Giovanni Montobbio, Matteo Basile, Alberto Cotumaccio, Alessandro Di Patria, Daniele Ciammaroni

SAPIENZA
UNIVERSITÀ DI ROMA

We Share

SUMMARY

1. INTERVIEWS

1.1 Interviews

We decided to ask some initially very general questions in order to get an overview of future users of the system. Specifically, we asked the following questions:

0) How old are you? What job do you do?

1) Have you ever placed your cell phone close to another device to make a payment by exchanging data with other users?

2) So far, do you think it is a useful/comfortable feature?

3) When you meet a new person live, what contacts do you normally exchange? How do you exchange them?

4) Do you ever forget to ask for contact information from a person you just met in person? How do you feel when this happens? How do you re-contact or find his or her contact information?

5) Do you find any problems in the classic contact exchange interaction, e.g., slowness, awkwardness during the procedure?

6) During an event (party, work event, conference etc...), do you find it difficult to interact with all the people you would like to meet? Why? What strategy would you adopt to make yourself known to as many people as possible?

7) What do you think of an app that allows the facilitation of contact exchange? Would you use it?

8) I will now describe 2 scenarios: Party with friends and business meeting; what data would you choose to share in each of these situations and which ones do not?

the total number of users interviewed was 32 people

1.2 Analysis Of Responses

In this section we will analyze the interviews conducted following this pattern:

1) **#of the question) question text:**
   a) analysis of the answers
   b) analysis of the answers

1) **Have you ever placed your cell phone close to another device to make a payment by exchanging data with other users?**

a) During the interviews, it emerged that respondents were not clear on the concept of NFC and many either confused it with other technologies such as bluetooth or wifi

b) From what emerged in the interviews, most (~80%) of the candidates used NFC in the context of contactless payment (Google Play, Apple Pay).

c) One user claims to have used it while visiting a museum, by bringing his phone close to the plaque near the artwork the application shows him its information. Others, however, have used it in the Post Office application, via PostPay Digital. Others, however, say they have used it in the electronic ID card application to log in via CIE

2) **So far, do you think it is a useful/comfortable feature?**

a) Interviewees believe it is useful in payments because of its immediacy and simplicity in use, although this feature can be abused.

b) In addition, some believe that because of the payment feature using NFC included in their smartphone it allows them to leave home with little cash or no wallet.

c) One user in particular expressed concern about the fear of loss of sensitive data and complaining about the slowness of the service.

3) **When you meet a new person live, what contacts do you normally exchange? How do you exchange them?**

a) The majority of users surveyed (>90%) say they give out their phone number by voice because, from what was found, chatting on whatsapp or talking to each other by voice through a call is considered more serious than exchanging social.

b) Others say that they share their instagram (~40%) with the person they want to get in touch with, here, however, some pointed out the difficulty in finding the user because they have difficulty in spelling the nickname. One possible solution that is adopted is to give the phone to the other person who searches himself.

c) A small proportion of respondents (~3%) said they exchange telegram nicknames, as an alternative to the classic cell phone number

4) **Do you ever forget to ask for contact information from a person you just met in person? How do you feel when this happens? How do you re-contact or find his or her contact information?**

a) Most of the users interviewed say they forgot to ask for contact information from the person they had just met (>85%); this generated frustration, anger and dissatisfaction with their communication skills in them.

b) To remedy this problem, people talk to friends and acquaintances about this person (~30%) or investigate independently in social media (~70%) to get their contact (Instagram, Facebook). To find contacts with people in the work environment, respondents also stated that they search the web.

5) **Do you find any problems in the classic contact exchange interaction, e.g., slowness, awkwardness during the procedure?**

a) Most of the people interviewed experience embarrassment in interaction (~70%) especially in situations involving the social and emotional sphere, while in the work sphere the interaction feels more natural. In the latter case, one user pointed out that the awkwardness is due to the slow exchange of emails, which are long to dictate and sometimes with alternating upper and lower case letters, underscores and underscores, and numbers from 1 to 9.

6) **During an event (party, work event, conference etc...), do you find it difficult to interact with all the people you would like to meet? Why? What strategy would you adopt to make yourself known to as many people as possible?**

a) One part of the surveyed users (~55%) will engage in conversations and make first steps, the other (~45%) will wait for the person they want to interact with to come forward, stating that their shyness results in a block for social interaction.

b) One solution respondents found to facilitate interaction is to find an activity to do all together (~16%), to establish conversations based on common interests (~84%), or to network during the event or possibly even before or after it.

7) **What do you think of an app that allows the facilitation of contact exchange? Would you use it?**

a) Most surveyed users find the application useful (~97%) described especially where there is a lot of networking (large cities). However, some point out possible security problems that may occur (data sniffing). Finally, the idea elicited positive reactions and interest from young respondents because of the speed and immediacy of interaction**.**

8) **I will now describe 2 scenarios: Party with friends and business meeting; what data would you choose to share in each of these situations and which ones do not?**

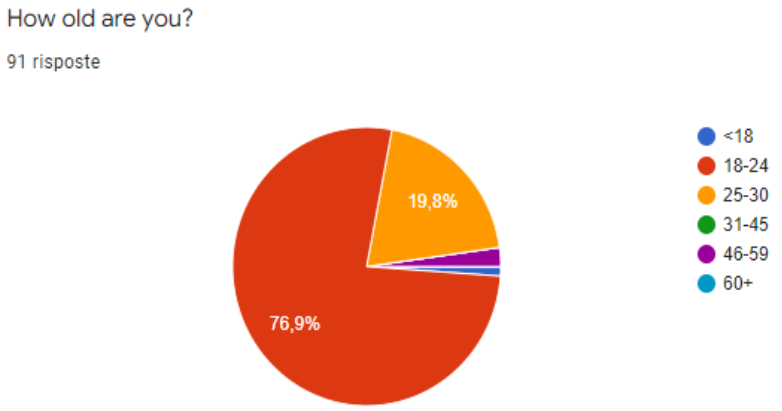
a) It turns out that personal phone numbers are almost always exchanged in both scenarios. In parties, given the increased confidence, the exchange of social networks such as Facebook and Instagram prevails.

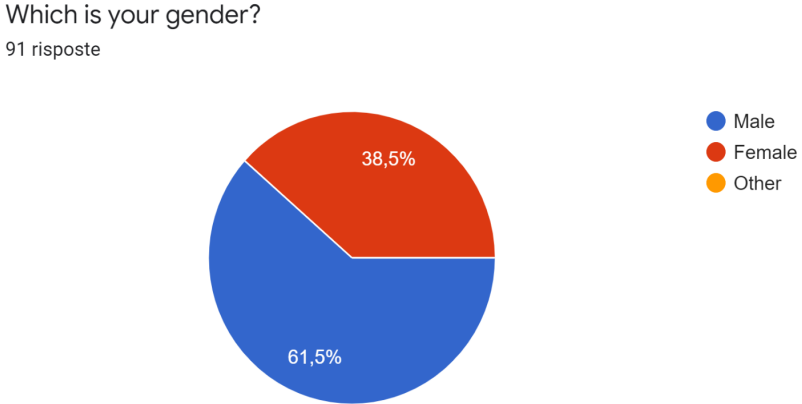
b) In the work environment, on the other hand, respondents find it useful to exchange their email, Linkedin profile, company number and a possible showcase web page with their projects.

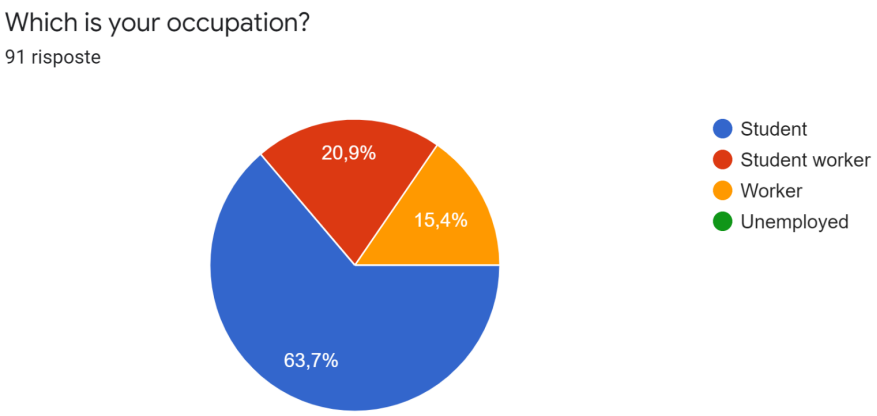
2. FORM & ANSWER ANALISIS

2.1 Information about people

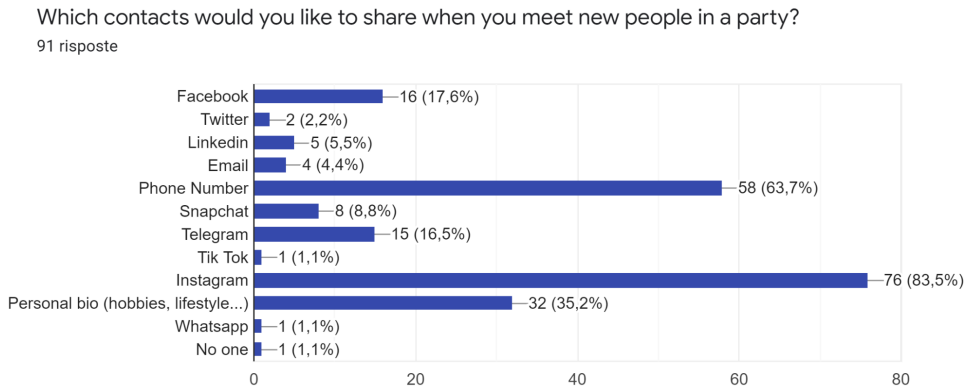
As the following charts show, the most of the users who have been sent the survey are young (77%) which are the main target of the final application. However, we are also interested in the opinions of older people (3%): the application will also be valid for them, but in particular we think it is important to understand the thoughts of different generations, getting their needs and advice. For the same reason survey's users are mostly students (64%), but since the application is designed also for the work environment, it was essential to find people that already have job experience (35%).



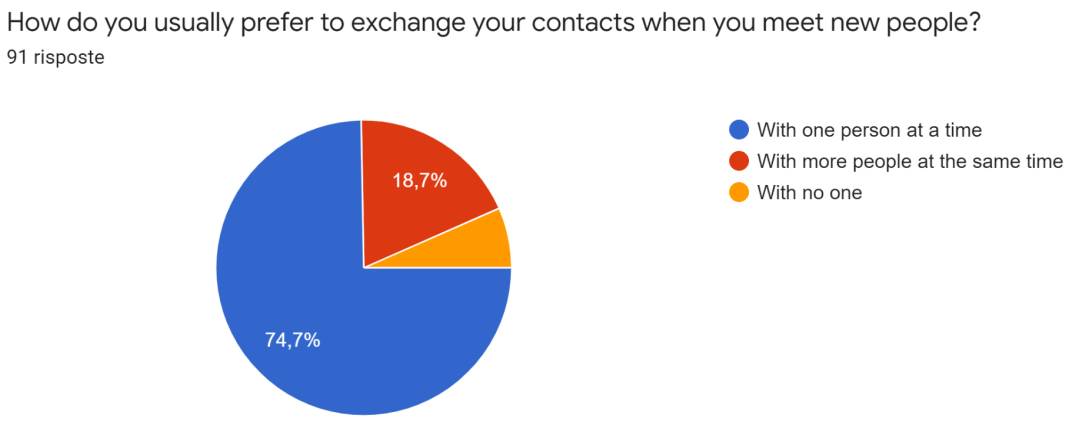




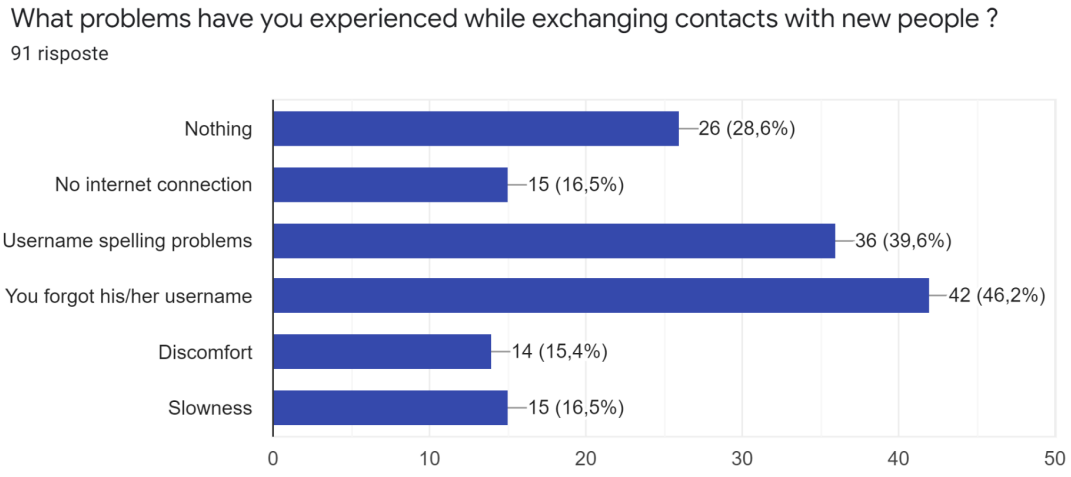
2.2 Social Habits



Our idea is to implement a task in our application that makes easy to share contacts with more people at the same time. As we can see from the answers, in normal situations it is very difficult for one person to share his contact information with more than one person at the same time in the “old way”; 75% of the users prefer sharing contacts with one person at the time. Maybe the use of the application can be useful in this sense, providing a solution for this problem.

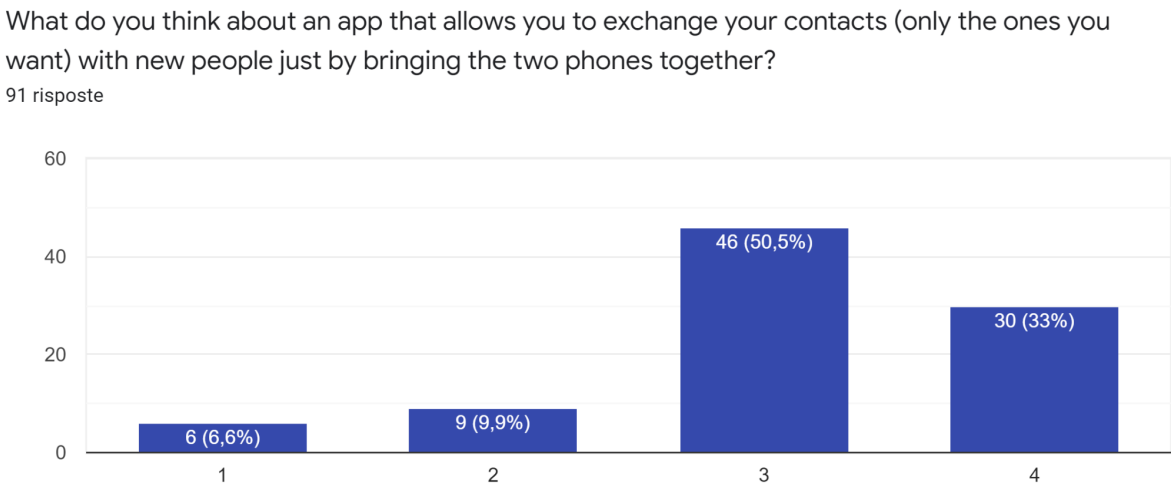


There are several problems the people experience while sharing contact with new people for the first time (only 28.6% of the survey users never had, which, unexpectedly, is a low percentage). Our goal is to solve all the problems presented in the list.

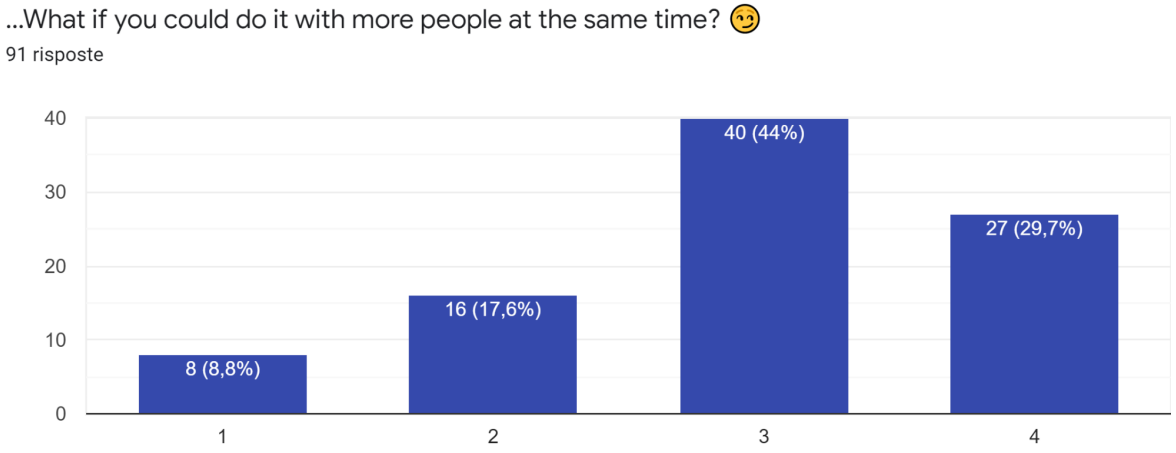


2.3 Application And Stuff

From the following results we can see that most of the people are interested in our idea of application. It is the confirmation that we should go further with the development.



Unlike before, most of the people show interest in the possibility of sharing contacts with more people at the same time, probably because our idea breaks the rules of normal one-to-many interaction.



Here there are some of the most interesting comments left by survey users.
More than one person put the focus on the security of the application, obviously the application has to be secure and you can exchange contacts only with who you want with an authentication procedure.

1. NFC friendly and secured by end-to-end cryptography
2. It can be useful if the application creates automatically a group on telegram or whatsapp with all the people in a work meeting for example
3. Exchange a profile photograph (to remember people's faces)
4. If I don't want to share my contacts with a single person among the group, and I use this NFC system, what would happen when that person approaches my phone with his? Will I be able to get my contact information even if I don't want to?
5. Personal qr code for share personal profile
6. Should hold a set of bios, e.g. a work one, a hobbies one and so on
7. Should add "youtube channel" to the list of contacts that can be shared
8. Making it possible to create several profile cards
9. A possibility to delete a profile card

3. TASK IDENTIFICATION

3.1 Task

After analyzing the responses to the interviews and Google form, we met to decide on the main Tasks to focus on.
Based on the responses we obtained, the following tasks were identified:

1. **Exchanging one-to-one contact with another device:**
   One person exchanges contacts with another using NFC technology.
   The two people bring their phones close together and through NFC receive each other's contact.

2. **Exchange contact from one to many:**
   If the action of exchanging contacts involves 3 or more people it must be one-shot here as well and not boring for the user.

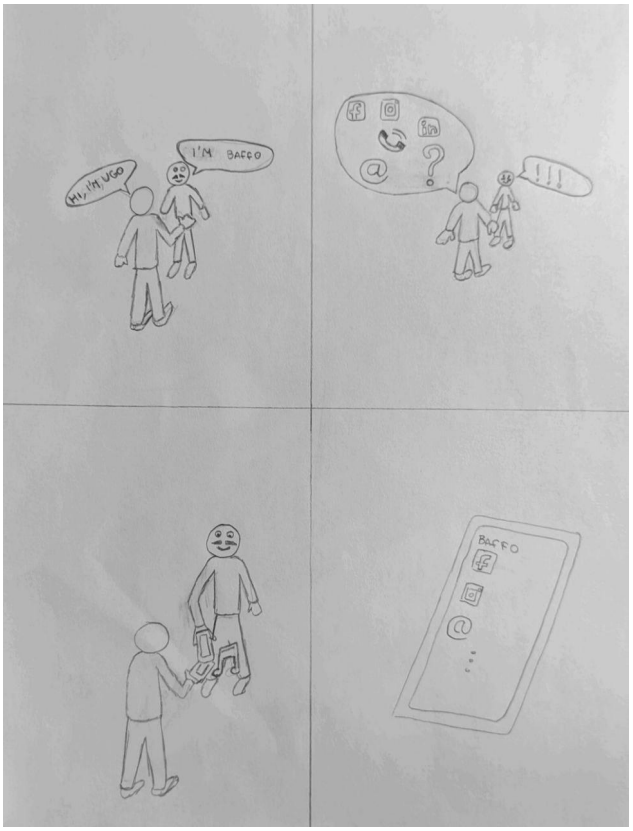
3. **Create and edit "business card":**
   The application allows you to create multiple business cards that can be customized according to the context you are in.

4. **View contacts details:**
   The application provides access to the cards of people previously met.

4. STORYBOARD

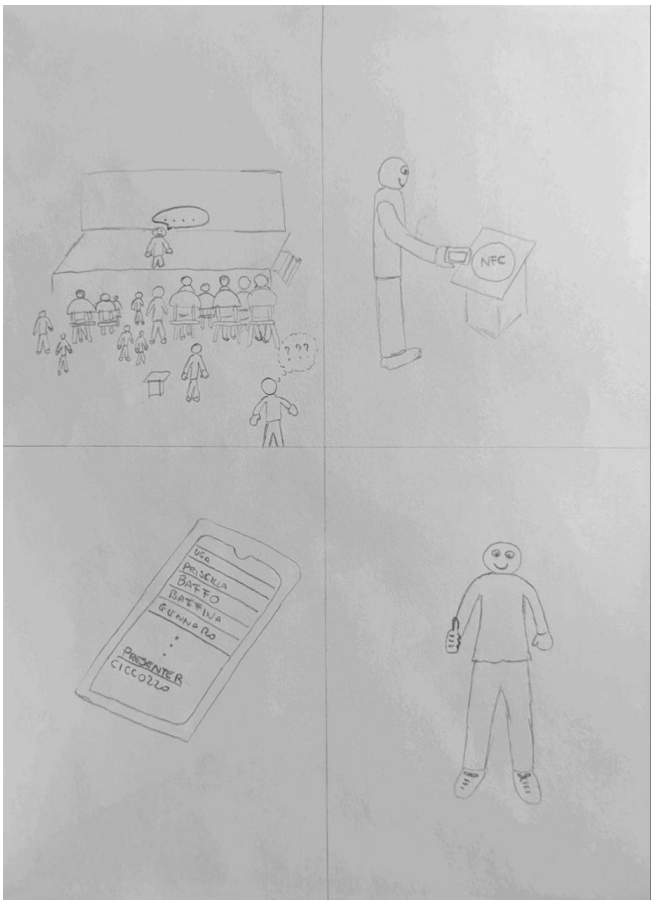
4.1 Exchange Contact

Two examples in two different contexts: first two people interacting in the classic way trying to find social in common, in the second the same two people exchange contacts quickly through our application



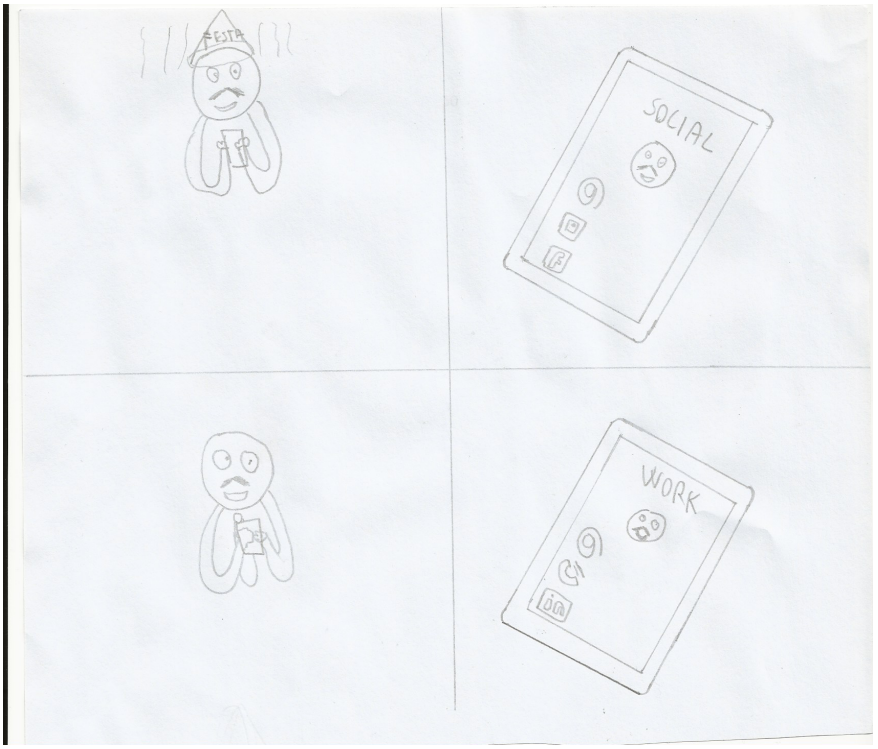
4.2 Exchange contact from one to many

During an event the little man approaches the NFC tag and receives the contacts of a set of people.
During a fair a little man sees in the distance 2 guys talking in the stage then he approaches them and after listening to them a bit he decides to approach the NFC tag to meet them.



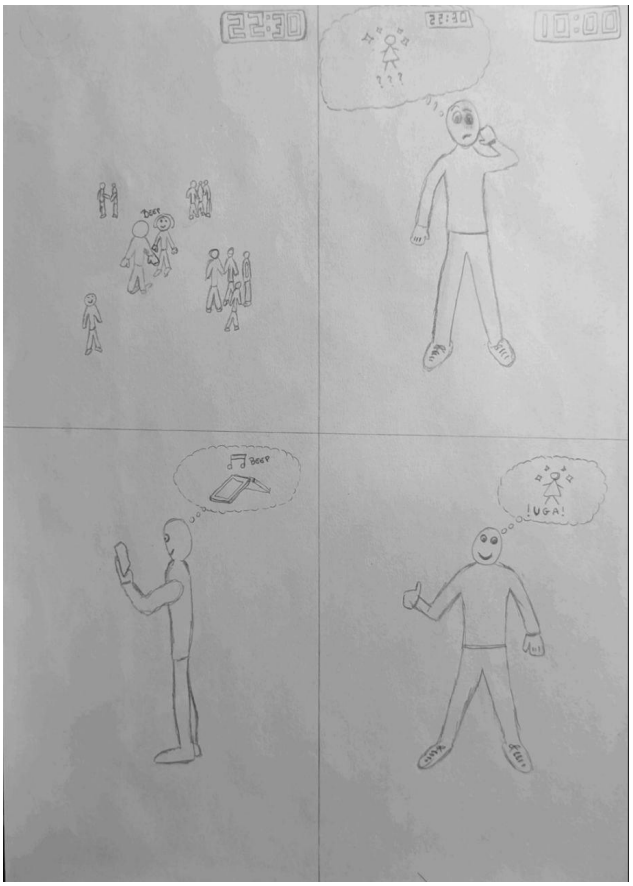
4.3 Create and edit business card

2 examples of how our application is malleable: it can be used in both social situations (first vignette) and work situations (second vignette).



4.4 View contacts

During a party a boy and a girl get to know each other and exchange contact.
The next morning the boy doesn't remember the girl's name but he remembers that he exchanged the contact thanks to our application so he goes to review in the contacts and finds her again (now he is happy!).



5. MARVEL PROTOTYPE

To create our marvel prototype, we used the UX design tools offered by figma.
Through Figma we created all the screens and connected them with Marvel.
The link of our prototype can be reached from here:
https://marvelapp.com/prototype/2egj1icg

To talk about the tests we did we will follow this pattern:

Number Iteration

(Pro)
Text

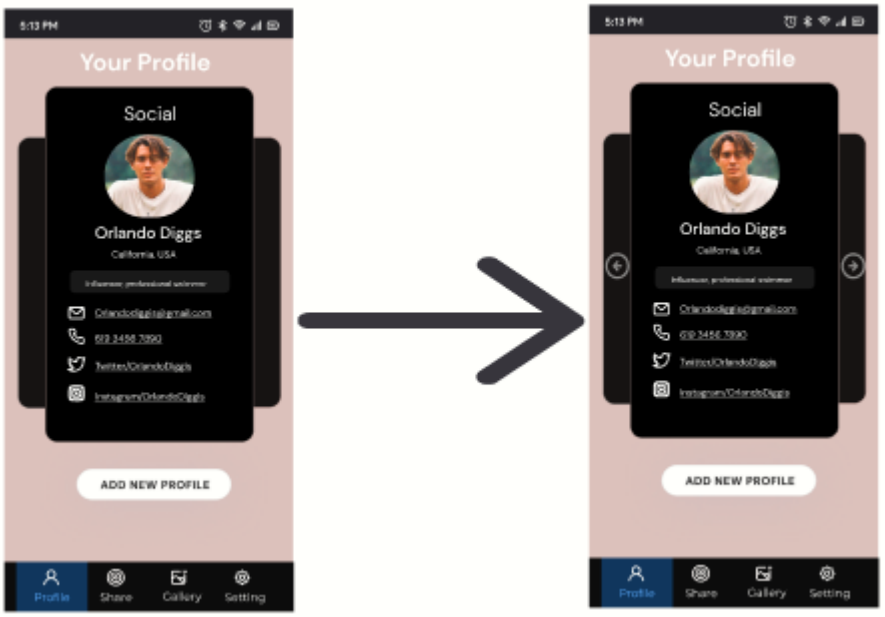
(Contro)
Text

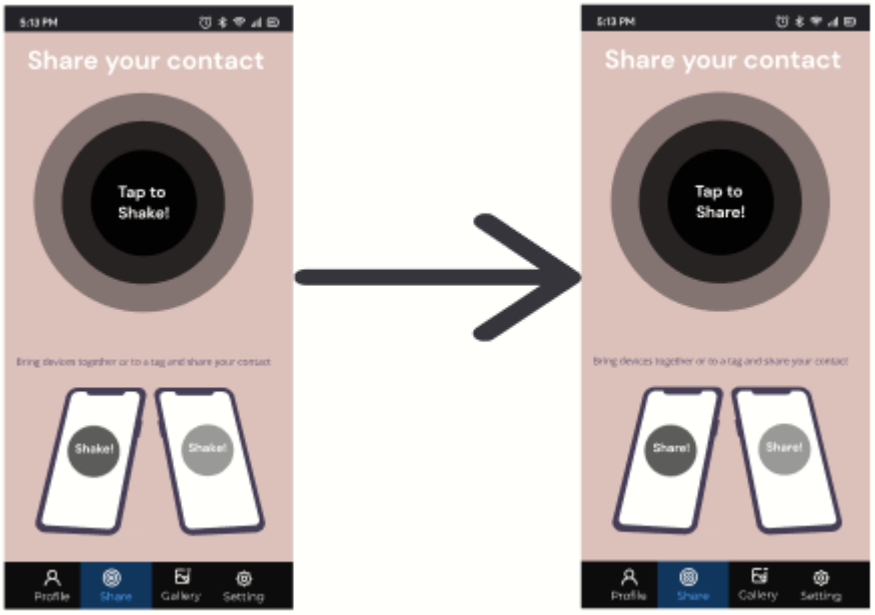
Images with related changes

5.1 First Iteration

(Pro)
In their first impact with the application, respondents were able to move nimbly and intuitively through the application through the use of the nav bar, and they had no problems using the Gallery and Settings sections.

(Contro)
Almost all of the respondents had never swiped their cards, so we included directional arrows that indicated the ability to swipe left or right.
Some users in the share tab did not when they read "tap to shake" shake their phones rather than click the button, so we changed it to "tap to share".

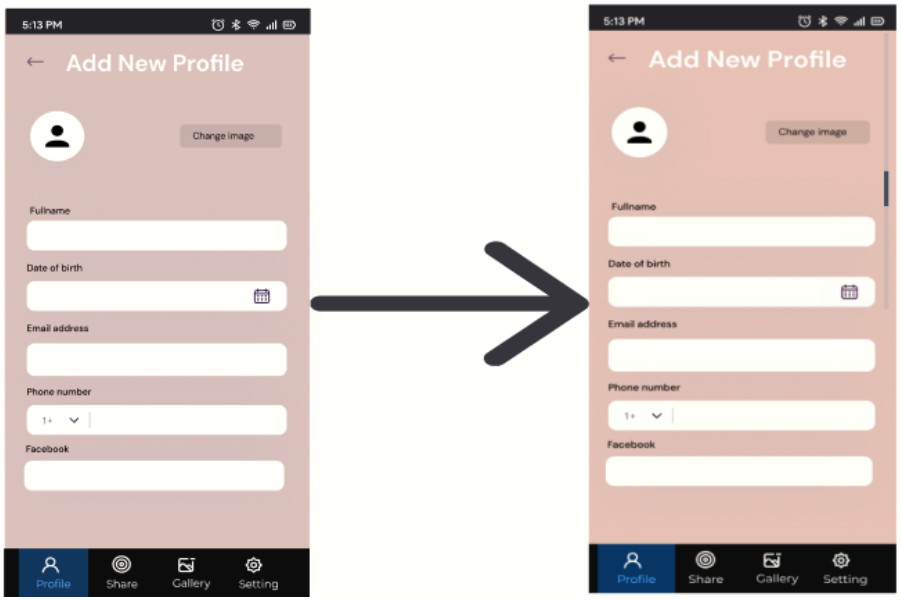

Your Profile
Social
Orlando Diggs
California, USA
ADD NEW PROFILE
Profile
Share
Gallery
Setting
Your Profile
Social
Orlando Diggs
California, USA
ADD NEW PROFILE
Profile
Share
Gallery
Setting

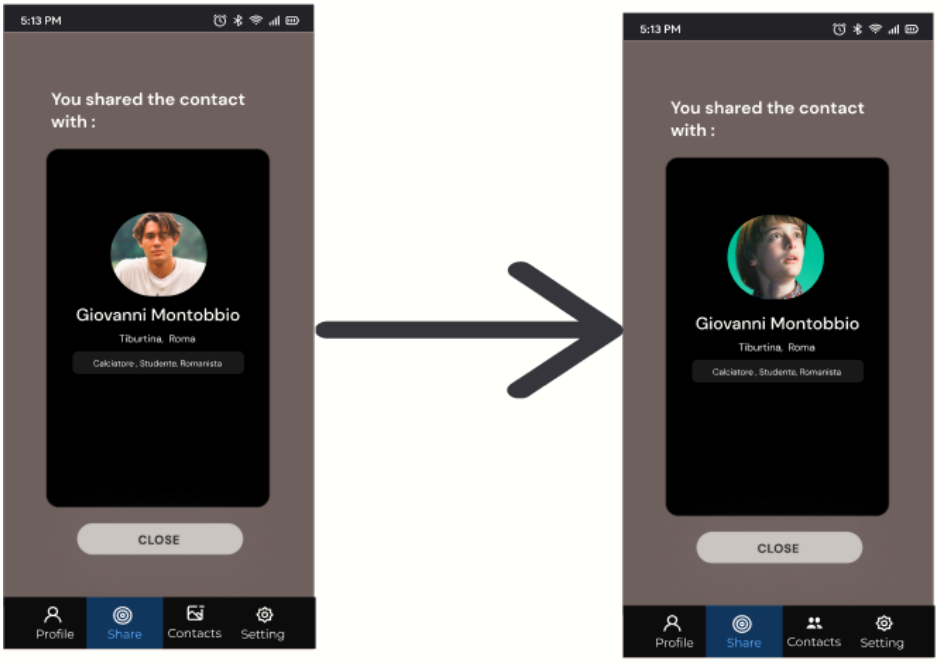

Share your contact
Tap to Shake!
Shake!
Shake!
Profile
Share
Gallery
Setting
Share your contact
Tap to Share!
Share!
Share!
Profile
Share
Gallery
Setting

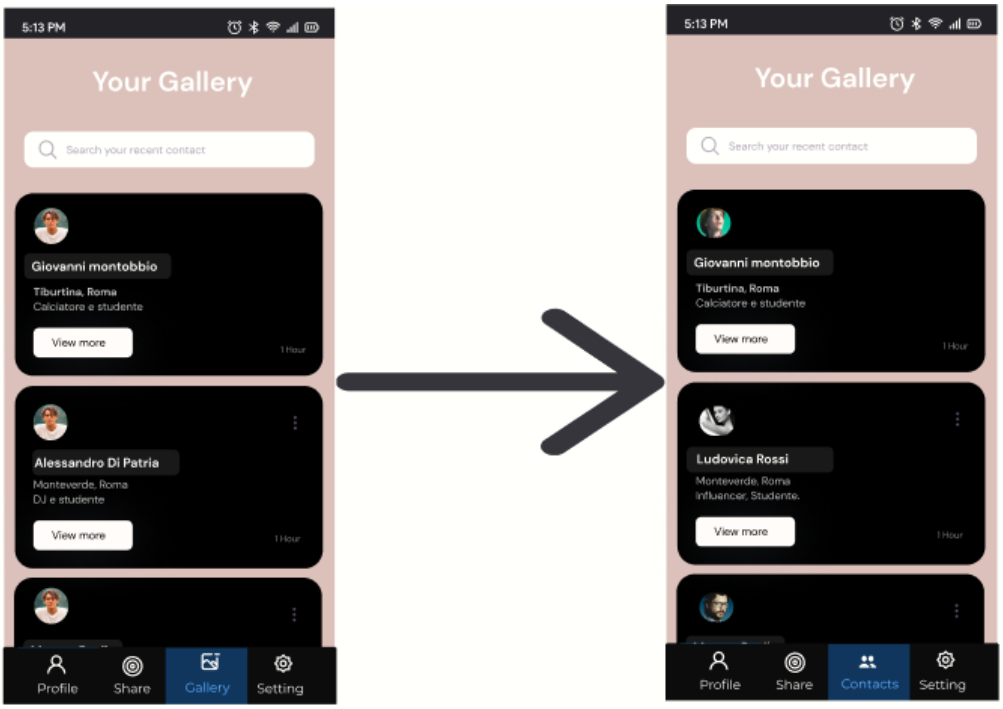
5.2 Second Iteration

(Pro)
From what emerged from the analysis of the second iteration, the improvements applied in the first interaction made the application even more intuitive.
In fact, users now used the special arrows to change their profile type without any kind of problem.

(Contro)
However, some users found some features difficult to understand.
In fact, one user suggested that we change the profile avatars because he did not understand the differences from the two types of profiles (Social and Work), so we change all the images.
Another user advised us to change the gallery image and description in the navbar because in his opinion it did not represent well the feature we were going to implement.
He suggested that we put an icon that represents multiple people together.
Finally, we added a scroll bar to make it easier to understand being able to swipe down on those screens.







5.3 Third Iteration

In the third iteration, users performed the tests easily and successfully without having any doubts in their executions.

6. MOBILE APP DEVELOPMENT

We chose to use react native which is a framework that allows you to build mobile applications for both iphone and android.
We chose this framework because of its simplicity in use.
For more information see the presentation.

6.1 General overview of NFC

What it is. Is a wireless technology for short range communication, used widely in our life.
Typical use case that we focus on:

- Payments (apple pay and samsung pay)
- Transportation and ticketing systems (suica in japan, octopus in hong kong)
- Access control and security systems. Lots of applications choose nfc as communication protocol
- Gaming. Nintendo amiibo use nfc to exchange data between amiibo figures and nintendo switch.

Types. There are two types of NFC, active and passive. Active ones are devices connected to the network and are actively transmitting data. Passive NFC is usually found in the form of NFC tags. There are 5 different types of tags and all of them have different capacity and uses.
Our basic idea for creating our application is to merge these two concepts and simplify the work for the end user. Then through a single share button is invoked the protocol for receiving and reading data from another device and in the same time you write sending your own data to the other device, making the communication two ways. It is in our interest to ensure that the exchange takes place in the best possible way, in terms of efficiency, efficacy and safety of the data exchange.

6.2 React Native library we chose for NFC

Introduction. Since we have decided to work with the React Native framework, we have browsed through the best libraries for managing the nfc interaction and we have chosen to work with the one that we have considered the best in terms of completeness of the available features, and that best suits our project idea: *react-native-nfc-manager*.
As we have already mentioned in the previous paragraph, this library also manages the read and write data separately. Our goal is to amalgamate the two features and thus make the interaction between two devices bidirectional. We want the user to be unaware of all this mechanism in the background, thus making their interaction easy, fast and fun.

Consequently, we are going to treat the devices as both passive and active, as if the reading were done by an nfc tag.
For the creation we wanted to focus on the implementation in Android and then make it specific and integrable with ios, which requires more accurate management.
For reasons of readability we are going to explain read and write separately.

Reading data. Referring to the library we thought of using, the simplest and most common way to read data sent from another device (containing an NDEF message) is the one that is summarized in the following piece of code:

```
async function readNdef() {
    NfcManager.start(); // It is a Pre-step,very important before any NFC
    operations
  try {
    await NfcManager.requestTechnology(NfcTech.Ndef);
    const tag = await NfcManager.getTag();
    console.warn('Tag found', tag);
  } catch (ex) {
    console.warn('Oops!', ex);
  } finally {
    // stop the nfc scanning
    NfcManager.cancelTechnologyRequest();
  }
```

`start:` Init the module. If the device doesn't support NFC, the returning promise will be rejected.
`requestTechnology:` Request specific NFC Technology to perform advanced actions. This method returns a promise: if resolved, it means you already find and connect to the other device supporting the requested technology, so the technology specific API can be called. if rejected, it means either the request is cancelled or the discovered device doesn't support the requested technology.

- `Ndef`
- `NfcA`
- `NfcB` (Android-only)
- `NfcF` (Android-only)
- `NfcV` (Android-only)
- `IsoDep`
- `MifareClassic` (Android-only)
- `MifareUltralight` (Android-only)
- `MifareIOS` (ios-only)
- `Iso15693IOS` (ios-only)
- `FelicaIOS` (ios-only)

`cancelTechnologyRequest:` Cancel previous NFC Technology request. clean up your tech registration through.

In the reading phase Android and IOS have different behaviors, in particular by default iOS will pop up a system scanning UI and instead android provides NO system scanning UI. Our design involves creating our own custom user interface.

Writing data. For example, here's an example to write NDEF:

```
async function writeNdef({type, value}) {
  let result = false;

  try {
    // STEP 1
    await NfcManager.requestTechnology(NfcTech.Ndef);

    const bytes = Ndef.encodeMessage([Ndef.textRecord('Hello NFC')]);

    if (bytes) {
      await NfcManager.ndefHandler // STEP 2
        .writeNdefMessage(bytes); // STEP 3
      result = true;
    }
  } catch (ex) {
    console.warn(ex);
  } finally {
    // STEP 4
    NfcManager.cancelTechnologyRequest();
  }

  return result;
}
```

`encodeMessage:` It allows you to generate a "package" with all the data you want to write to the other device.
`ndefHandler:` select the proper NFC technology handler, which is implemented as getter in main NfcManager object, for example:

- `ndefHandler` (for `Ndef` tech)
- `nfcAHandler` (for `NfcA` tech)
- `isoDepHandler` (for `IsoDep` tech)
- `iso15693HandlerIOS` (for `Iso15693IOS` tech)
- `mifareClassicHandlerAndroid` (for `mifareClassic` tech)
- `mifareUltralightHandlerAndroid` (for `mifareUltralight` tech)

`writeNdefMessage:` Request writing NdefMessage (constructed by bytes array you passed) into the tag. This method returns a promise: if resolved, it means you successfully write NdefMessage to the tag. If rejected, it means either the request is cancelled, the write operation fail or the operation is not supported in current tech handle.

This library provide a default export NfcManager and 3 named exports Ndef, NfcTech and ByteParser, like this:
All methods in NfcManager return a Promise object and are resolved to different types of data according to the individual API.

- Ndef is an utility module to encode and decode some well-known NDEF format. NDEF is the standard nfc data format supported by both android and ios, and can be used for almost any nfc interaction.

- ByteParser is an utility module to encode and decode byte[] arrays (used in Mifare Classic technology).
- NfcTech contains predefined constants for specific NFC technologies, which include NfcA, NfcB, NfcF, NfcV, IsoDep, MifareClassic and MifareUltralight.
    - These constants should be used with requestTechnology (Android Only) to obtain a NFC technology handle, and use it to perform technology specific operations.

7. TESTING

After programming the entire application and its functionality, we decided to run some tests to verify that the tasks and the application as a whole are working properly.
During this phase users pointed out several errors and suggestions so we decided to divide this phase into several iterations.
At each iteration we make improvements based on user feedback.
We have tested the app with 20 different users.
To do the testing, we devised tasks for the user to perform:

1) Log in

2) Create a new job profile

3) Create a second profile for a party

4) Share the job profile with the testing supervisor.
   When doing the share simulate nfc contact between the two phones
   Does the user understand that they must have NFC enabled in their phone?
   How does the user select the work card and not the party card?

5) Save in the contacts of the received card.

6) Make a second share. In this case the user does not have to add it to the contacts

7) View the details of the previously received contact

8) Delete in the profile the previously created party card
   Does the user understand that a long press is needed?

9) Delete the contact "Francesco Totti".
   Did the user understand that a long press is needed?

10) Log out

7.1 First Iteration

User 1 : Elisabetta 50 years

During this first phase, the user shows fluency in using the application.
The user first logs fluently into the system, creates the first card and highlights a problem in the text input.
In fact, the text input is clickable only on the right side.
After creating the two profiles, the user tries to share the contact with a member of the group and finds that he cannot save the contact in the gallery.
We interrupted the session and asked the user what he thought in general about the application.

The user says that the application has a nice interface but that it needs to be improved because of bugs encountered during testing.

VIDEO available here: https://youtu.be/clzrsztP66g

User 2 : Alice, 18 years

Overall, the user seems to be comfortable during the test.
The user was able to confidently complete each task assigned to him.
He logged in, created profiles, shared and browsed contacts without experiencing any problems.

User 3: Cristiano, 25 years

During the test, The user encountered problems creating a card when he needed to enter input data but overall he completed all tasks in an agile manner.

User 4: Ludovica, 14 years

The user logged in, created profiles, shared and browsed contacts without experiencing any problems but in the task to delete a card first tried to enter the card to look for a "delete" button which it did not find, then held down until the pop up appeared on the screen and successfully deleted it.

User 5: Francesco, 24 years

The user was able to confidently complete each task assigned to him.

VIDEO available here: https://youtu.be/HD8tlQ46LKc

User 6: Lorenzo, 24 years

The user was able to confidently complete each task assigned to him.

VIDEO available in the directory : Test Video : Lorenzo

User 7: Marco, 24 years

The user was able to confidently complete each task assigned to him.

VIDEO available in the directory : Test Video : Marco

User 8: Luca, 23 years

The user was able to confidently complete each task assigned to him.

VIDEO available in the directory : Test Video : Luca

User 9: Angelica, 14 years

Overall the user completed tasks quickly but had minor difficulties when he had to enter info inside business cards.

User 10: Martina, 13 years

The user was able to confidently complete each task assigned to him.

7.2 Second Iteration

In the second iteration, after adding features based on feedback received in our application, we interviewed more people, but there were no problems in task performance.
In fact, users 11,12,13,14, and 15 stated that they had no problems whatsoever.
In addition, many reiterated the fluidity of the application and the ease of use.

8. CONCLUSION

Since no problems were encountered in using the second prototype, we decided to make it final.

The application still has much unexpressed potential in our opinion, in fact, we thought about how to improve it and came to the following conclusions:

1. implement the setting tab

2. Add new features such as the multi-sharing

3. Add a database to save the accounts

In conclusion, we feel very satisfied with the work we have done, and we are confident of one day making it available to the world.