


# ENERGIA

Design for evolving  
scenarios

Giadamaria Battiato  
Doğa Deniz Bozfiat  
Daniele Garancini  
Ana Cristina Garcia Dávila  
Eduardo Marin Torres



sendero



**POLITECNICO**  
MILANO 1863

*School of Design*

*Product Service System Design, Innovation Studio, 2022-23*

*Team Sleep&Shout:*

Giadamaria Battiato, Doğa Deniz Bozırat, Daniele Garancini, Ana  
Cristina Garcia Dàvila, Eduardo Marin Torres

*Professors:*

Valentina Auricchio, Stefana Broadent, Marta Corubolo, Fabio Di Liberto,  
Ilka Suppanen

*Tutors:*

Vanessa Monna, Chenfan Zhang

# Table of contents

## 0.

<b>Introduction</b>	<b>4</b>
Sendero	6

## 1.

<b>Scenario</b>	<b>8</b>
Lights and safety	10
Situation in Mexico	14
Scenario	18
Storyboard	20

## 2.

<b>Product</b>	<b>22</b>
Overview	24
Interaction	26
Lighting the path	32
The signal	34
The materials	38

## 3.

<b>Service and system</b>	<b>42</b>
Sendero's family	44
How does Sendero grow?	46
Service map	48
Personas	50
First aid assistance	52
Raising awareness	54
Customer Journey Map	56

## 4.

<b>Communication</b>	<b>60</b>
Why Sendero?	62
Our values	64
Logotype	66
Advertising campaigns	68

## 5.

<b>Annexes</b>	<b>78</b>
Technical drawings	80
Design process	84
Bibliography	86

# **0.**

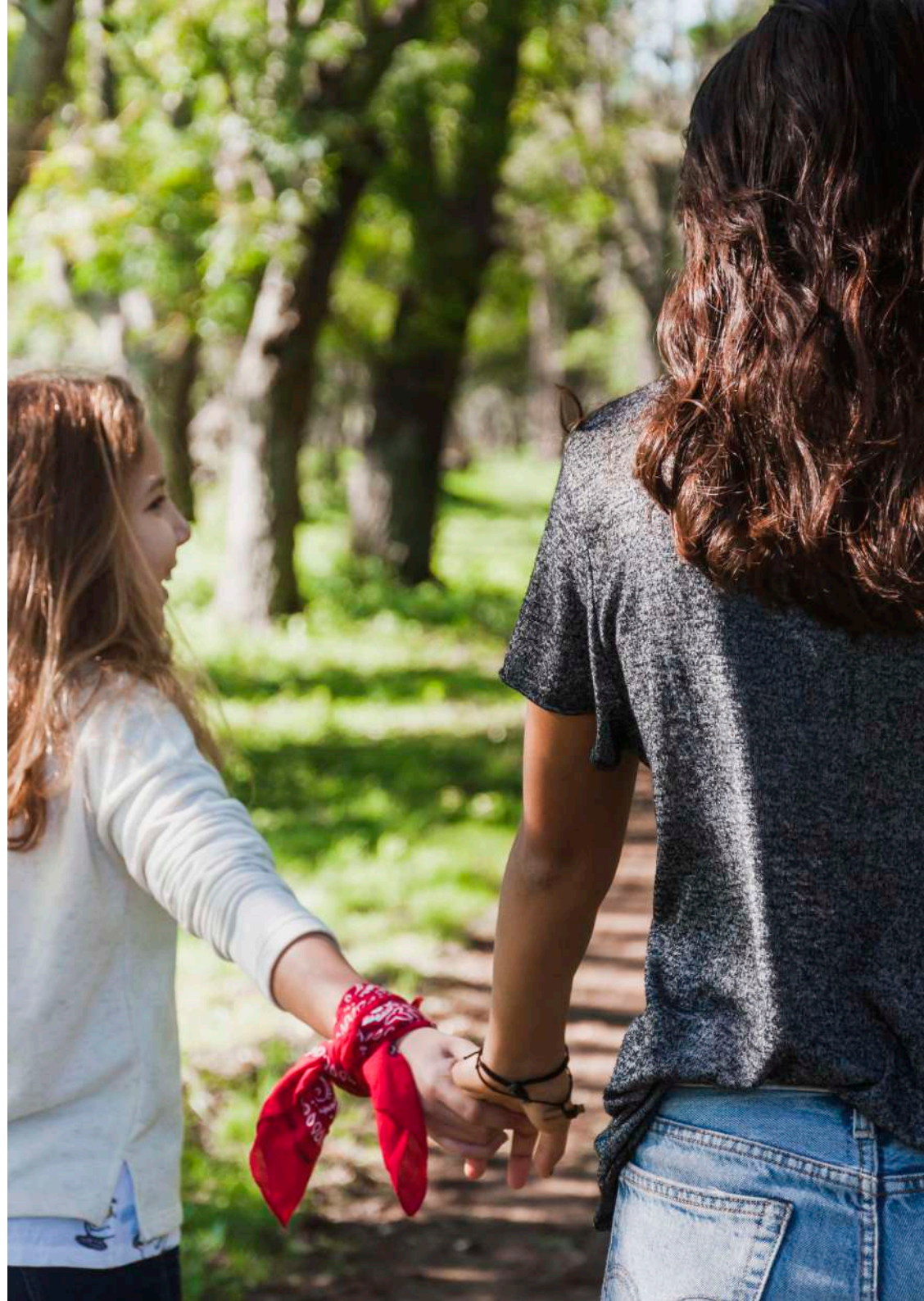
## **Introduction**

*Welcome to Sendero's world!*

# Sendero

Sendero is the proof that enhancing safety without disrupting already existent (or non-existent) infrastructures is possible, especially in rural areas. The project is not just a light or a SOS product, but it is a new way of feeling that you are not alone on dark paths and that your community is going to rescue you when feeling lost or injured. Innovation is in the community itself: today, you need help, but one day you could be on the other side.

Together we share a new meaning of safety.



# 1.

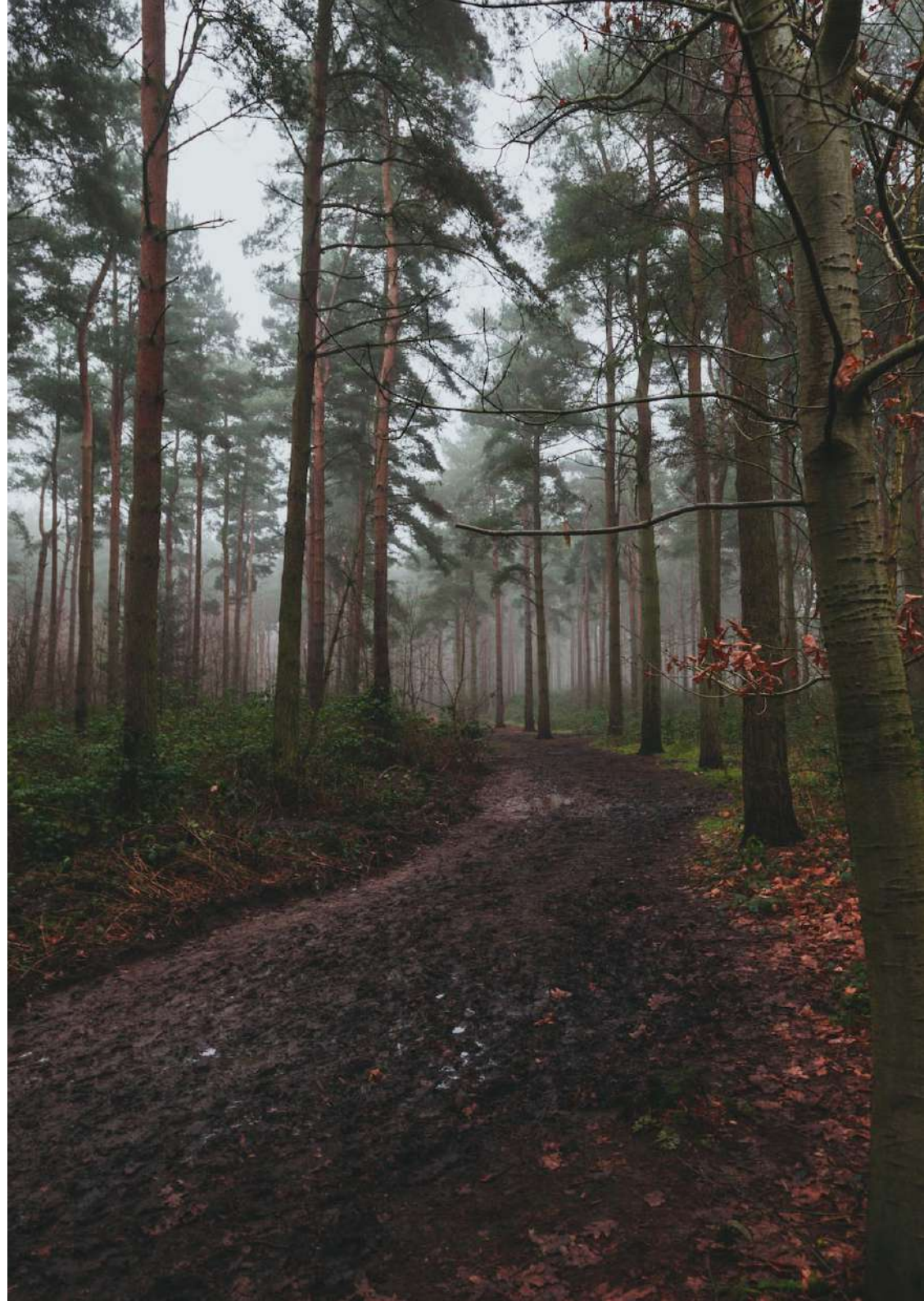
## Scenario

*The reason why a solution like Sendero is so important in these realities*

# Lights and safety

*Why are we speaking about this now?*

There has always been a connection between lighting and perceived social safety. The link between them is the better lighting, the higher safety perceived. It is true that public lighting is highly energy consuming and has several effects, positive and negative on the environment.



A study conducted in the Netherlands showed that in 2007, public lighting points were responsible for 30 to 70% of total municipality energy use, which comes with considerable economic costs and high carbon emissions. Another environmental concern is light pollution, which can interfere with the life of wild animals and plants. Artificial lighting is growing 6 to 7% each year in the Netherlands alone. (Boomsma, C. 2014)

Many countries have opted to dim the lights at certain times of the day to help mitigate the environmental and finance crisis that derives from public lighting services, yet a social problem must be considered for such policies to be successfully implemented, given that perceived and actual social and environmental safety is linked to lighting conditions.

Improving street lighting has shown to lead to a reduction in some types of crimes, accidents, reduced fear of crimes, greater use of the streets at night and more positive opinions of the local authorities. (Boyce, P. 2000).

Besides perceived and actual social safety, road accidents are also tightly linked to lighting conditions. Road accidents at night are disproportionately high in numbers and severity compared to the day, of which the main factor contributing to this problem is darkness because of its great influence on the drivers behavior and ability.

**62**  
lighting and  
accident studies

**15**  
different countries

**85%**  
proved lighting to  
be beneficial

**13-75%**  
of reduction if the lighting was sufficient



# Situation in Mexico

## *Why not somewhere else?*

According to the Mexican government, “A good public lighting service is an important factor for attracting important investments for the state, as it’s more likely for investments to take place in a well lit area than in an area with poor or lacking of public basic infrastructure”.

The public lighting service consists of supplying artificial illumination in streets, roads and public spaces, as its a fundamental service that allows for community life and is directly linked to security, as better lighting the less chances of delinquent incidents.

By constitutional mandate, the state government is responsible and must provide public lighting service equality through the state territory.



**of state capitals are covered with this basic service**



**of the rest of the state has working public lighting**

*Scenario*

Approximately between 60-70% of the lamps are installed directly on poles from the National Electrical Commission (CFE), which leads to bad lighting quality even if they are working lamps, given that they are not evenly distributed and the distance between them is greater than the recommended one to provide quality lighting. Of the places that have working public lights, it was estimated in 2019 that 7 out of 10 public luminaires installed presented some type of malfunction or flaw, causing poor, inadequate or lack of lighting in public spaces.

*Actual road that connects a village to a school in La Tomatina, Mexico.*



*Scenario*

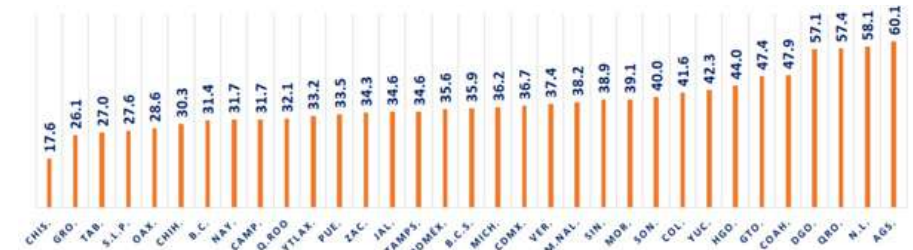
### What do the surveys show?

In a survey made by the national electrical commission 57.3% of the population considers the public lighting service of their municipality to be inefficient. Out of the 32 states, only 9 of them are above the average adequate lighting line.



% of the population that considered their municipality's public lighting system to be adequate (2019).

Even though 57.3% of the total population considers their municipality lighting service to be adequate, on average only 38.2% of the population is satisfied with the public lighting services.



% of the population that is satisfied with the public lighting service in their municipality (2019).

In a budget analysis made by the Mexican government administration, to provide an adequate and extensive public lighting service it would require the substitution of non functional lamps and extend the networks coverage, which would cost approximately 85.6% of the public budget of each state.

# Scenario

## *We need YOU to enhance safety*

In the year 2027, Latin-American countries are governed with plans to invest in better infrastructure in low income communities, however, little is achieved. The government has not really invested in the development and interconnection of small towns surrounding bigger cities.

Population, especially children and mothers, experience feelings of anxiety and fear when they are out at dark hours, due to the perceived unsafeness of not seeing the roads and fear of transiting through vulnerable areas.

Sendero is not just the product and the system that will be explained, but is what divides the knowledge about these issues from the braveness to take action.

*“Sendero is our opportunity”*



# Storyboard

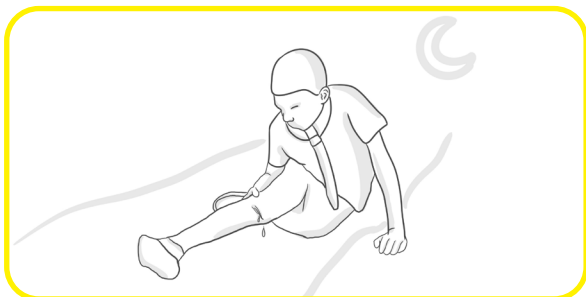


## 1. The family

Guadalupe always takes her children to school. Sometimes she is not able to pick them up because of work, so her children have to walk alone for a long distance.

## 2. The problem

It is late afternoon and Guadalupe's child is coming back from school. He cannot really see the road, so he falls and hurts his knee.



## 4. The signal

The signal travels through all the volunteers of the precise community where Guadalupe and her children live.



## 4. Coming to help

The nearest volunteers reach the child, who is now really scared. They help him wash the knee and calm down.



## 3. Reaching Sendero

The nearest Sendero station is just some meters away from him. He reaches that and presses the button.



## 5. Back home

Guadalupe was so scared about her child, so she hugs him in relief and she is really happy that Sendero has been implemented.



# 2.

**Product**

*The touchpoint that leads you along the darkest paths*

# Overview



## *Sendero's functions*



**Lighting**



**Sending signals**



**Receiving first aid assistance**



**Creating and reinforcing communities**



**Improving quality of life**

# Interaction

*From the perspective of the user that needs help*

*Seeing the product from long distance*

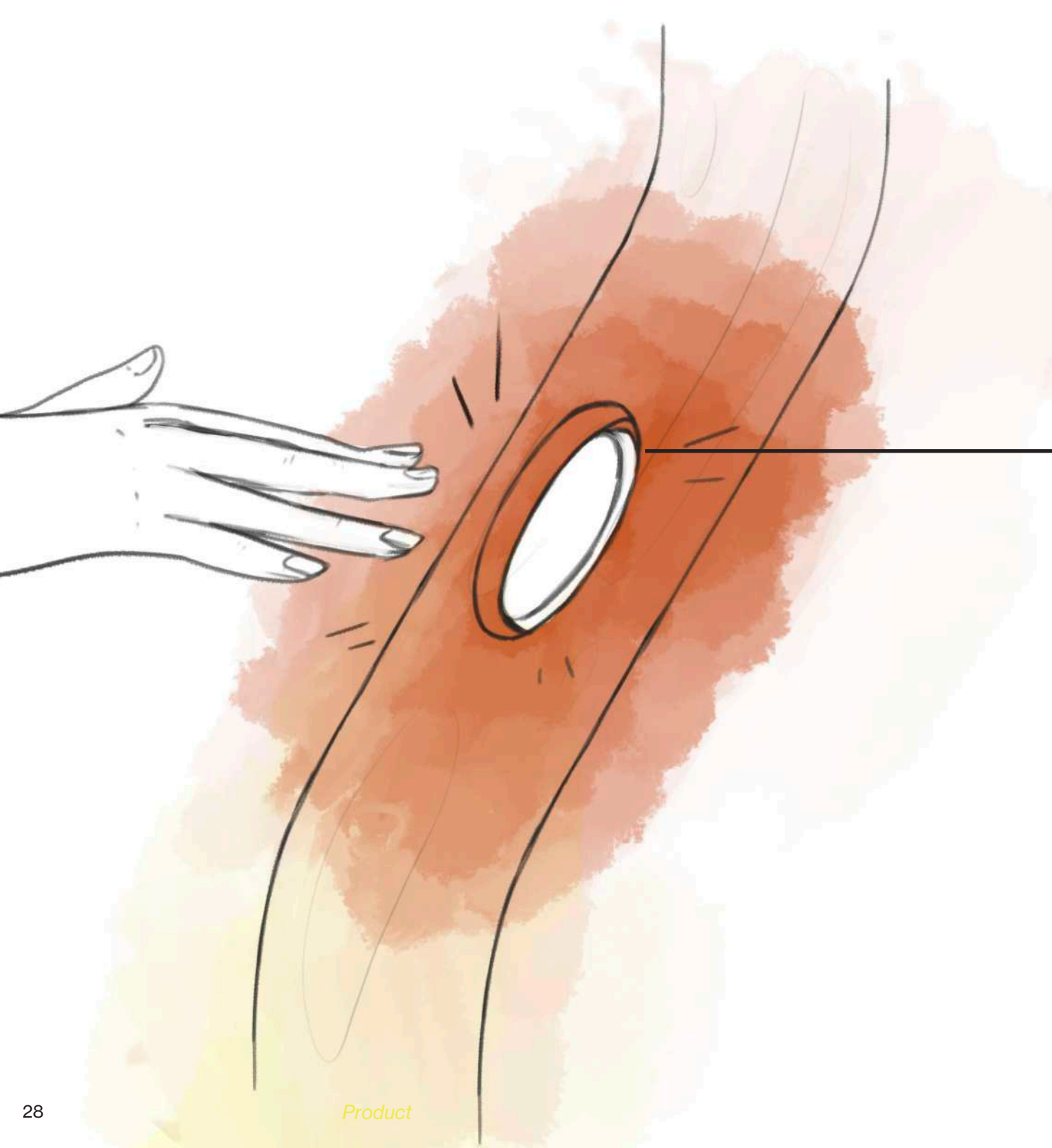
Visualizing the path on the dark path has never been so easy and fast. Thanks to the bright powders and the resin that diffuses the effect, everybody can follow the path and make sure to never get lost on the roads between a village and another.

---

*Reaching the product, individuating the red part*

If something bad happens, like falling or being hurt, every hub is displaced in a way that it is impossible to not reach that. Also, the brighter yellow part of it is on the bottom part but a bit far from the ground, so that you can see along the journey without being blinded.





### *Pressing the button*

The red resin stands out and the button indented inside it is safe from accidental pressing and natural accidents. Here is where the interaction really happens. Also, it is not too high placed so that everybody can reach it, also injured people.

---

### *Waiting for assistance (approximately like 10mins, but can vary a bit)*

The opportunity to have different channels of signals is what make the service to really work. Small communities are easier to connect, but also is more helpful to create less huge but more closer ones.





# Lighting the path

## *Subtitle*

*Never feeling  
alone in the dark  
again*

Every path is dangerous in its own way, but there is actually no need to be scared every time it goes dark.

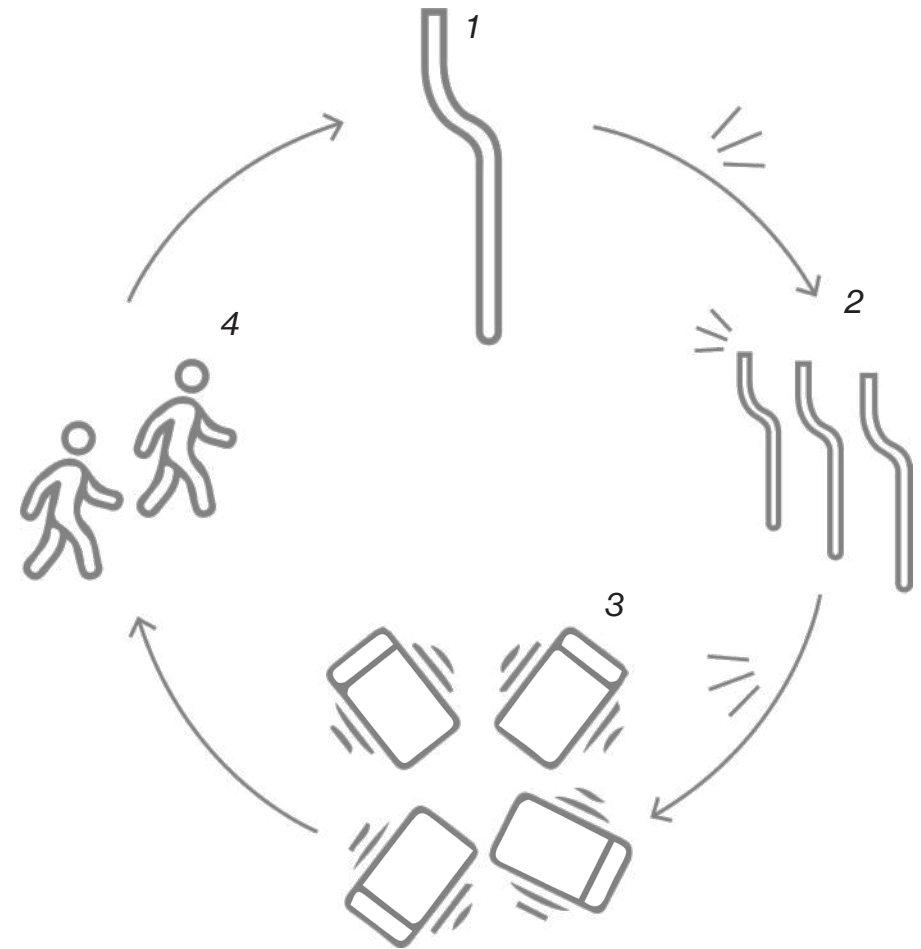
The placement of Sendero has actually been inspired by the movement of the fireflies, which manage to stick together and send signals one to another thanks to their light.

# The signal

## *The ambient backscatter*

The ambient backscatter is a technology that reflects radiofrequencies around us to generate radio signals between devices.

It needs at least two of them in order to create a connection and to communicate. It is for now a 1bit communication meaning that it is either a ON/OFF technology that uses battery with really little power, but in the future it will provide a solid alternative when power is unavailable.



- 1 - The signal starts.
- 2 - The chain starts.
- 3 - Messages arrive to the volunteers.
- 4 - Volunteers come to rescue.

It uses that power to modify and reflect the signal with encoded data. Antennas on other devices, in turn, detect that signal and can respond accordingly.

Initial implementations can communicate over several feet of distance, even if the transmission towers are up to 10.5 kilometres (6.5 mi) away.

At the end of the chain, the signal is transformed into an sms text and sent to the volunteers phones, who receive an alert providing the information where the signal was sent.



# The materials

## *Resin + fluorescent powder*

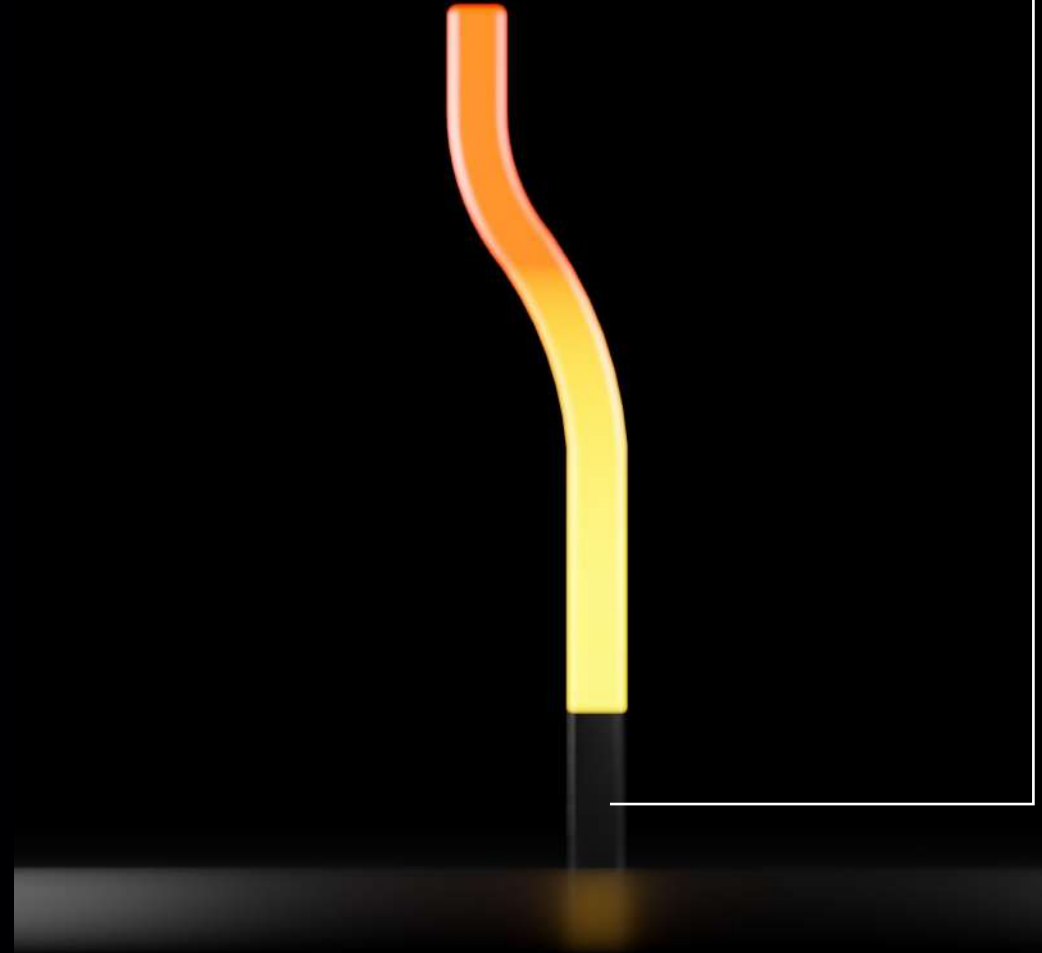
The actual products are created by using waste materials from industries like resin and fluorescent powders, in yellow and red.

The choice of the material is not made casually; in fact, resin in every shape can be used as diffuser for light of, as in this case, fluorescent light. The material mixed usually takes two or three days to solidify and then can be easily set in every path.

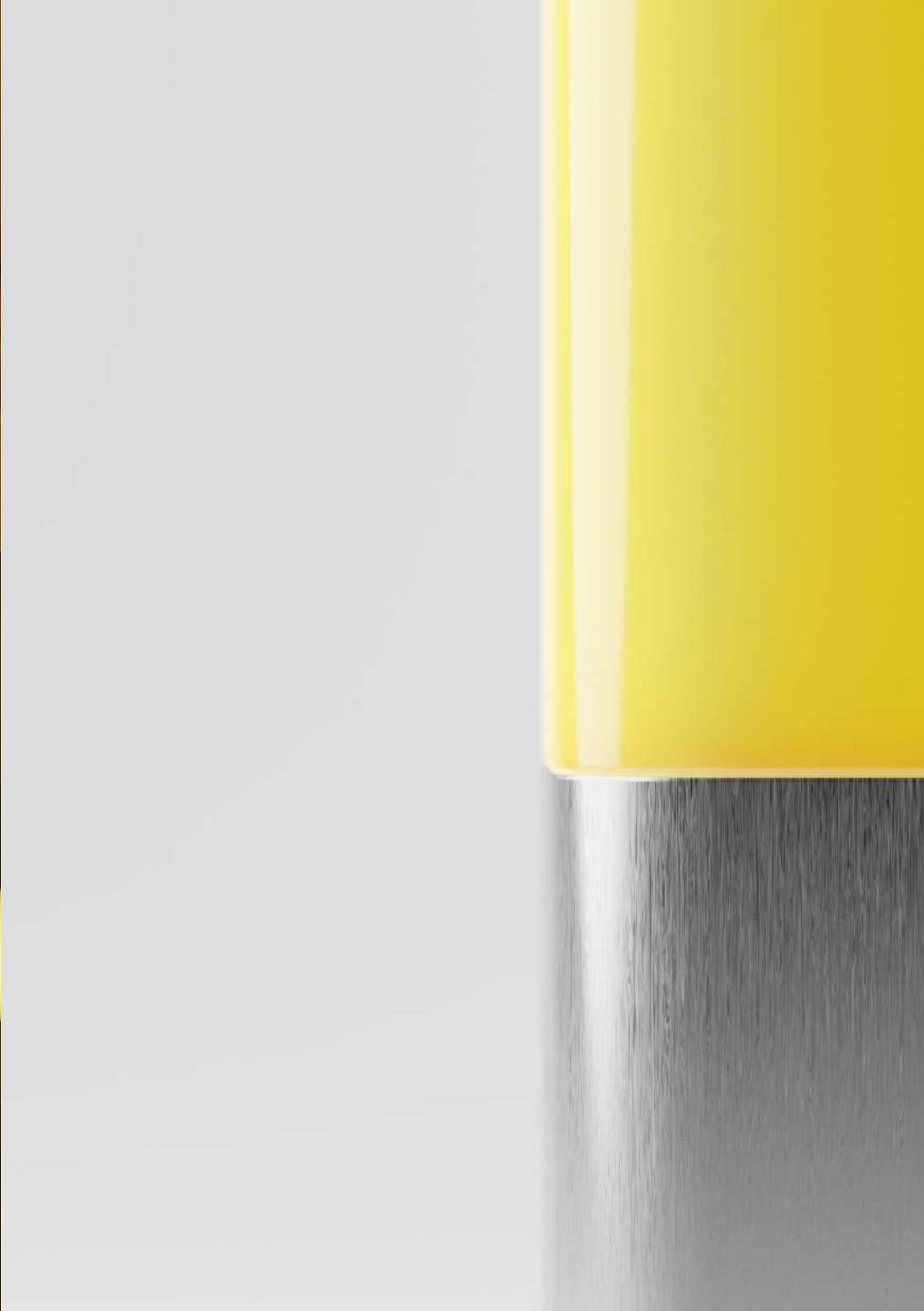


*Product*

## *Aluminium base*



*Product*





# 3.

## Service and system

*A community that closely works on the same purpose*

# Sendero's family

## *A service with multiple levels*

Sendero is not just a product, but mostly is a service and system.

The main hub is where the real interactions take its place. The bigger Sendero products are the ones that you can see also from long distance, even when the path is abrupt and not flat at all, even with trees and tall grass. Also, the red resin indicates the precise part to press and it is really easy to interpret.

The little products have the precise meaning of follow the right path and permit the people to really understand the direction to follow.

The paths are efficiently reported by the community itself, which is engaged at the very beginning of the process with an advertising campaign.

*"We don't want to help you, but to walk with you"*



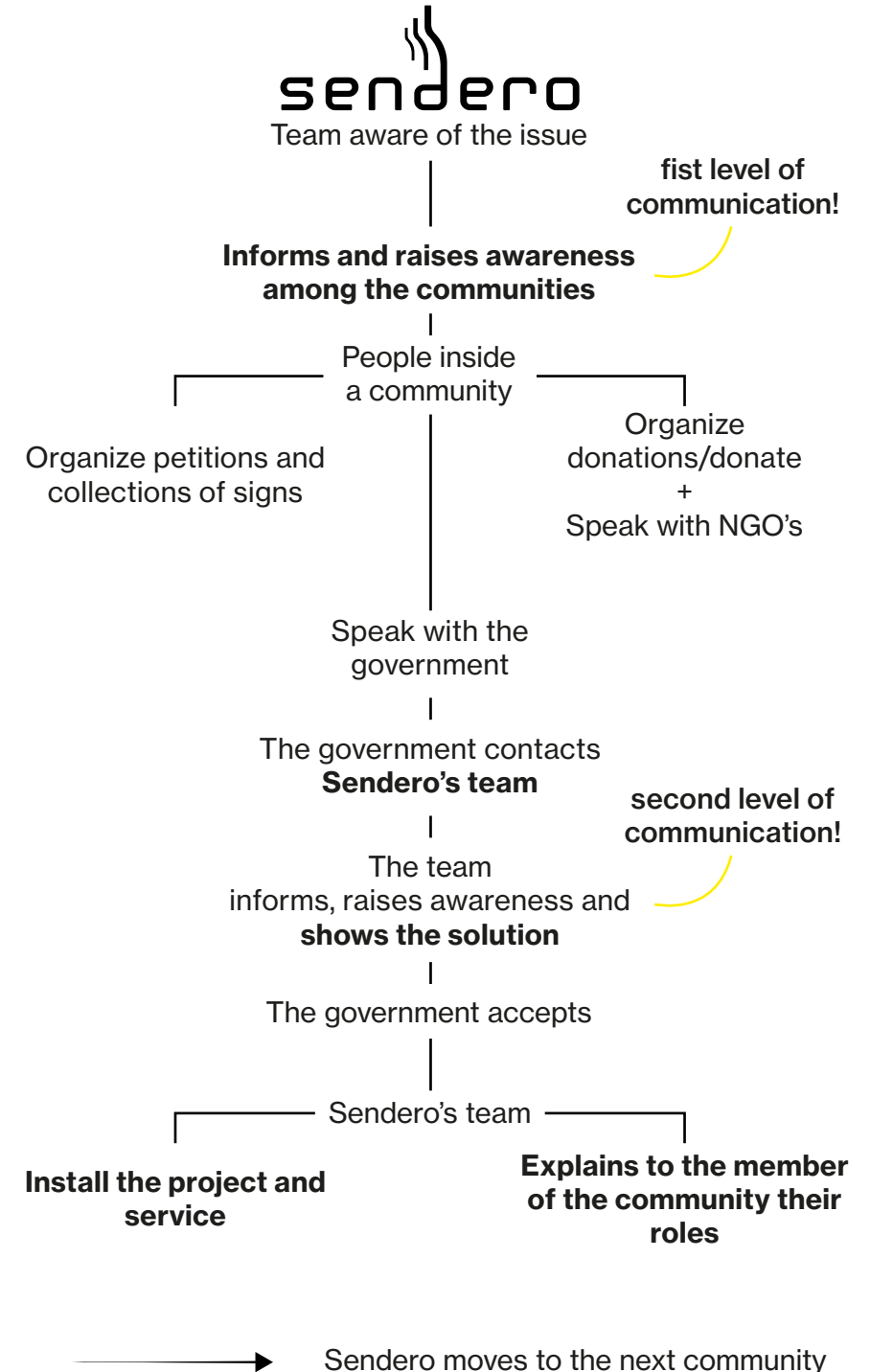
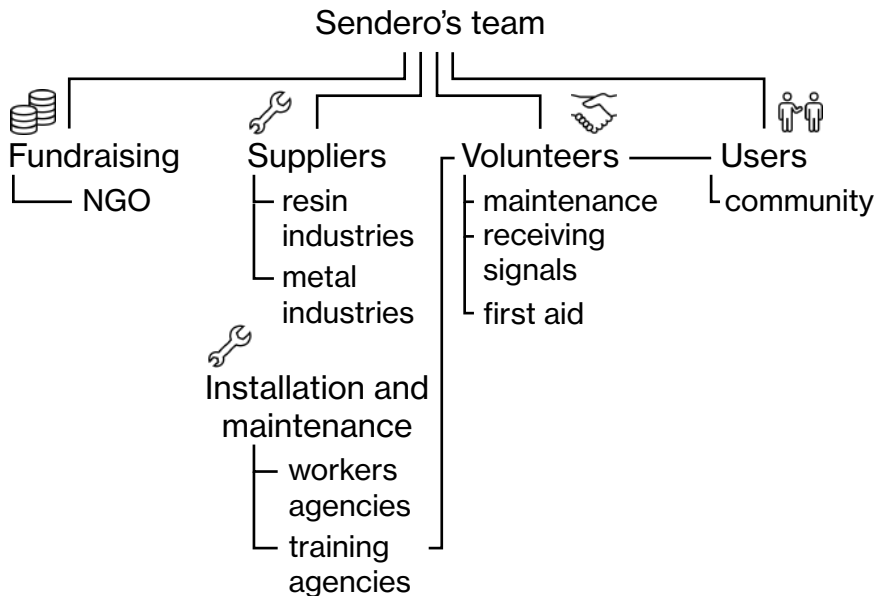


# How does Sendero grows?

## Timeline

The stages of Sendero's project are repeated for each community that needs this kind of solution. Sendero's team gets information about the precise community they need to help and start a precise adv campaign to inform the community itself, which is ignorant about its issues. Then, the population itself permits the project to actually take place and develop.

## Stakeholders map



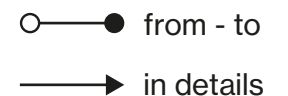
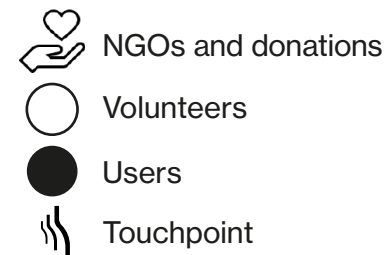
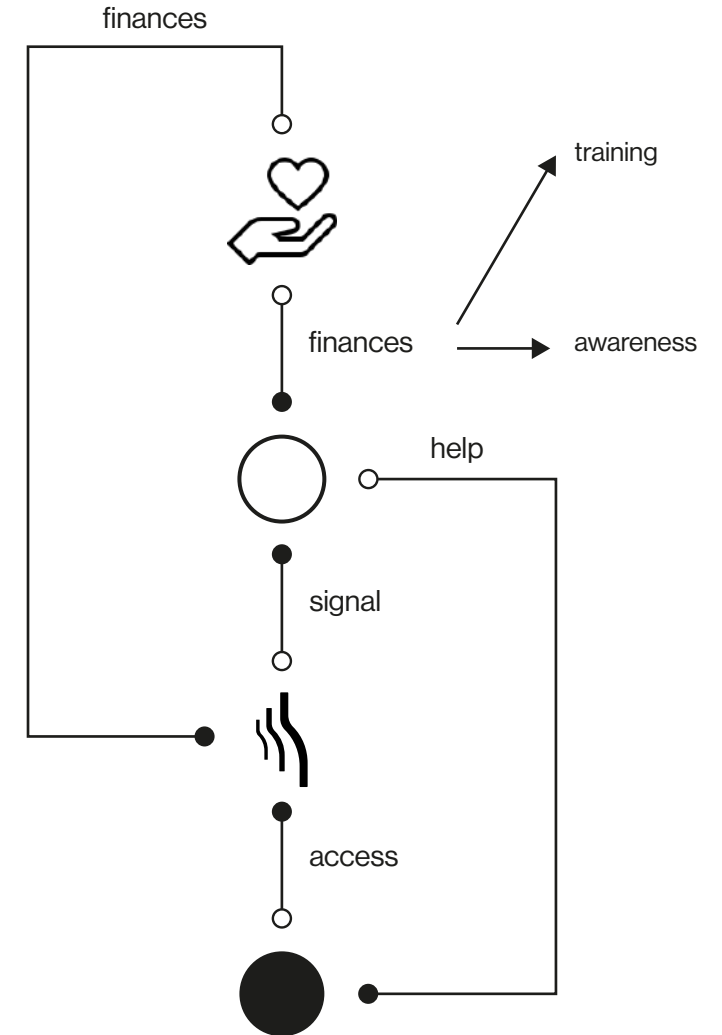
# Service map

## Overall view

The service in general works really making physical contact between people and every stage of the system.

In fact, Sendero's team reaches the community at first, but then it is the community's turn to take really action, speak with government and NGOs and make the movement starts.

As it starts, the system keep working by itself, as the community does, fully united and with solid relationships that works perfectly with the project.



# Personas

## The main users and actors

What is a community?

Speaking about Sendero, the community the project really communicate to is really heterogeneous. Every person is actor of a moment of change.

These three are categories that can be mixed, their boundaries are not so distinct and one could take part in the project being a USER™ and a PARENT at the same time, or just a piece of one of them.

*“It is not just that I need something, I want the change to really happen”*



### The USER™

- only uses the service in the moment of the emergency
- knows about the issue

#### The journey 1° advertising lvl

sees the adv, understands, but has no time to do something to help about the issue in the community

#### before Sendero

neighbor asks and convinces them to sign the petition, they actually think is a good idea

#### during Sendero

never had thought about that anymore until they got lost coming without their phone; they followed the path of lights



### The ACTIVIST

- knows about the Sendero team and immediatly creates online petitions
- wants to help receiving the signals sometimes

#### The journey 1° advertising lvl

so invested!! why didn't they notice that before? they talk with Sendero team and search for info about various paths

#### before Sendero

they create the petition and gather other activists to collect signs; then, the Activists take them to the government

#### during Sendero

sometimes, they help receiving signals because they have really little time due to work and other activities



### The PARENT

- knows about Sendero and thinks it is a good idea for their children because he works a lot
- sometimes helps with maintenance

#### The journey 1° advertising lvl

starts getting scared for their children coming back for school alone when they work; sees the adv and is unsure if it will ever happen

#### before Sendero

signs and tells everybody inside and outside his family to sign, they also ask to coworkers and friends

#### during Sendero

they are now less concerned and happier for their children; sometimes they also help with maintenance

# First aid assistance

## *Basic help and training*

If the button is pressed, it is sure that the one who is gonna reach the place will be well trained about first aid assistance. It is impossible for Sendero to exist without a huge community of volunteers who will actually get informed and trained about what could be needed by every user of the touchpoint.

This will become possible thanks to first aid courses.

*“Together we become stronger”*



# Raising awareness

## *Why the need to take action?*

The personas do not define every point of view inside each community.

At the same time, every point of view converges inside the same pattern: the principle and the final aim is to give the population the critical thinking necessary to carry forward a huge change, both in the mentality of the entire place and the government, both in the real world of solutions that could be taken.

Sendero does not offer the only solution, but the most situable in the context of energetic issues and corruption that is real and concrete.

*“If not me, who? If not now, when?”*



# Customer Journey Map



**Rodrigo (Rorri), 10 y.o.**

Primary school student  
Living in a village near La Tomatina  
Has a younger sister and his mother, Guadalupe,  
works a lot inside and outside of the house

## Actions

### Before Sendero

gets bullied for being taken by parents  
feels like he is not a kid anymore  
sees the advertisements but doesn't understand them

### The need

tries to go alone at home, but falls  
crawls to Sendero and presses it

## Community stakeholders



ALONE

## Fears

DARK BEING BULLIED  
TALL BAD GUYS SWIMMING

## Hopes

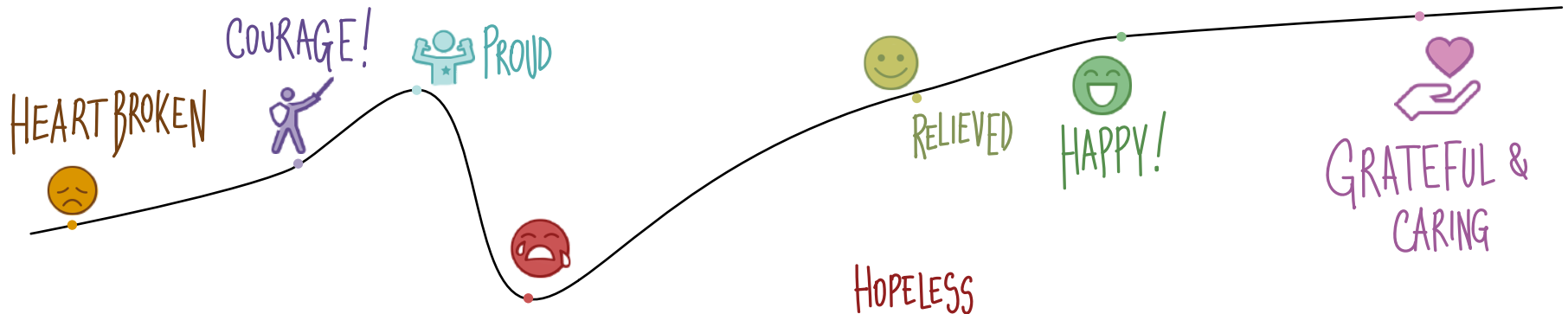
- having better friendships
- don't make his mom worry about him
- become stronger

### The rescue

the wait is not long, two kind people come help him  
they help him with medications and getting up  
Rorri feels so glad and grateful to the volunteers

### After Sendero

Rorri is now on the other side of the service and, well grown up, decides to be a volunteer to go rescue other kids like him 3 years ago; the community become closer than ever



## Quotes

I don't want this to happen again!

I feel so brave and grown up!

What did I do??

I'm safe! Sendero really works!

Mom! I won't do this again!

Now it's my turn to do something for the others!





# 4.

## Communication

*Not only brand identity, but our identity*



# Why Sendero?

## *The meaning*

Sendero is a spanish noun that means narrow path, mostly formed by humans and animals' passing.

*Quote*

## *Deeper*

Sendero means also:  
the path that each and everyone of us goes through in his or her life.  
It's the path that represents a reason for the before and a motivation of the after.

## *And deeper*

Sendero is the path of life.



sendero



## Our values



### *Reinforcing the community*

Creating something that people do not need is not our aim. We want to respect what is already present in the community we are working on, and make it closer and bigger.



### *Enhancing safety*

Of course safety is one of our main values and aims at the same time. Through Sendero, we want people to understand that also very little work can make really huge differences in quality of life.

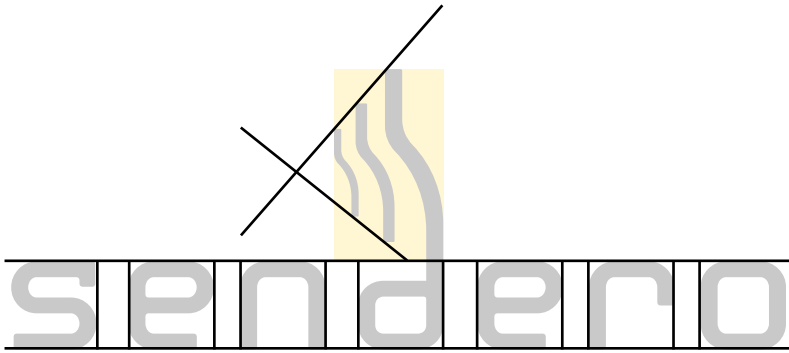


### *Respecting nature*

Sendero does not want to mix with nature, but wants to be part of it and complementing it, helping everybody to discover paths again with a new powerful and confident point of view.

# Logo

Logotype grid




Typography


**AaBbCc**  
 abcdefghijklm nopqrstuvwxyz  
 ABCDEFGHIJKLMNOPQRSTUVWXYZ  
 MObY BOLD

**AaBbCc**  
 abcdefghijklm nopqrstuvwxyz  
 ABCDEFGHIJKLMNOPQRSTUVWXYZ  
 Agenda Regular

**AaBbCc**  
 abcdefghijklmnopqrstuvwxyz  
 ABCDEFGHIJKLMNOPQRSTUVWXYZ  
 Neue Haas Grotesk Display Pro

Colors

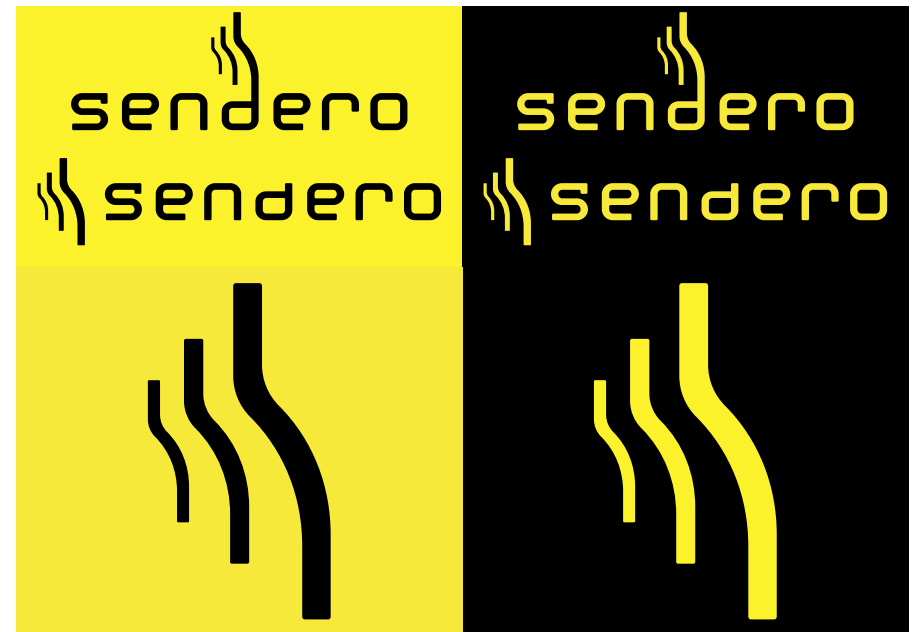
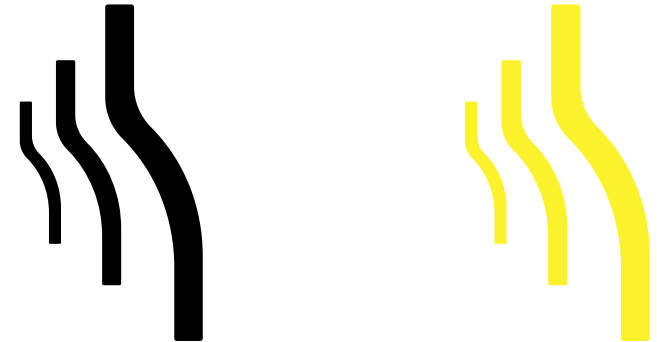
 #000000  
 R 0 G 0 B 0  
 C 0 M 0 Y 0 K 100

 #f6e93b  
 R 252 G 243 B 44  
 C 8 M 0 Y 83 K 0

 #ffffff  
 R 255 G 255 B 255  
 C 0 M 0 Y 0 K 0



Used in different variations



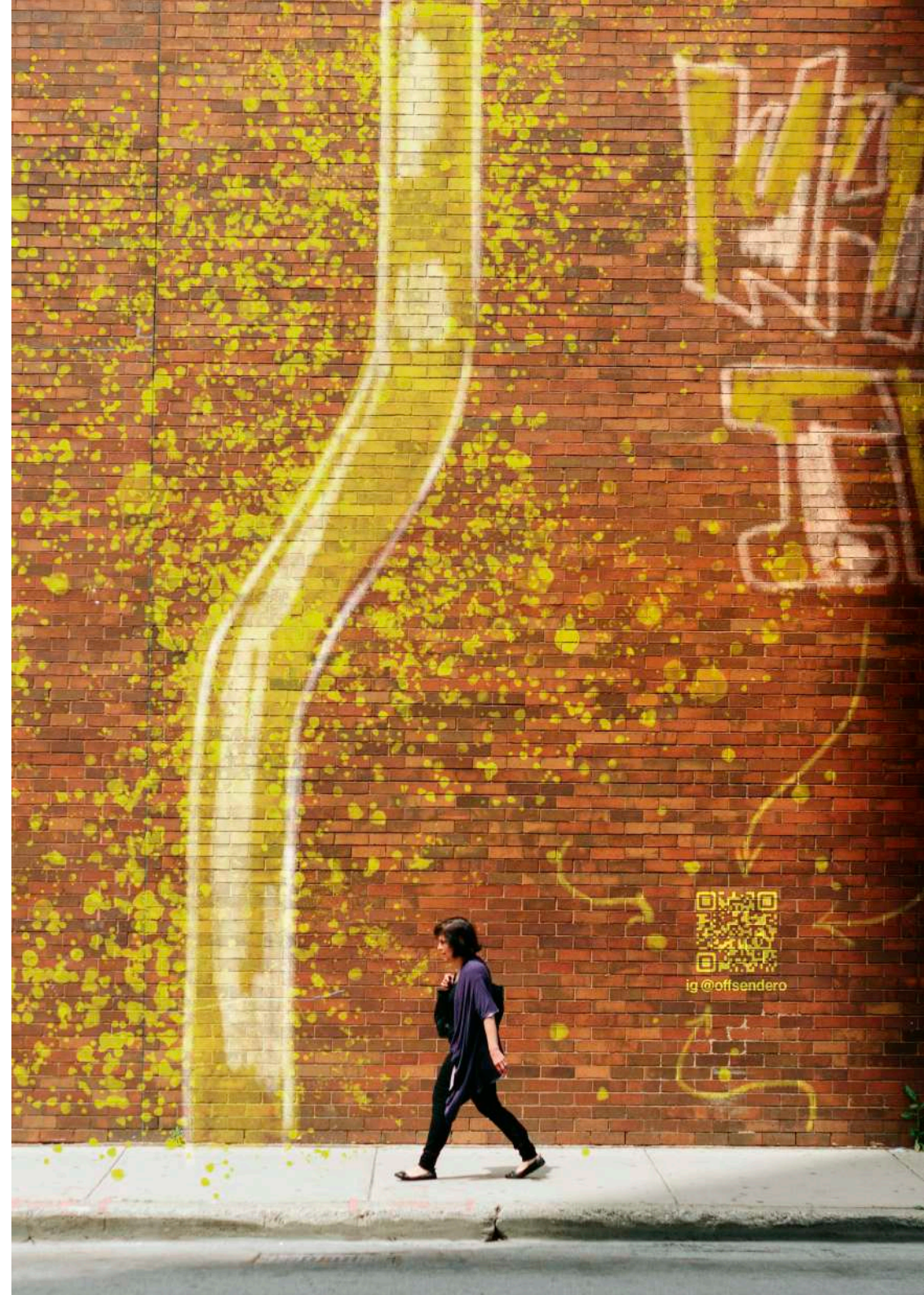
# Advertising campaigns

## *Step 1: alert the community*

When our team chooses a community, the first step is for sure making everybody aware of the situation that is currently happening.

In fact, probably most of the people of a specific community are concerned about the problems of dark paths and unsafety, but little of them is really aware of what can be done to change this.

For this reason, graffiti is the most immediate way to make people understand our and their reasons, because it is fast and really radical inside them.



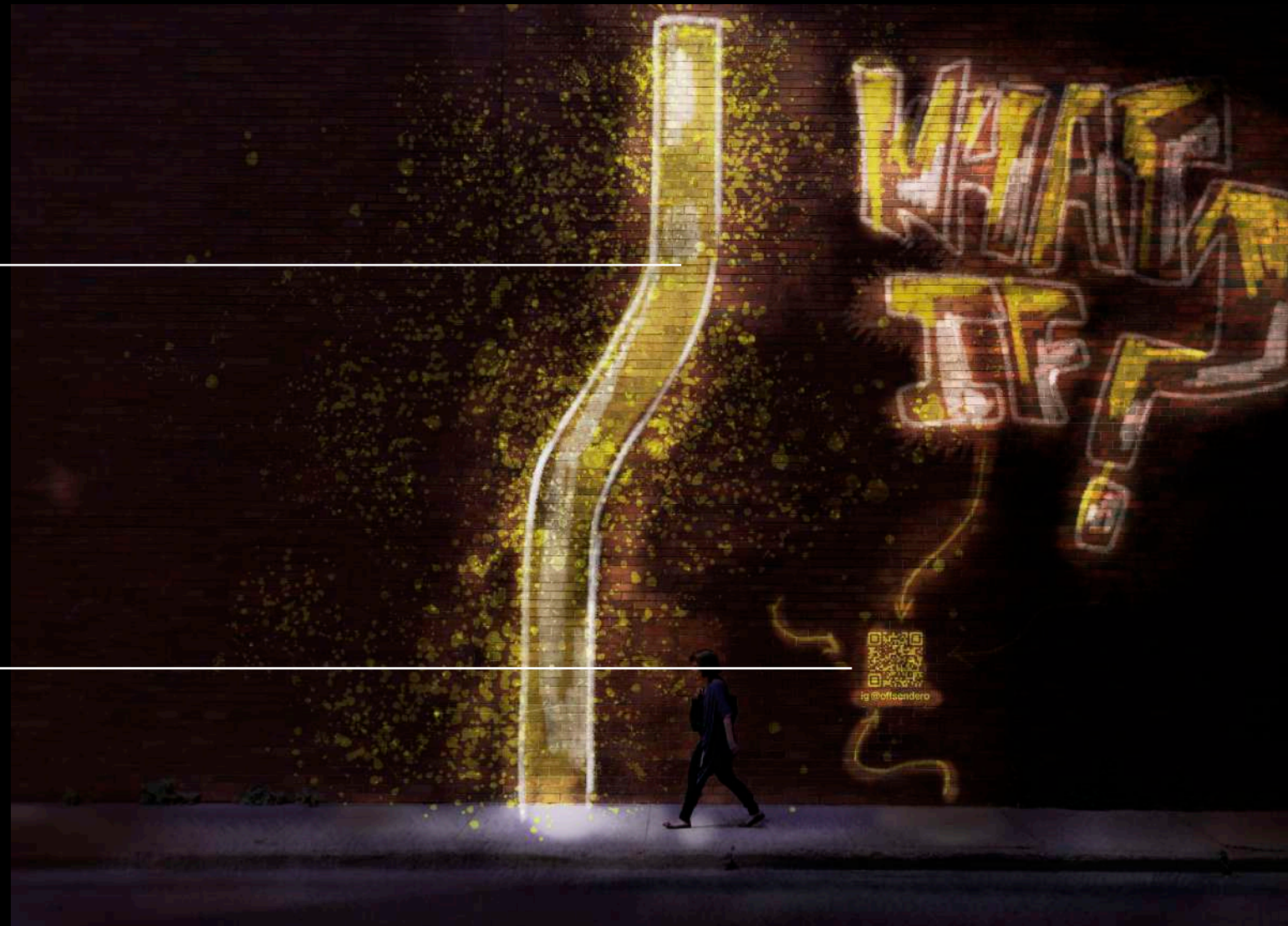
*Night view*

Using fluorescent powder, to show more the way we want to change the situation and to already giving hints about the product.

---

IG Page informing people  
Managed by our Sendero's team

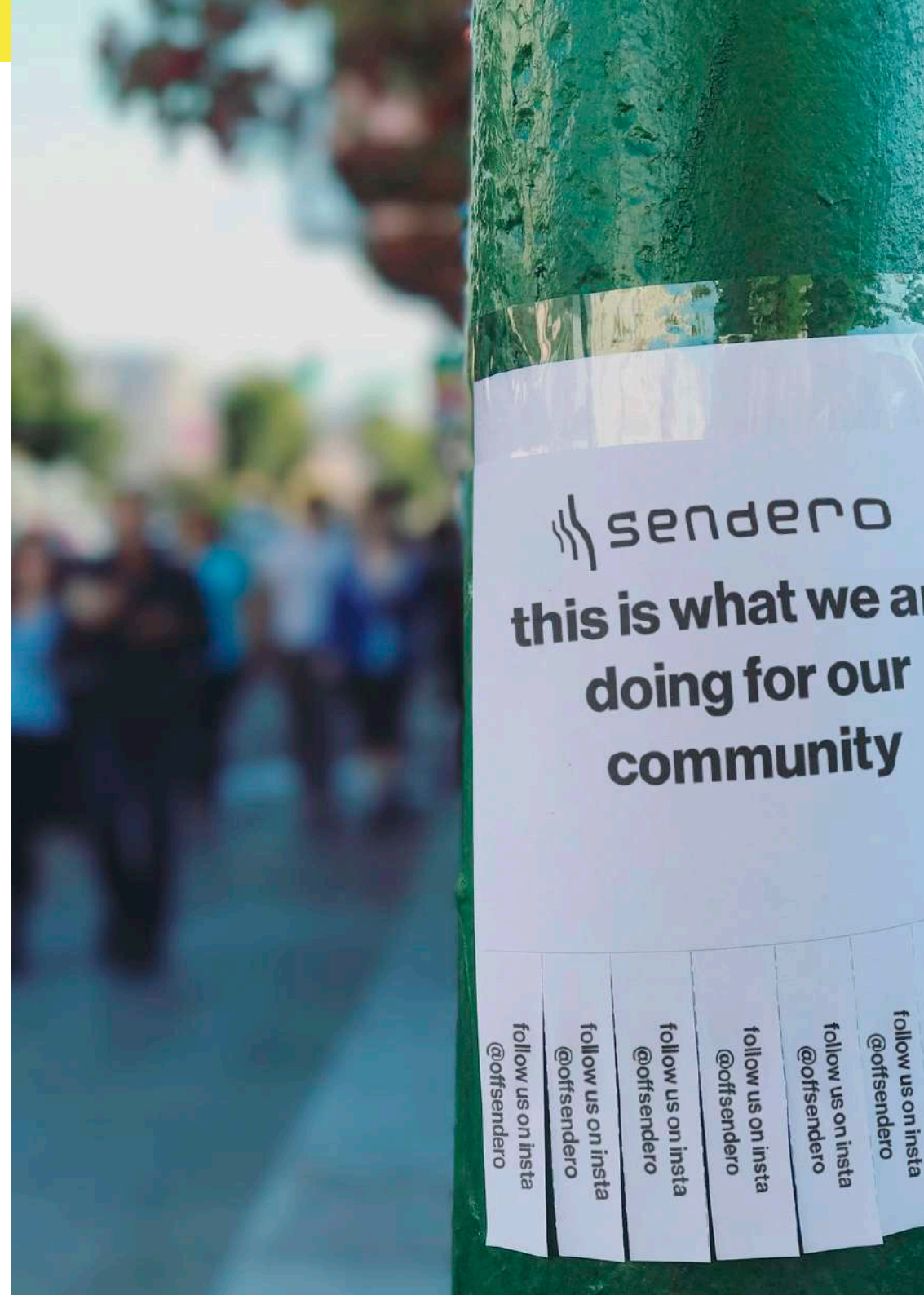
---



## Step 2: the community movement

After being informed, it is the population's turn to realize a real movement to alert more and more people.

We imagined them creating their very specific campaign, with really simple materials and slogans, to really engage each other.

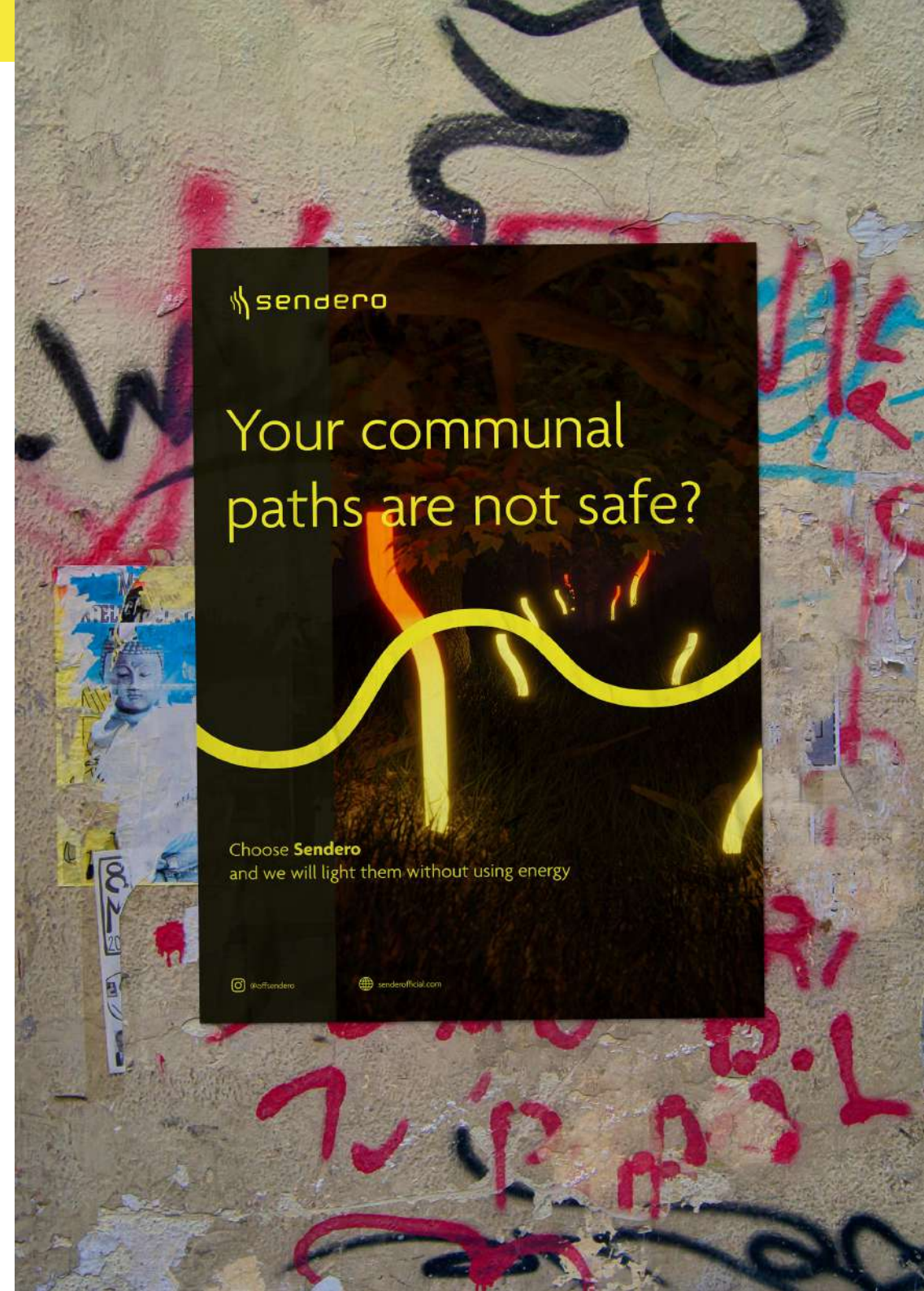


### *Step 3: government & NGOs*

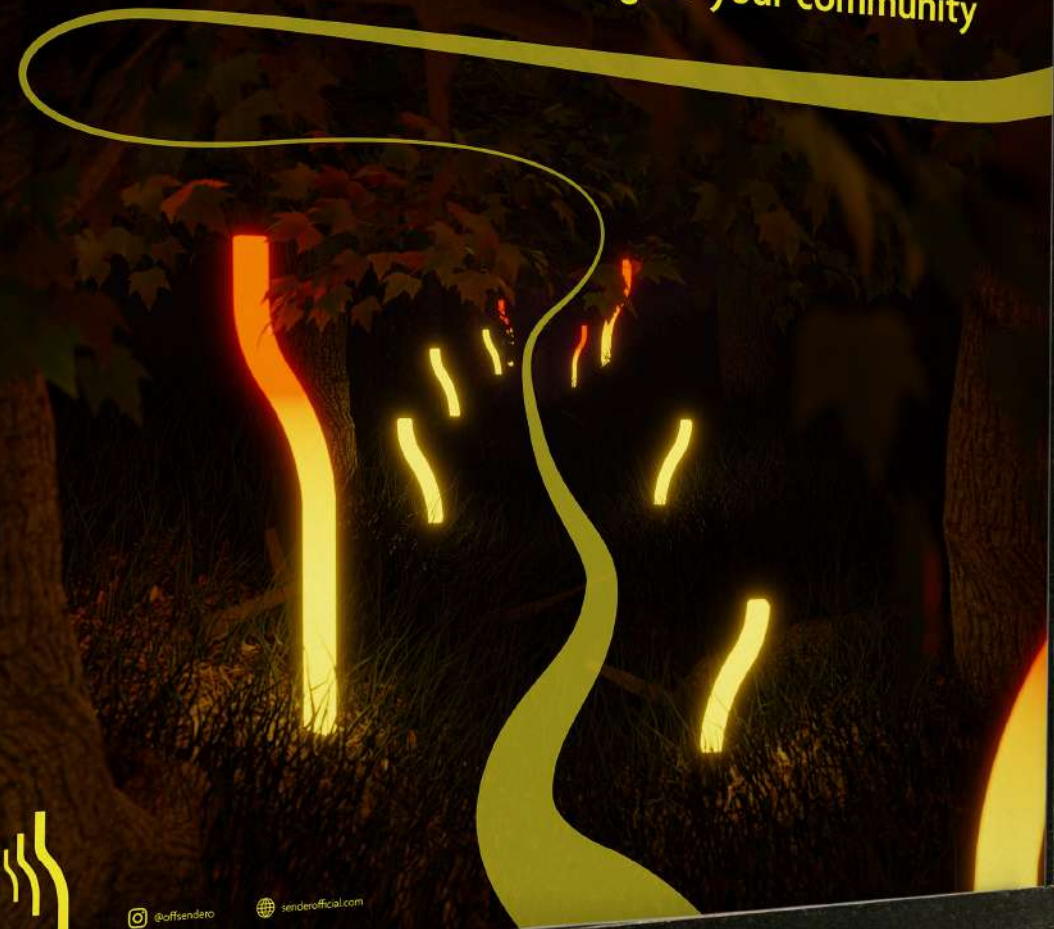
The advertising is also going to focus a lot on the governments that are going to buy the service. This means that it is needed a much more institutional and almost provocative communication language, by using direct questions and immediate calls to action.

### *Step 4: informing about the service*

A good way to communicate and advertise the product is to actually show it in action. The plan is to photograph Sendero while it is working in the dark environments where it will be installed. This way the community and the population will realise that the initiative that the government invested on is deeply needed and has a deep and important effect on the situation it addresses. In this sense the key communication language used is emotional. Emotions are an important driver towards a better understanding of the need for better safety infrastructure. In this case technicalities and technological aspects are going to be kept aside, since the communication is much more directed towards the population.



This is what **Sendero** is doing for your community



 @offsendero

 senderofficial.com

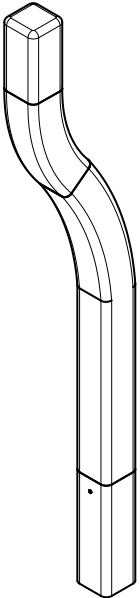
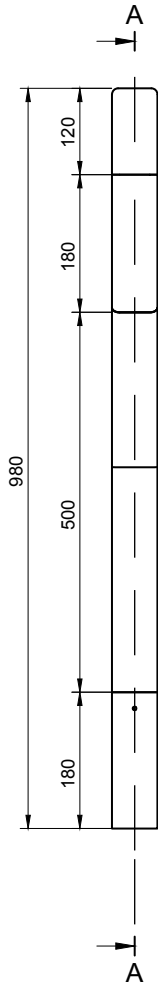
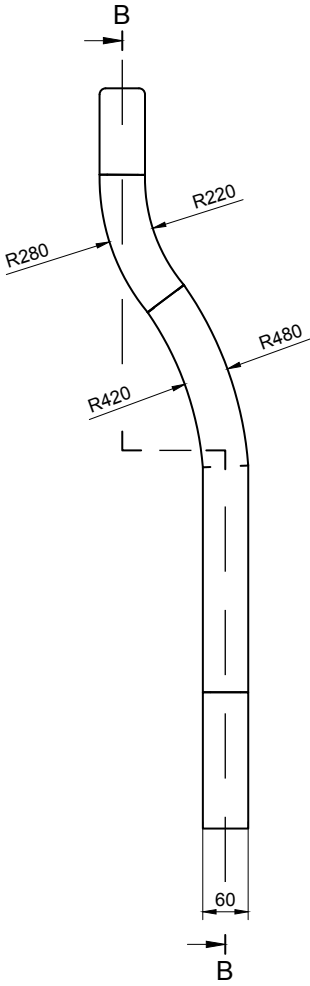
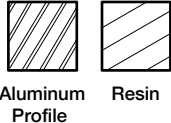
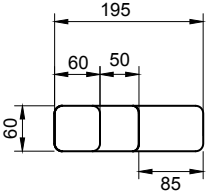


# 5.

## Annexes

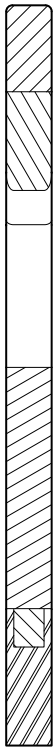
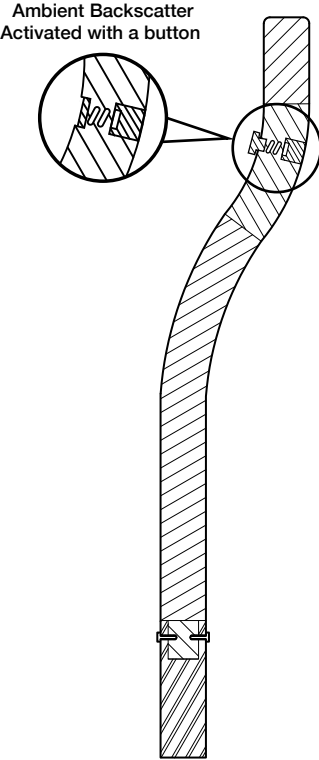
*To round off the Sendero journey*

# Technical drawings

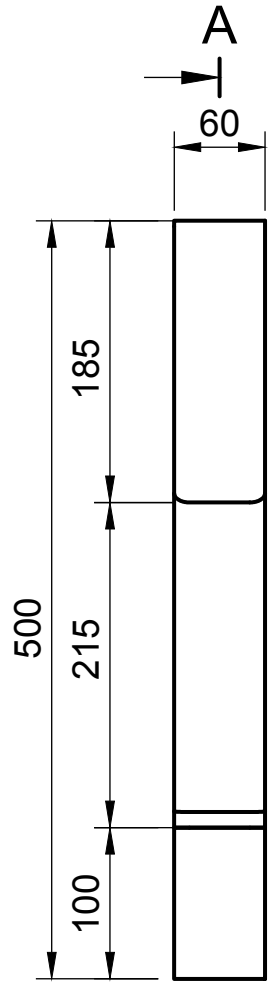
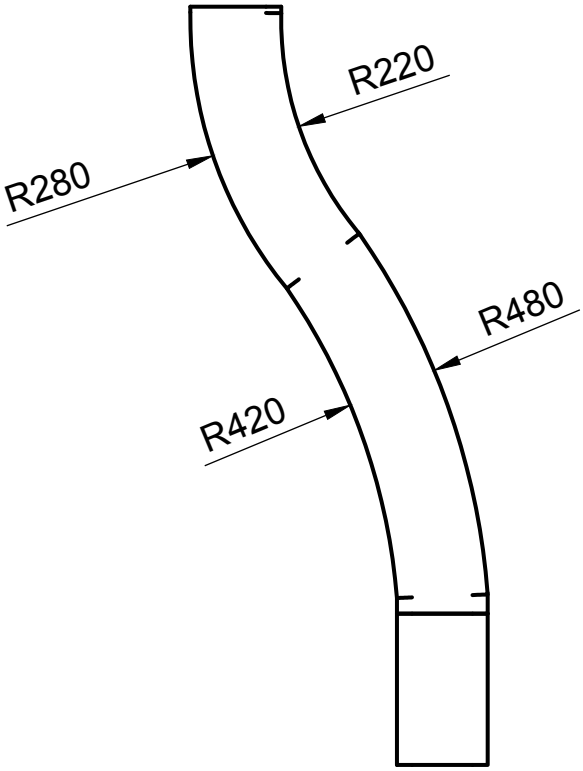
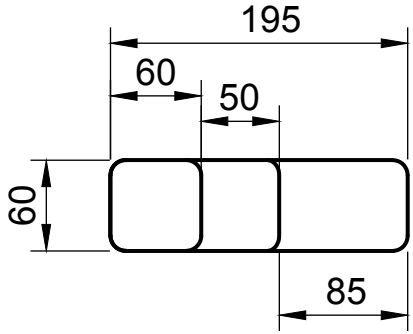


A-A (1:10)

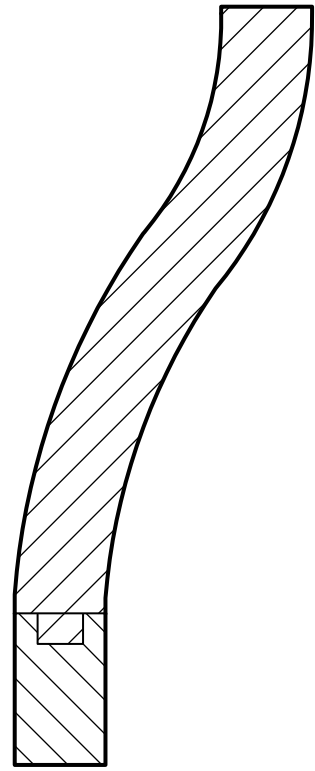
B-B (1:10)



# Technical drawings



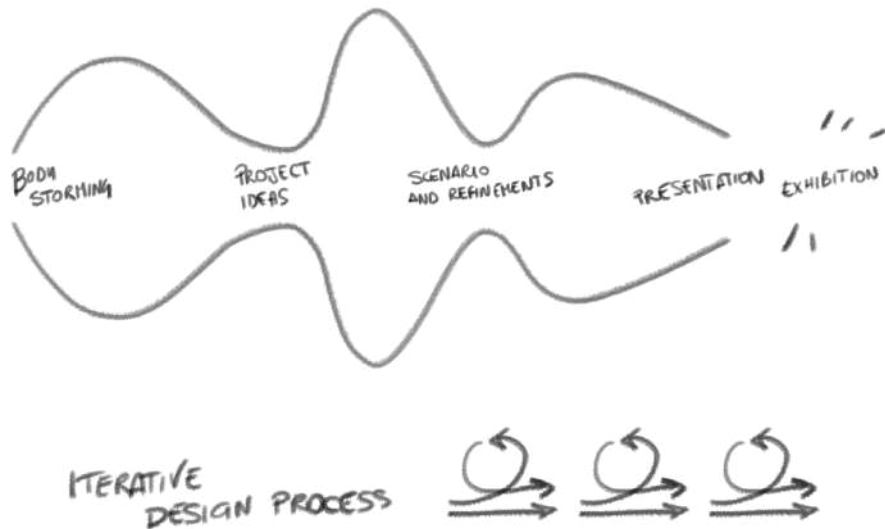
A-A (1:5)



# Design process

## Iteration and double diamond

Sendero is the result of a iterative process that integrates various types of phases, which are not completely separate one from the other. In fact, during the whole time, the group Sleep&Shout went through changes and, of course, crisis, going forward and backwards when needed. Also, the logic of the double diamond helped the group to really focus on each stage without losing general perspective on the whole project.



## 1 Research phase

Japan consumptions energy poverty  
 ethnography alternatives Mexico ...  
 needs

## 2 Inspiration phase

nature biomimicry paths  
 fluorescence bioluminescence



## 3 What was removed?

- a lot of things!!
- Japan: was too difficult to change really deep cultural habits
- natural shapes: the project needed to stand out, not to mimic with the backgrounds
- solar energy: was not really innovative for our aim to make it easier and not too expensive for the government

## 4 What was kept?

- the path of lights generated from the idea of the fireflies
- sos hubs, that were something really important for the context we are referring, even if it is a delicate theme ambient backscatter
- ambient backscatter, the technology key
- yellow, our main color

# Bibliography and sitography

Arellano, S. (2020, Agosto 20) Las entidades con peor alumbrado público. México social.  
<https://www.mexicosocial.org/las-entidades-con-peor-alumbrado-publico/>

Bank, A. D. (2015). Balancing the Burden?: Desk Review of Women's Time Poverty and Infrastructure in Asia and the Pacific (2015th ed.). Asian Development Bank.  
<https://www.adb.org/sites/default/files/publication/177465/sdcc-balancing-burden.pdf>

Barthel, D. et al. (2021) Ambient Backscatter Communications in Mobile, Networks: Crowd-Detectable Zero-Energy-Devices. Cornell University  
<https://arxiv.org/ftp/arxiv/papers/2110/2110.05927.pdf>

Boomsma, C. (2014, February) Feeling Safe in the Dark: Examining the Effect of Entrapment, Lighting Levels, and Gender on Feelings of Safety and Lighting Policy Acceptability  
[https://www.researchgate.net/publication/259575962\\_Feeling\\_Safe\\_in\\_the\\_Dark\\_Examining\\_the\\_Effect\\_of\\_Entrapment\\_Lighting\\_Levels\\_and\\_Gender\\_on\\_Feelings\\_of\\_Safety\\_and\\_Lighting\\_Policy\\_Acceptability](https://www.researchgate.net/publication/259575962_Feeling_Safe_in_the_Dark_Examining_the_Effect_of_Entrapment_Lighting_Levels_and_Gender_on_Feelings_of_Safety_and_Lighting_Policy_Acceptability)

Boyce, P. (2000, January 17). Perceptions of safety at night in different lighting conditions  
<https://journals.sagepub.com/doi/epdf/10.1177/096032710003-200205>

Gallelo, I. (2020, 24 noviembre). Luces contra la delincuencia en Iztapalapa. El País México.  
<https://elpais.com/mexico/2020-11-24/luces-contra-la-delincuencia-en-iztapalapa.html>

Gobierno de México (2021, 25 Agosto) El servicio de alumbrado público en los municipios- Instituto nacional para el federalismo y el desarrollo municipal.

<https://www.gob.mx/inafed/es/articulos/el-servicio-de-alumbrado-publico-en-los-municipios?idiom=es>

Irving, M. (April 06, 2021). Fireflies may use ultrasonic “musical armor” to fend off bats. New Atlas.  
<https://newatlas.com/biology/fireflies-ultrasound-musical-armor/>

Kaplan, J., Chalfin, A. Ambient lighting, use of outdoor spaces and perceptions of public safety: evidence from a survey experiment. Secur J 35, 694–724 (2022).  
<https://doi.org/10.1057/s41284-021-00296-0>

Liu, V. Ambient Backscatter. (n.d.).  
<http://abc.cs.washington.edu/>

Unknown. (March 22, 2022) Biomimicry: How Fireflies Illuminated LED Light Design. Random acts of green.  
[https://raog.ca/lightening-bugs-how-fireflies-inspired-leds/?fbclid=IwAR3dvV\\_OZTXUXfaov2TK9P7qQ0bsK3xFifrDI3H3aTK9EL4KtaJ1lgHyYNA](https://raog.ca/lightening-bugs-how-fireflies-inspired-leds/?fbclid=IwAR3dvV_OZTXUXfaov2TK9P7qQ0bsK3xFifrDI3H3aTK9EL4KtaJ1lgHyYNA)

Unknown. (2020). What is strontium?. CRM Alliance.  
<https://www.crmalliance.eu/strontium>

Unkown, (2019). Uluru fields of light. Curious campers. <https://curiouscampers.com.au/uluru-field-of-light/>

Unknown. (2018). Adequacy of social safety net programs, 2008 to 2018. Our world in data.  
<https://ourworldindata.org/grapher/adequacy-of-social-safety-net-programs?tab=chart&country=MEX>

Unknown. (2022). Homelessness statistics. Homeless World Cup <https://www.homelessworldcup.org/mexico>

**Thanks  
and keep  
following us**

**Sleep&Shout**



EVOLVING  
for scarcity