to use these inputs.

Which control would you like to use/not use forever?

The answers to these two questions gave varying answers. What is sure however is that a lot of people like the touchscreen. Nine out of seventeen people like the touchscreen enough to have it as their primary way to control their devices. This could be because of the widespread use of touchscreens in things like mobile phones, but also on other appliances like laptops and even fridges. A lot of people interact with a touch device daily. So that could also make it that it is a popular way to control their devices. Next in line would be the keyboard and mouse set-up. Again, an interface a lot of people deal with in their day to day life. The only exotic interface mentioned was the game controller. This one was mentioned once.

Als je een input voor altijd zou kunnen gebruiken, welke zou dat zijn?

17 responses



For interfaces that people would like to never use anymore, is way more varied. Here the exotic input interfaces come to the surface. Things like the game controller, motion control and voice control are mentioned twice or more. These are inputs that are not really used by everyone, as such not everyone likes them as much as the interfaces they are more familiar with.

- Bewegingsbesturing 3x
- Idem
- game controller 2x
- Pincode
- Motionbased 3x
- Knopjes
- resistieve touch screens
- Spraakbesturing 3x
- Gebaren 3x
- Spraakbesturing 3x
- Spraak techniek 3x
- Nvt
- Gameconsole 2x
- Geen alles heeft een goede functie
- Geen
- Geen idee
- Afstandsbediening

Conclusion

From what I can see out of the survey results, I can conclude that people like interfaces that they use on a day to day basis. These type of inputs are well known and understood by the majority of people. Inputs as keyboards, labelled button interfaces and touchscreens are by far the most popular. These are well known and adopted interfaces being found in most peoples home. Things like motion and voice controls are less adopted. Making it so that these types of inputs are less known and wanted for people.

As such, if we want to choose a intuitive type of input for our controller, we have to take in account that the type should be simple and well known by the user. Otherwise the user might not understand the controls without a tutorial beforehand. Or worse, they might get frustrated by the complexity or unreliability.

Which input components does Plong need?

Plong will be based on Pong, the hit game from Atari. To get a gist of the controls we need, we will investigate which Pong used. We will look at the arcade cabinet and the home console versions. The controls from these versions should give us an idea which inputs Plong should have.

From there we will make a list what controls Plong will need. These are the minimal amount of inputs to make the game playable. These basic requirements do not take in account extra gameplay elements. We have ideas to add controls to give a bigger multiplayer experience, which we will address later on in the overarching project.

What controls did the original Pong use?

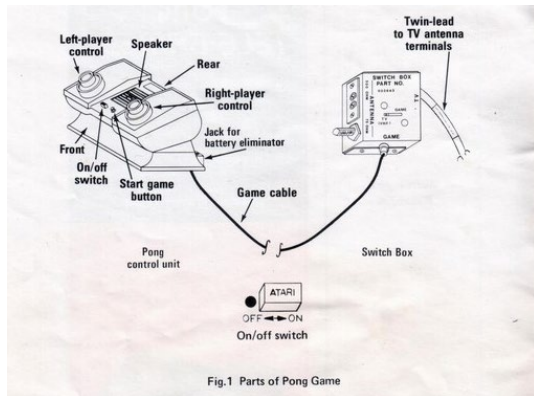
Arcade

The arcade cabinet had a small control panel. One player could man the right knob, while the other the left one. The knobs could be turned to the left or right. This would send the paddle towards the corresponding direction. To start the game the player should insert a coin into the slot. The coin would then go into the machine and trigger the button that started the game.



Home console

The home console of pong had one interface for both players. Player 1 had a turning knob on the left. Player two had the other on the right. It had a speaker for the sounds the game made. It also had a on/off switch and a start game button.



What are the basic specifications for Plongs controls?

If we take a look at the controls from the above mentioned versions, we see that in the basis plong has the following controls:

- Two paddle controlsknobs
- A on/off switch
- A button to start a game

Because Plong is a derivative of Pong, the controls will be in the basis be the same as Pong. But, because of the setup of Plong being played across a stream, the game needs some additions to make it playable. As such the basic controls of Plong will be:

- An input to move the paddle
- An input to give a signal that the player is ready.
- An admin button to turn the game on and off

The gameplay of Pong is a derivative of the game Ping-Pong. We decided that Plong won't change that part of the gameplay. As such we need the player to be able to influence the place of the paddle. This will done by a move paddle input, just like in Pong.

Secondly we need a way for both players to sign that they are ready. Because they are standing across a stream, it is difficult to communicate when the game should start. As such we want both players to give an input when they are ready. As soon as both players are ready, the game will start. This way the player ready input makes sure that the games starts smoothly.

Last we need an administrator to be able to start up and shutdown the game. This way the game can be started at the beginning of a festival day, and shutdown at the end of it. This gives us also a way to reset the system if something would go wrong.

Concluding

Plong needs a couple types of input to be able to be played. These are:

- An input to move the paddle
- An input to give a signal that the player is ready.
- An admin button to turn the game on and off

These are needed for players to be able to control the game and to signal they are ready. Next to it will also be able for an administrator to start, restart or shutdown the game. With these basic inputs I am confident that all the needed inputs for PLONG are covered.

Which input components are possible with plong?

Plong is based on Pong. The control inputs that are needed are a derivative of that game. However, the way the input is given can be different to the original. Here we will go over some inputs for the controller lay-out that might be compatible to way the players control the game.

In the last chapter I have looked into which inputs PLONG need. The player ready signal and the admin turn on/off will not be taken in account here. These inputs will be discussed in other documentation about the controller of PLONG. I will however focus on which inputs will be compatible with PLONG based on the paddle axis.

The input types will have certain requirements they have to adhere to. These being:

- Compatibility with the target audience
- Weatherproof
- Sturdiness
- Novelty of the input

These requirements stem from user ability to use the controller, the environment of GLOW, it needing to survive a lot of touching by people and the novelty of the input type. These are the most important requirements for the controller, as they impact the use and attractiveness of the controller the most.

Per requirement I will explain what I have found per input type. At the end there will be a table with scores of all inputs. From that I will draw conclusions what inputs rank high and low. And what inputs should or should not be used.

Possible inputs for the paddle controls

There are a couple of way the axis of the paddle can be controlled. Below I will list a couple that could be used to control the paddles. I will also explain how they would be used, and what pro's and con's the have relating to the festival environment.

Buttons

Buttons are a well known way to give an input to a machine. The way they will work as the input for the paddles is that we have two buttons. One to position the paddle the right, the other to position it to the left. To convey what button does what, we could label them with indicators. We also could look into buttons that can give feedback to the player when they are pushed. Maybe by a clear 'click' feeling or sound, or maybe via a light-up function.

From earlier findings in this document buttons are well known types of inputs under the target audience. It is quite safe to say that most people know how to interface with this type of input. As such, the button will definitely rank high with the users based on compatibility with them.

Weatherproofing shouldn't be a problem either. There are a lot of buttons that are [weatherproof on the market](#). (Google and you shall find!) And making a weatherproof button should also not be difficult. As we can make a chassis with a rubber cover for this input type. According to that I rank the button high in this regard.

Sturdiness shouldn't be a problem either, depending which button type we use as a basis. A simple small button from an Arduino starter set would most likely be to fragile. But the market has sturdier options available. As such, the button will rank quite high for sturdiness.

The novelty of the button is however not too good. Buttons have existed since 1880, meaning that people are well attuned to the concept of a button. As such using buttons is not really a novelty for most people, giving it a low rank in this regard.

DDR style pad

A Dance Dance Revolution-style trackpad could also be used as an user input. It won't differ much to the regular old button. Except, instead of controlling it with the hands, it will be controlled by user's feet. Also here we need to label what button does what.

If I look at the requirements, it is much the same as the button up above. Compatibility, weatherproofing and sturdiness will be the same as a button. It will however rank higher on the novelty scale.



Why? Well you don't see a button controlled by feet that often. You have floorbuttons for lights ofcourse. And the Wii home console from Nintendo had a balanceboard that used feet controls But it is not as common place as the regular old button. Because of that it will rank higher in novelty.

Joystick/slider

The joystick will mount on one axis. The player can slide the joystick from the right to the left. The paddle will then move with the corresponding movement of the stick. As for the handle we could try multiple ways. We could try to use a stick, but we could also use a slider like on a sound controller. As for labelling what direction does what, that could be certainly be handy for people who aren't familiar with the type of control. For giving the user feedback to what they are doing, I think moving the stick and seeing the paddle could be enough. But this is also something we could test.

Looking at the requirements, we are nearing gaming controller territory. Meaning that for user compatibility, not alle people will be comfortable to use this input. However, according to the data from the form that was send out, most people are atleast mildly comfortable using a gaming controller. As such, it will rank in the midrange for user compatibility.

For weatherproofing it shouldn't be too difficult to do. Open top construction and less abled vehicles use joysticks for their interface. They are weatherproofed by having a rubber cover attached from the base to the stick.

Sturdiness can be a bit more trickier. We will have to take measures to make sure that the user cannot overstress the sensor/input that we will use for the joystick. This can be done by adding restraints or other ways. But this will be a bit more difficult then the sturdiness of a button. It is possible, just a bit more trickier. As such it ranks in the upper midrange.

The novelty of the joystick is higher then a button. The joystick is not really found in mosts peoples daily life. As such it is more novel for most people. As such it will rank in the lower higher ranks.

LiDAR (motion control)

From Wikipedia: "Lidar, also LIDAR, LiDAR or LADAR, an acronym of "light detection and ranging" or "laser imaging, detection, and ranging", is a method for determining ranges by targeting an object or a surface with a laser and measuring the time for the reflected light to return to the receiver. Lidar may operate in a fixed direction (e.g., vertical) or it may scan multiple directions, in which case it is known as lidar scanning or 3D laser scanning, a special combination of 3-D scanning and laser scanning. Lidar has terrestrial, airborne, and mobile applications."



LiDAR could be used as an input by looking where the users hand is positioned. From there the controller could calculate where on the axis that would be for the paddle, and move the paddle in that direction. This way we would make a motion controller where the player controls the paddle by hand gestures.

For this technology we need a good way to explain to the player how to use the controller. Hand gesturing is a technology that is still now much used by the general public. As such, some form of tutorial or labelling is heavily recommended. This will however reduce user

compatibility as it is not as intuitive as, let's say the joystick. And people have said in the questionnaire that they don't like motion controls.

Weatherproofing lidar is also something that can be difficult. While lidar can be made waterproof, rain can interfere with the laser. Making it so that it becomes less effective. And if we want to use a different form of motion control, via camera's for example, they will also be impeded by the darkness of night. As such it will rank quite low here as well.

Sturdiness should not be a problem however. LiDAR can be made into a column the user doesn't need to touch. As such we can make it really sturdy so it doesn't break easily.

Novelty ranks also high with LiDAR. You don't see motion controls that often in the regular household. As such for most people it can be quite interesting to try this technology.

Touch sensor

Sensor controls are controls that use touch sensitive sensors as a way register an input. A common place you can find these kind of inputs are in induction stove. These controls can be used as an alternative to buttons. As such, the control idea as the buttons also applies here.



Something to keep in mind however, regarding the user compatibility, is that these inputs need better labelling than buttons.

Because there is no physical 'bump' that suggests where the place of input is. As such we need an outline at least to mark where the finger needs to be placed. This makes this rank a bit lower than a standard button.

Weatherproofing is also more difficult. While these buttons are waterproof, they don't register touch as good when water is on them. This means that the button won't register the input all the time, or even register an input that was not given. It will rank low on weatherproofing for this.

Sturdiness is good for this button. They can be hidden behind thick glass that isn't broken as easily. Because it will rank quite high.

Novelty is also a bit higher. Not everyone has "glass buttons" in their home. But it won't rank very high since it is basically a button in the end. It will have a midrange novelty score.

Steering wheel

A steering wheel can also be used to steer the paddle over the control axis. By moving the steering wheel to the left or right sends the paddle in the corresponding direction. This control can be quite intuitive to the players, as well as inviting. We could add some markings telling the players how to use it, but we probably don't need much as this input type is very well known.

For player compatibility this input will rank quite high. A lot of people, especially in the Netherlands have used a steering wheel, or bar, in their life. If it is not a car steering wheel, they

have most likely used a bike before. The controls of a steering should be compatible with the users.

For weatherproofing, a steering wheel should also not be too much of a hassle. The electronics can be hidden in a base, like a digital steering wheel for PC gaming. We could then watertight the shaft that goes into that base. This makes it weatherproof enough for GLOW. It will rank quite high in this regard.

In regard of sturdiness, the same applies here as for the joystick. We should make sure the electronic parts can't be overstressed. As such we need to build in barriers to make sure it is sturdy enough to survive the people of GLOW.

Novelty is not too high however. People know the concept of a steeringwheel quite well. As such it might not be a too novel of an idea for most. It will rank a bit lower because of that.

Touchscreen

A touchscreen can be used as an input for Plong. It lends itself to a lot of ways to design a controller UI for the player. The way touchscreens are used is also known under the general populace. It is easy to use and quite clear, so long the designer makes the controls clear and easy for the user.

If we go this way, we should take in account the many ways a touchscreen can be used as a controller. It can have virtual buttons, sliders and joysticks. The sky is the limit and that makes it a complex way to design layouts for this controller. This also relates to the connection to the paddles of the game. Meaning that, yes a touchscreen is compatible with the user. But we also have to design a good interface the user understands. I will rank the touchscreen in the higher middle for that.

Weatherproofing has the same problem as the touch sensor, since a touchscreen is basically a big touch sensor. As such it will rank low for that.

Sturdiness is also a problem. Because we have a screen under the glass, the touchscreen can be quite fragile. However, making it sturdy also reduces input sensitivity by making the glass thicker. As such it will rank lower.

For novelty it will rank in the middle. The input itself is not that novel anymore, you can make a novel touch interface. It depends on what we do with it. That is why it ranks in the middle.

Turnable knob

A turnable knob can be used to steer the paddle along the control axis. Turning the knob to the left or right moves the paddle in the corresponding direction. This control is similar to the original Pong game and can be quite intuitive for players. Minimal labeling is needed as the design itself communicates the paddle's movement direction. Ensuring user feedback, such as a discernible middle point, will enhance the user experience.

For player compatibility, this input ranks well. Many people are familiar with turnable knobs, making the control method straightforward.

Weatherproofing a turnable knob should not be too challenging. The components can be waterproofed by adding a rubber casing around a shaft towards the electronic casing. This will ensure durability for outdoor use.

In terms of sturdiness, we need to ensure that the knob is well attached to prevent it from breaking off and that the electronic parts are protected from overstress.

Novelty is moderate. While the concept of a turnable knob is not as visually striking as a steering wheel, it is a known and reliable control method

The table of goodness

Concluding the above I have made a table in which I have scored the formentioned inputs as in the way they relate to the requirements. This table will be used to see which inputs are potentially more viable for PLONG then others. This way I will choose which inputs I will use to develop the first prototypes for the controller of Plong.

The table of goodness

Requirements	User compatibility	Weatherproof	Sturdiness	Novelty	Overall
Buttons	*****	*****	****	*	****
DDR style dancepad	*****	*****	*****	****	****
Joystick	***	*****	***	****	****
LiDAR (motion control)	**	**	*****	*****	**
Touch sensor	***	**	****	***	***
Steering wheel	*****	*****	****	**	****
Touch screen	*****	**	**	***	***
Steerable knob	*****	*****	****	***	****

Conclusion

From the table of goodness, based on the information about the inputs, I have five possible inputs that rank the highest for the paddle control. These are Buttons, a DDR style pad, a Turnable knob, a steeringwheel and a joystick/slider. These inputs can be considered the best theoretical fit for GLOW. From these options I will look further as how to make an prototype for PLONG.

What is a good controller user experience for GLOW?

The audience for GLOW is broad and general, appealing to a wide demographic that includes both regional and national visitors, and even some international interest. Insights from previous attendees and projects confirm this broad appeal, indicating that GLOW attracts people of all ages. Given Eindhoven's demographic, particularly the 25-45 age group, and their digital proficiency, it is important to design Plong with simple digital interfaces that can be easily used by this diverse audience.

Survey results indicate that people prefer interfaces they use daily, such as keyboards, labelled buttons, and touchscreens, which are familiar and widely adopted. In contrast, motion and voice controls are less popular and less understood. To ensure an intuitive user experience for our controller, we should choose simple, well-known inputs to avoid the need for tutorials and prevent user frustration due to complexity or unreliability.

Plong requires three types of inputs for gameplay: one to move the paddle, one to signal player readiness, and an admin button to turn the game on and off. These inputs ensure players can control the game and indicate their readiness, while the administrator can start, restart, or shut down the game. With these basic inputs, all necessary controls for Plong are effectively covered.

From the table of goodness, based on the information about the inputs, I have five possible inputs that rank the highest for the paddle control. These are Buttons, a DDR style pad, a Turnable knob, a steeringwheel and a joystick/slider. These inputs can be considered the best theoretical fit for PLONG on GLOW. And should give a good user experience for the people attending GLOW.

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