

# User Study and Concept Design for Compliant Mobile Communications:

A Case of a Joint Project between Tsinghua & Nokia

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**Abstract:** This paper articulates a joint project of Tsinghua University and Nokia Research Center, which comprehensively investigates into user's demands in terms of compliance, and develops new form factors, user interactive concepts and internet service system combined with new hardware technology for the user communications. The project team synthesizes 6 concept solutions based on the design opportunities. We will exhibit 3 of them in this paper. FAMONE is a concept of new communication platform for home phone and mobile phones, which provides more convenience and fun to our life. FOLDPHONE accomplishes different function modes by changing the form of the mobile phone. And APTEGG is to adjust the volume of ring and headphone intelligently by being aware of the environments and distance between phone and ear.

**Key words:** *compliant UI, user study, concept design, joint project.*

## 1. Introduction

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There are two main drivers to stimulate people's aspirations for mobile products with ever-increasing demands: one is the rapid development of mobile communication technology, which provides new mobile devices numerous viabilities and further catalyzes our curiosities and experience desires, another, even more important, is the change of people's living style, especially in the current state of China.

Chinese people currently migrate on a large scale: from countryside to towns, from towns to cities. This has been strengthened by the increasing national holidays: the international labor's days in May, National days in October,

and Chinese Lunar New Year Holidays, when there would be hundreds of millions people traveling. Therefore, the “movement” has become the vivid description for Chinese People’s contemporary living styles, and become the theme of this time without saying.

With this new trend, people’s demands for mobile communication products and the relevant services are increasing. The core of these demands is the passion for an intelligent device that can be aware of the contexts and comply people’s needs by any time, in any place, and with any condition “initiatively”.

Nokia is a world leader in the field of mobile communication, as well as one of the world's largest mobile manufacturers. It has been transiting to a mobile service provider in these years, and attempting to provide users entire mobile communication solutions. This joint research project of Nokia Research Center and Industrial Design Department at Tsinghua University aims at researching into the compliant/adaptive communication UI solutions for growth markets and creating the relevant UI concepts and devices, and internet services to let users feel connected anywhere and anytime.

## 2. Research methodology and steps

Most methods used in this project are qualitative research approaches, and quantitative analysis is only complementary. In order to make sure design solutions being valid, both technology driven and user driven approaches were applied in the study, which include literature review, key technology analysis, questionnaires & in-depth interview, focus group and user participative design (Figure 1) .



Figure. 1 The research steps of the project adopted

- **Literature review** is the first step of the research project. At the beginning, we analyzed the concept of “compliance” and the relevant achievements in various areas and disciplines. Then we put forward the possible application scope of the “compliance” in the mobile communications. We finally found the key points of the mobile devices noncompliant to the user needs from the literature review, which were integrated (divided) into several categories later on. The project team had also investigated updated technology information in the mobile communication areas with the cooperation of technique researchers in Nokia in this stage.
- **User research** is a core part of this project. We conducted field observation and in-depth interviewing with questionnaires to get real needs of the users. The key points clearly categorized from the literature review became the foundation for the questionnaire design. Age, occupation and gender are the key parameters of sampling in this stage. 70 valid questionnaires together with the field notes of in-depth and observation equip the research team with great amount of data and information.
- **Design Analysis** is to further analyze and pack up the data and information captured in the literature review and user research, from which the “compliant” issues and latent needs of users were found out, and design opportunities were then inducted.

- **Concept development, evaluation and improvement** aims at proposing creative solutions both complying the use contexts and technical requirements. Numerous ideas had emerged in our designers' minds lead by design opportunities. It is designers' imagination and depth of their understanding key findings and relevant technologies that determine the outcomes of designing. Focus group is the major measure of concept evaluation in this project, which enabled more users to participate in the process of concepts improvement. After several rounds of appraisal and improvement, the research team eventually synthesized and integrated concepts into 6 concept solutions aiming at different design opportunities.

### 3. Literature review

The project team had extensively studied the issues of “compliance” from perspectives of biology, architecture, mechanical and electrical product design, management and service, and concluded that the compliance is a procedure, phenomenon or capability, through which subjects (such as creature, building, product, organization, service) adapt themselves to the environments in order to survive.

The adaptability of mobile device mainly refers to the adaptation and coordination between the device and the restrict conditions like environments, users and operations. If there is some change with these factors, the device should adjust itself accordingly. (Figure 2)

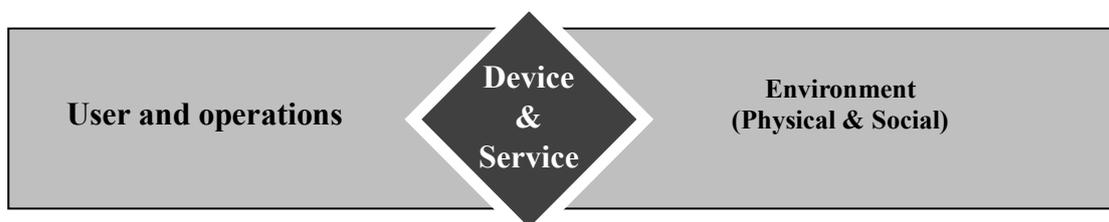


Figure. 2 Relationship in the adaptability of mobile device

Design for compliance is an issue with complexity, which not only requires a profound understanding of the user needs for “compliance”, but concerns the researchers' mastery of the means to the relevant new technologies. In the meantime, it needs to be concerned that the over “smart” devices, though extensively convenient to our lives, can affect our “freedom” and intervene our “privacy” to some extent. “Compliance” and “privacy” protection from a broad sense are likely to construct two extremes which need be balanced in the designing of communication products.

Based on the understanding of social status quo in China, we conclude the following application scope for the “compliance” in the designing of communication services and products:

- Adaption and privacy issues of mobile devices in an extremely noisy and crowded public traffic;
- Adaptability of mobile device when riding a bicycle which is still a major means to commute;
- Combination of mobile device and fixed line in China telecom industry;
- Adaption and privacy issues of mobile devices for 140 million migrant workers;
- Special adaptive requirement of farmers during the construction of new rural area;
- A peaceful and private space required by people who suffer information disclosure and call/message disturbance in their daily life.

The above study into “compliance” and its relevant concepts from literature review had our research team

comprehensively and deeply understand the major purpose and essence of the project. From this perspective, we figured out that the key task of this project in this year is to investigate the mobile communication problems for “compliance” in the process of urbanization, and the issues of “compliance” for the users in the rural areas would be dealt with in the research projects to come later on.

**4. User research**

We employed in-depth interviewing questionnaire and context observation of user research methods for this project. Thus the questionnaire design and observational interviewing memo composition would be the key issues at the start of this step. The multi-disciplined project team had concluded the key problems and points of the user needs in the compliance of mobile devices and services after the observation and interviews with their diversified expertise and experiential skills. The key points combined with the conclusions from the literature review are as below. (Table 1)

**Table 1.** Listing of the key problems and points

<b>The key points of non-compliance of current mobile devices and user needs</b>	
<b>Relating to users' behaviors</b>	• The problems of answering a call and sending and checking SMS while driving, e.g. asking directions or facing special situations.
	• The problems of answering a call and sending and checking SMS when riding a bike.
	• Answering a call while both hands are taken up.
	• Operating different functions in the same time, e.g. the need to forward the phone numbers stored in the mobile phones to others.
	• Being unable to be recognized and advised when calling a wrong number.
	• Being unable to locate the mobile phones when setting to go out.
	• Missing important SMS while the mobile phone is not around.
<b>Relating to use environments</b>	• The messages on the mobile phone’s screen are not readable in the sunshine outside.
	• Being unable to hear the phone rings, and to clearly hear the voices of caller and answerer when being in the noise settings.
	• The interference of each other when several people calling in the same place.
	• The talking voice levels are not comparable when the two parties are in different settings, e.g. quiet and noisy.
	• Users’ eyes are uncomfortable while reading SMS, watching Video, or playing games in vehicles.
	• Clothes are not suitable to carry mobile phones on some occasions.
	• The inconvenience to carry a mobile phone when wearing a little clothe in summer.
	• Missing the phone ring while wearing heavy coats in the winter.
	• Forgetting to switch back to the tone status frequently.
	• Interfering other and uncomfortable by themselves to call at a meeting, but being afraid of missing key messages or having to deal with necessary affairs.

	<ul style="list-style-type: none"> <li>• Having to stay in seat to call or answer phones in a concert or theater, as the compact space makes it uneasy to go out and in.</li> <li>• A strong need in use of mobile phones, which, however, disturbs patients and interferes medical devices.</li> <li>• Attempt not to miss the key SMS when sporting, e.g. running, swimming, or playing ball.</li> </ul>
Relating to contexts	<ul style="list-style-type: none"> <li>• Unwilling to be interfered by phone calls in some special situations (except for emergency), e.g. being with family at weekends.</li> <li>• A sudden call during sleep at night.</li> <li>• The compliant issues when watching TV or taking other entertainment activities.</li> </ul>
	<ul style="list-style-type: none"> <li>• The compliant issues when the elderly people use the mobile phones.</li> <li>• The compliance of mobile phones for farmers or other low educated users.</li> <li>• The compliance of mobile phones for high level electronic product users.</li> <li>• The compliance of mobile phones for disabled (with sight, audition, language or arm &amp; leg) users.</li> <li>• The compliance of mobile phones for the foreigners who use the local mobile phones.</li> </ul>

On the basis of problems and key points above, the project team designed in-depth interviewing questionnaire. We had not adopted the form of close questions and being checked by users themselves, but more like an interviewing memo with which the notes taken by our researchers according to the characteristic of each user in the face to face interviewing, with only a few multiple choices for their basic personal information. Moreover, the design researchers were divided into several groups to get observation and experience data on the key spots, e.g. on the bus, in the store, and riding the bike.

The questionnaire comprises 4 parts: personal information, issues of compliance, issues of privacy, and the notes and insights about each user’s in-depth interviewing and observations from user behaviors and environments.

The sampling of rolling snowballs had been used, and 70 sample users covering different genders, ages and jobs had been investigated.

**5. Design analysis**

In design analysis stage, we firstly integrated the questionnaire, interviewing note, user characteristic and observational insight. Then together with the findings from the previous literature review, we concluded 12 key findings, which we hope can reflect the real needs of the users. (Table 2)

Table 2. Listing of 12 the key findings.

**Key findings**

**1. The requirements from different users vary remarkably:** the research revealed that the requirements of technical users, normal users and low-end users are quite different.

**2. Simple, convenient carrying ways:** users need carrying ways adaptive to different seasons and circumstances, which in the same time don't make them feel any inconvenience when going out with the phone.

**3. Intelligentizing operations in common use:** most users need a intelligent device that can deal with missed calls, remind the unsettled information in time and switch ringtones automatically according to circumstances.

**4. Adaptation in crowded and noisy environment:** Requirements of comfortable use of mobile device in crowded and noisy environments (e.g. bus or subway).

**5. Adaptation in different activities (especially while hands are occupied):** users want to use mobile device conveniently when their hands are taken up during driving, shopping, or exercising.

**6. Information display and its adaptation to environments:** users wish the screen of mobile device is adaptive in strong sunlight and special conditions.

**7. Integrating mobiles with other devices (fixed phone/computer):** users prefer mobile device that can integrate with fixed phone or computer, etc.

**8. Adaptation of mobiles in social networking:** users prefer the mobile device that can express their social identities.

**9. Not bothering others when using a mobile device:** users prefer the mobile device not bothering others, but having good performance in communication at meeting, class or cinema at the same time.

**10. Multi-task parallel processing:** a lot of users prefer the mobile device that has multi-task parallel processing function.

**11. Users' emotional needs:** more and more people have emotional needs for mobile device, such as reminding the past/historical emotion, relying on the familiar operation manner and interface.

**12. Requirement for extra power in emergency:** there always is an emergency when the battery of mobile device is used up.

Based on the above key findings, a plenty of design opportunities occurred in the designers minds. With the reference to the technology advancement, the opportunities had been transferred into the design concepts in the next step.

## **6. Concept design, evaluation and improvement**

After a comprehensive discussion, our team finally focused on six directions to which the concepts can be developed further according to the findings and design opportunities above. All concepts took account of software interface, hardware technology and the product appearance to address both UI and industrial design.

Focus Group had been used to evaluate the concepts. The sample users, mainly young people with the ages from 20 to 38, selected from the previously interviewed informants had been divided into 2 groups. Among them, there are professional designers, engineers, college students, officers of organizing committee for 2008 Olympic Games, and white collars etc. The male to female ratio is 1:2, and time spent about 2 hours. In the focus group, the project researchers firstly introduced and presented the design concepts, then the participants discussed and gave their opinions about the concepts, and after that the moderator summarized the discussion with the

participants' complementary.

Figure. 3 The spot of the focus group



The research team had obtained very useful feedback and information from the participants in the focus group, which, especially the users' emotional pursuits during the use of mobile devices, inspired designers a lot in the process of concept improvement. The following text will introduce the three final concept solutions respectively.

### 6.1. Concept 1 - FAMONE

FAMONE is a concept of new communication platform for home phone and mobile phones, which provides more convenience and fun to our life.

From the research and interviewing, we found that the frequency of using fixed line phones in China is very high, both in office and at home. In the office the caller uses fixed line to call may bring the receiver a sense of trust, but at home fixed phone is not only the common tool to communicate with relatives and friends, but might be a symbol of easiness and convenient voice environment and exchange center for family's information and feelings. Famone is to combine the mobile phone and the fixed phone, which would bring more convenience to users, and may become a new way to advance the feeling exchange at home.

The devices for Famone (dependent upon the number of the family members) will form an active connective process with the base, and the connection and disconnection will conduct automatically without manual reminding and switch when users return home. The information exchange will be carry out by preconfigured levels. Each user can customize its own device material and color according to its own preference, even menu style. These would allow them to express their own individual personalities. The device needs to be switched on by the user fingerprint to keep the user's privacy. In the menu, user can set the level by which the information can be disclosed. When the devices come together, they can exchange data and information by the levels set in advance. The data exchange via the base, and base holds a copy as well, especially the phonebook like common need information can be well checked and used. Devices can be charged on the base. The mobile devices can be the terminals for the fixed line at home, and work like wireless telephone when calling.

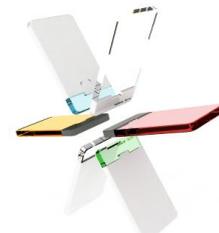
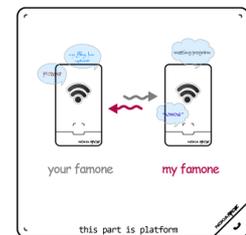


Figure. 4 FAMONE

When the devices are quietly lying on the base, please do not think they are merely charged for the power, they are actually exchanging data and information by the level set previously by their users, recording the sentiment and experience their users experienced on the day, and backing up the phone numbers being able to be disclosed with set level.

**6.2. Concept 2 – FOLDPHONE**

FOLDPHONE accomplishes different function modes by changing the form of the mobile phone.

Normally the function modes of mobile phones are fulfilled by interface operations. This kind of switches among different functional modes is not only complex and sophisticated, but often causes error operations as well. To the users, the change of phone shape is most intuitionistic. The shape changes are parallel with the function modes. This can mostly protect the privacy and control sharing levels of the phone set in advance.

Foldphone is combined with 4 different modules. According to various contexts, it can fulfill 6 different functional modes by some simple operations. Foldphone can operate as carrying mode, normal mode, calling mode, silent mode, private mode, and sharing mode. In the carrying mode, the phone can fold to inside by the middle of the screen, and only time is displayed outside, just similar to normal mobile phone with cover, which can protect the screen and be suitable to carrying with the compact volume. In the normal mode, the LCD screen fully stretches out, which allows receiving and sending SMS, browsing information, enjoying photos or videos. In the calling mode, the lower module would be fold up to 45 degrees, to allow an easy calling and receiving. If the LCD screen is fully folded by the middle, the silent mode is achieved. This guarantees the tone of mobile phone to switch off in some necessary conditions. In this time, the incoming calls show merely with messages, and only the intimates indicated in the phonebook can get through. In some public space, the users can fold two side modules to some angle to block neighbor’s sight and protect the users’ privacy while coping with message or browsing text and photo documents. Besides, it seems that the psychological feeling is more important than the actual effect. This makes it communicate a strong signal of “no bothering without invitation”. And finally, if the device is folded into a form of box and put in the front desk at a meeting, it becomes the sharing mode. It can display part of user’s personal information (such as, to be name board at meeting), and be used to transmit information or deal with personal affairs.



Figure. 5 FOLDPHONE

**6.3. Concept 3 –APTEGG**

APTEGG is to adjust the volume of ring and headphones intelligently by being aware of the environments and distance between phone and ear.

This device has a very concise form, like an egg, and with multiple colors to be selected, which would emit a sense of friendliness. The surface of the device is made up of a flexible transparent touchable material. The soft keyboard may have you feel a feedback of power when being pressed.

This device is very highly intellectualized, with the functions of sense and response to sound, pressure and space positioning. Firstly, it can automatically adjust its ring tone level in a noisy environment. Secondly, many operations and controls do not need complex and extra interface selections, e.g. receiving a call and checking a new message need just to take a pinch to the device. Thirdly, the distance sensor fixed in the device can automatically adjust the voice volume of headphones according to the distance between it and ears during a call, which effectively avoid the asymmetry of voice level at various sound surroundings. And fourthly and finally, it can be automatically switched between non hand free and hand free status according to the distance between the device and the user's face during a call. That is, the device switches to hand free status when it is apart from the user's face to satisfy the requirement of sharing with others, while it will switch to non hand free status (normal calling status) when it close to the user's face in order to protect user's privacy.



Figure. 6 APTEGG

## 7. Conclusion

Compliance is a big issue in communication arena. We don't think one single project can completely deal with all the problems. What we did here is a general study for the definitions of compliance and then to carry on divergent thinking from different perspectives rather than to focus on a certain kind of users or scenarios. It is hoped that our research outcomes will bring users more convenience and more pleasurable experience, and positively contribute to Nokia's coming product and service development.

## 8. Acknowledgments.

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