Adaptation of Driver Interface of VOLVO Trucks for India

Project II
Guided by Prof. Nishant Sharma
Co Guided by Sudeep Nakhe (Volvo)

MVD II-24

Project by Jinesh P Bhaskaran
Mobility & Vehicle Design (146390001)
MDes. IDC, IIT Bombay

Acknowledgement

I would like to thank my gide Prof. Nishant Sharma and co gide Sudeep Nakhe for the support and valuable inputs that he has provided during the course of this project. I also thank Prof. Ramachandran for his inputs on the project. Then I would like to extend my sincere gratitude towards Mr. Hari Babu (manager, customer training competence centre volvo), Mr. Somarajan(Trainer Volvo) and all the drivers at Volvo training centre for their cooperation towards this project.

Last but not least, I would like to thank my family and all my friends at IDC and outside, for being constant source of support and inspiration throughout the project.

Jinesh P Bhaskaran

Date

Contents

Introduction

Trucks play a major role in smooth running of an economy. They are the base of inland freight movement. There are trucks which travel inter continent to supply goods. All perishable goods supply depends on trucks. But trucking in India is not so developed even the freight movement is plenty. Indian truck drivers spent up to a month in a truck cabin during their trips. Even though India is an emerging economy trucking in India is a cottage industry owned by families and poorly treated drivers. they never get amenities to sleep or take rest, there is no air conditioning and sometimes a kerosene stove is a luxury.

With entry of brands like Daimler, Volvo, scania etc. into Indian market trucking going to experience drastic changes.

I. Research

1. Characteristics of Indian Culture

India is a diverse culture. Unlike any country india speaks more than 20 different laguages, 5 religions and hundreds of other classifications. But it portrays unity in diversity. Highlt populated cities and 50% of its population thrives on agriculture. These contrast demands frequent movement of goods between places. With a road network of 92,851.05 kms. trucks are the major goods carriers. India's long route trucks travel thousands of kilometers across india. Driver and the co driver cooks food and sleeps inside the truck, it is their home away from home. Current trucks are built by body builders as per the requirement of the owner. Usually it have a driver's cabin and a small crew cab, which is the extension of the driver's cabin.

[1]

1.1 Font

Indian typography is evolved from 17th century Devnagari scripts. And calligraphy is the base for Indian scripts. Bamboo shoots were used for inscribing Devnagari script.

It advanced through hand painting and calligraphy. Trucks became a canvas for calligraphy and sign writers. They beautifully painted trucks in vibrant colors and they travelled across India. They did a great job when people unaware of laser printers and flex boards. India still have hand painted hoardings and vehicle liveries unlike any country which are completely transformed into digital medium. Huge drop shadows and reflection are the main attractions about their works and each region have their own uniqueness. Anyone who used a paint and brush will no the struggle in getting the strokes right

Painter Kafeel font

Developed by an untrained painter from old Delhi, later become identity of Indian typography

Painter Bimal from Mumbai

Painter Bimal from Mumbai does Fruit-Juice stall sign boards, He has painted on many Juice stalls particularly on the ones in Juhu beach.

Painter Umesh from Gujarat

Painter Umesh 27, is not a street painter but he used to be one. Umesh earlier ran a painting shop in Dhoraji, Gujarat with his partner Mayank. After having completed his education with a Fine Arts degree from the famed M.S University in Baroda,

Gujarat, he joined the advertising industry. Currently he works as an art director in the Gurgaon office of Publicity. His partner Mayank still runs the painting shop.

1.2 Truck Art

The truck art from kerala have their own style. The name boards have a combination of incredibly elaborate text styles and carved wooden panels painted in a riot of colors. The ultra-bold, slab-serif fonts took up every square inch of available space on the boards and what remained was filled with an almost psychedelic set of patterns - something that reminds us of graffiti text.

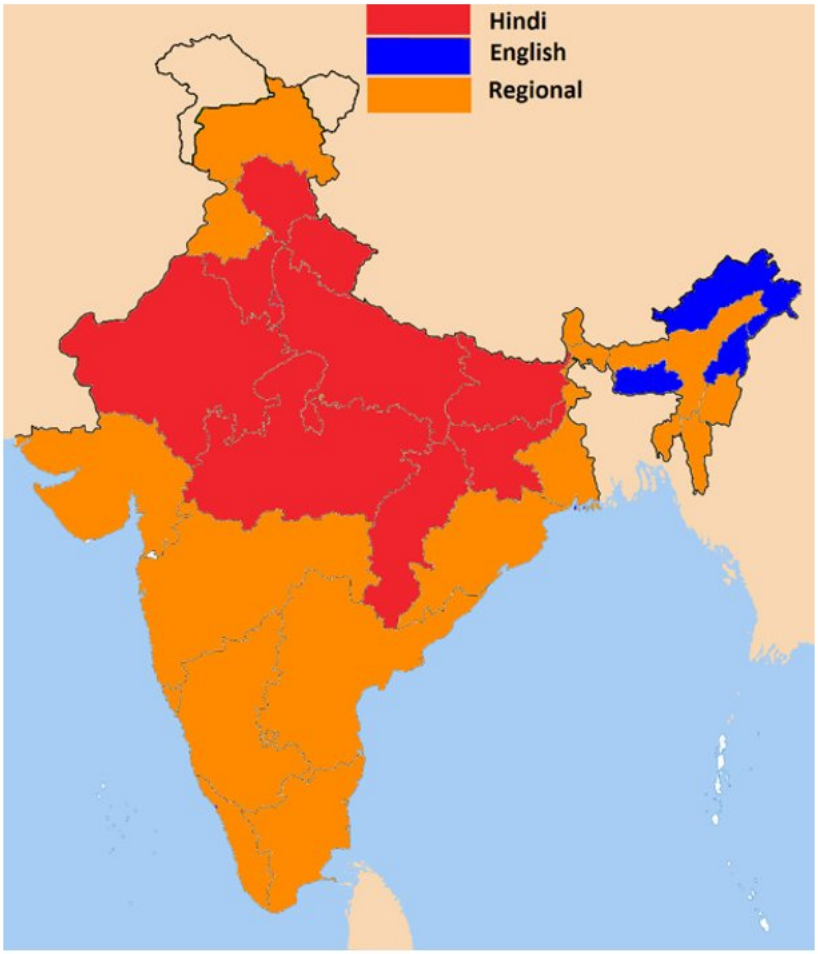
Their charcteristics are
Thick Strokes
Huge boarders
Less use of Helvetica opposed to international trend
Use of thick drop shadows
Maximum Utilization of Space

1.2 Language

Indian government have a bilingual system for language for important official communications
Hindi
English
But States in India can follow their own language for legislation. There are more than 20 official languages

India have its own adaptation of English known as Indian English. It differs in vocabulary and pronunciation. Indians also

[2]



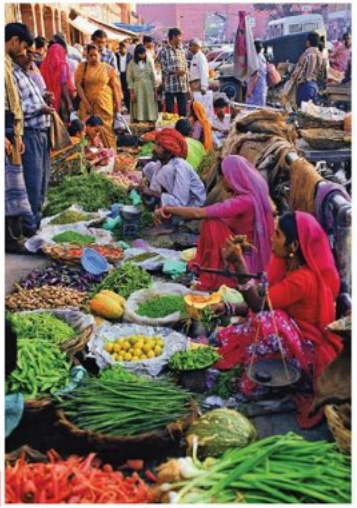
shorten many words to create commonly used terms. Enthusiasm is called enthu; as such, it can be used in new ways. One can say, “That guy has a lot of enthu. “

When bringing Indian words into English, terms such as roti (bread), which are already plural, will be pluralized for English by the addition of -s (rotis). English suffixes are also appended to Indian terms. An example which was brought up in the first discussion is the practice in Bombay of adding -fy to a Hindi word to indicate that an action is being done to someone by someone. From the Hindi word muska, to muskafy means to flatter somebody or to butter them up. Similarly, to pataofy is the action of wooing someone. Other suffixes such as -ic (Upanishadic), -dom (cooliedom), and -ism (goondaism) are used to create new usages for Indian terms. Prefixes can also be used in new ways. In Indian English, pre- is substituted for post- in postpone to create prepone, which indicates, for example, that a meeting has been moved to a sooner time.

Hindi Influences in Indian English

achchaa = good
arrai = hey
bahut = a lot
bus = that's it
ek = one (as a number)
ghotu = one who reads a lot
hajar (hazar) = a ton (more than a lot)
ho gaya = done; finished
yaar = buddy; pal
koi bat nahi = no problem

[3]



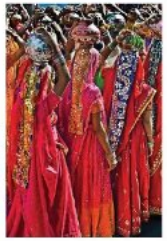
An indian Market

1.3 Color

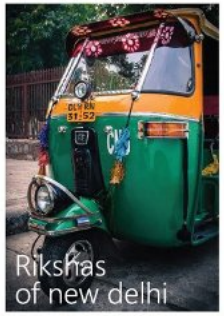
India has always been exalted and remembered fondly as the country of symbolic colors. To an outsider, its colorful culture, streets, and stories seem like a page out of an ancient folk tale. But color, in essence, has been a large part of the Indian consciousness. Here I'm trying to analyze the colors of the Indian Street and come up with color pallette which may help me in the later stages of the projct.

From the visual study the color preference is vibrant, we can find bright reds Yellows in plenty. Indians wont hesitate to select bright colors.

Temples of south India



Rajasthani Women



Typical Indian Truck

India product line-up

FM
25-125 tonnes
420-440 Bhp
Daycab/ Sleeper cab

FM Dump Truck
59 tonnes
Day cab

FMX
51 tonnes
440 bhp
Day cab

FH
Upto 200 tonnes
520 bhp
Sleepr cab

3. Research on the brand- VOLVO

A small research on the brand was necessary to understand the emotion and the story behind the volvo trucks line-up. Volvo rebooted its product line in 2012

3.1 Vision

The Volvo Group's vision is to become the world leader in sustainable transport solutions by:

- creating value for customers in selected segments
- pioneering products and services for the transport and infrastructure industries
- driving quality, safety and environmental care
- working with energy, passion and respect for the individual.

3.2 Lineup Reboot

Since September 2012, Volvo Trucks has launched five new truck models. It all began with the spectacular launch of the new Volvo FH, followed this year by the introduction of the new Volvo FM, Volvo FMX, Volvo FE and Volvo FL. All the new models include innovations and features that make the driver's job easier and more efficient.

Major Players in Indian truck market

3.3 INDIAN TRUCK MARKET

Major Players

Major domestic and international brands in Indian truck industry are.

- Mahindra Navistar
- Tata Prima
- Ashok Leyland
- Volvo-Eicher
- SML-Isuzu
- AMW
- MAN-force trucks
- Bharat Benz
- Volvo
- Scania
- DAF
- Mercedes Benz Actros

Volvo have a joint venture with Eicher, in the name VE trucks. Bharat benz is the joint venture of FUSO and Daimler group. Other than that Volvo, Mercedes Actros and Scania usually used for heavy haulage and in mining industries.

All the general purpose trucks have basic(analogue) HMI. Some of the new generation trucks have an integrated LCD display which shows vehicle settings and necessary information.

Mahindra Navistar

TATA Prima

Dashboard and HMI

A market analysis would help in finding out solutions for india, so a quick comparison of all the instrument console and HMI of indian trucks. It is important to know how Indian manufactures are adapting to the complete digitization of truck HMI. Many models have low or very little digital elements in the instrument console, mainly to make it cheaper and robust. The maintenance should be easy in case of any failure.

TATA Prima features an integrated LCD display which shows all the vehicle related informations and allows user to change settings of vehice through the interface

Asok Leyland

This is the most common truck in Indian roads. People buy chassis of various configurations and then build the body according to the requirement

Volvo Eicher

This model features a lcd display which is similar to Driver Information Syatem in volvo FH series. These are premium range of trucks

Man Force

Fully analogue console

Isusu

Fully analogue console

Bharat Benz

These trucks have a digital display integrated to the dashboard, through which the driver can access the settings and other drive related informations.

Volvo

This Particular model is FH 16 and it have a Driver Information display and a Secondary Information display for infotainment purpose.

Scania

Scania trucks also features a digital display integrated into the console.

[8] [9] [10]

Mercedes Benz Actros

Mercedes trucks also features a digital display integrated into the console.

4. User Interviews

There were two user interviews happended during the timeline of the project. The first one was to get an overall idea of truck driver's lifestyle and their preferences. The second User interview and validation of the prototypes were carried out in volvo driver's training center. This time the questionnaire was more specific and elaborate. Below is the consolidated result from both of the user interviews.

Abbas

Personal Details

Age	: 45
Truck Model	: Ashok Leyland 10 wheeler
Monthly trip Distance	: 1000km/Month

Use dashboard frequently for checking:

Speed
Engine Temperature
Air Pressure
Fuel gauge

Wish it was there

Mechanical Parts failure Alert
Engine info
Tyre Pressure info

Sajeev

Personal Details

Age : 28
Truck Model : TATA 1109
Monthly trip
Distance : NA

Wish it was there

Wish it was there
Mechanical Parts failure Alert
Engine info
Tyre Pressure info

Use dashboard frequently for checking:

Use dashboard frequently for checking:
Fuel Gauge
RPM
Eng. Temperature
Turn Indicators
Speed

Sarath

Personal Details

Age : 30
Truck Model : Mahindra Loadking
Monthly trip
Distance : NA

Wish it was there

Wish it was there
Total Trip Distance
Distance to Empty
Mechanical part failure alert.

Use dashboard frequently for checking:

Use dashboard frequently for checking
Speed
Park Brake
Eng. Temperature
Turn Indicators
Head lamp

Kurien mathew

Personal Details

Age : 26
Truck Model : TATA Taurus 10 wheeler
Monthly trip
Distance : Upto 2000kms/Month

Wish it was there

GPS
Tire Pressure
Tire heat
Seat belt warnings

Use dashboard frequently for checking:

Speed
RPM
Air Pressure (front and rear)
Engine temp
Oil

Rathiwan singh

Personal Details

Age	: 35
Truck Model	: Scania
Monthly trip Distance	: NA

Tech. Orientation

Uses basic phone, not familiar with smartphone and apps

Understanding of the present DID

Can distinguish green, orange and red light warnings.

Most used DID functions

Gauges
Time/ Distance
Fuel data
Vehicle Message
Dignosis

VOLVO Drivers' Training center

Sunit singh

Personal Details

Age	: 33
Truck Model	: Tatra
Languages known	: Hindi/ English

Tech. Orientation

Familiar with smartphone and latest apps

Most used DID functions

Gauges
Time/ Distance
Fuel data
Vehicle Message

Wish it was there

There should be warning system for low pressure in tyres and automatic tyre inflation

VOLVO Drivers' Training center

SB Patil/ D. Subramaniyam

Personal Details

Age	: 35/ 36
Education	:10th/ 10th pass.
Truck Model	: Volvo FM
Languages known	: Hindi/ telungu

Tech. Orientation

Uses basic phones

Most used DID functions

Gauges
Fuel Data
Vehicle Message

Wish it was there

It is good to have DID in the center console

VOLVO Drivers' Training center

Somarajan (Trainer, volvo driver trainig center)

Driver's Dont care about facilities like reverse camera
Sometimes they neglect vehicle messages
They are not aware about daily checking
And preliminary check before each trip
Driv ers use number reference for menu items

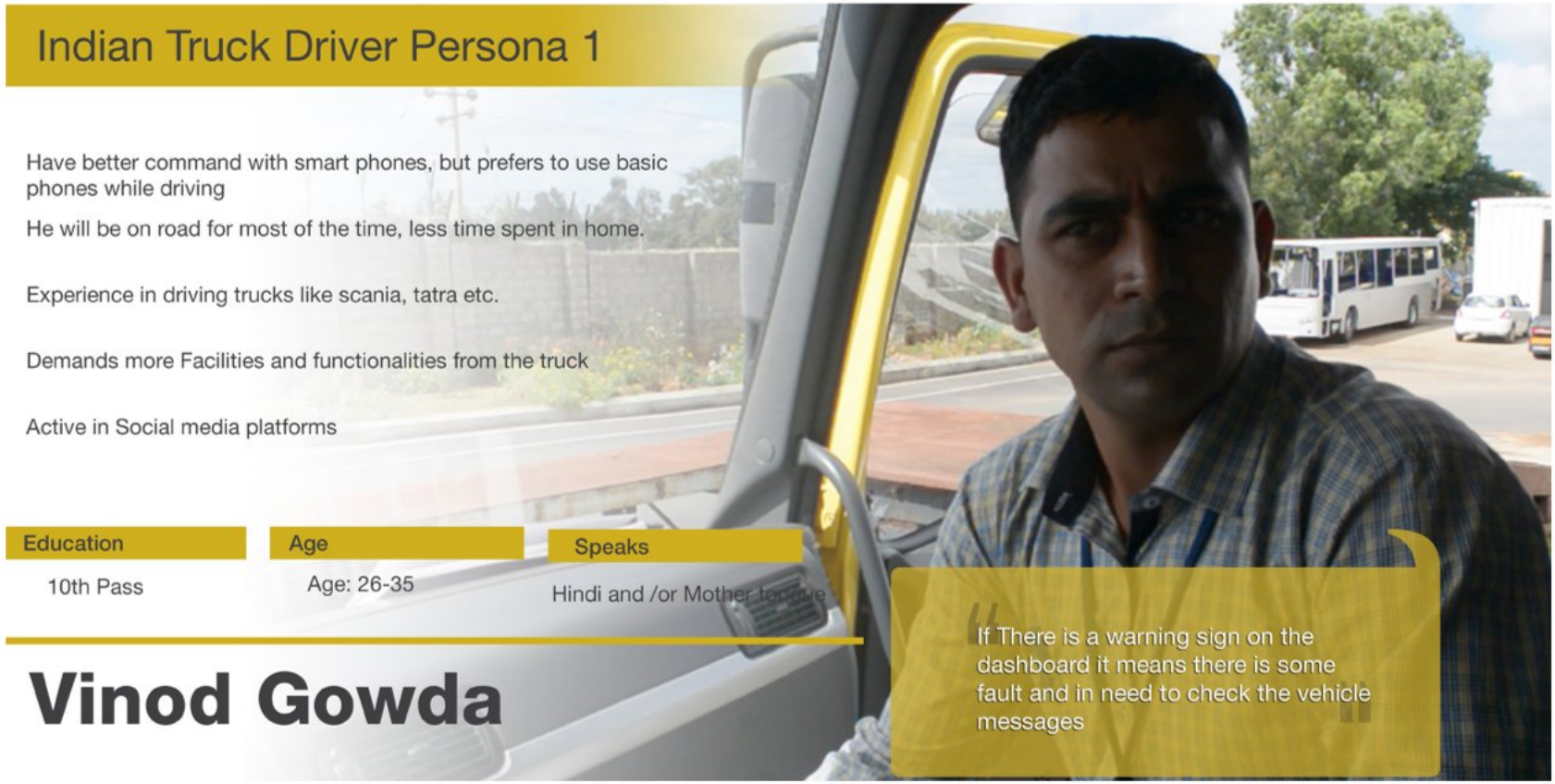
VOLVO
Drivers' Training center

4.1 Inferences

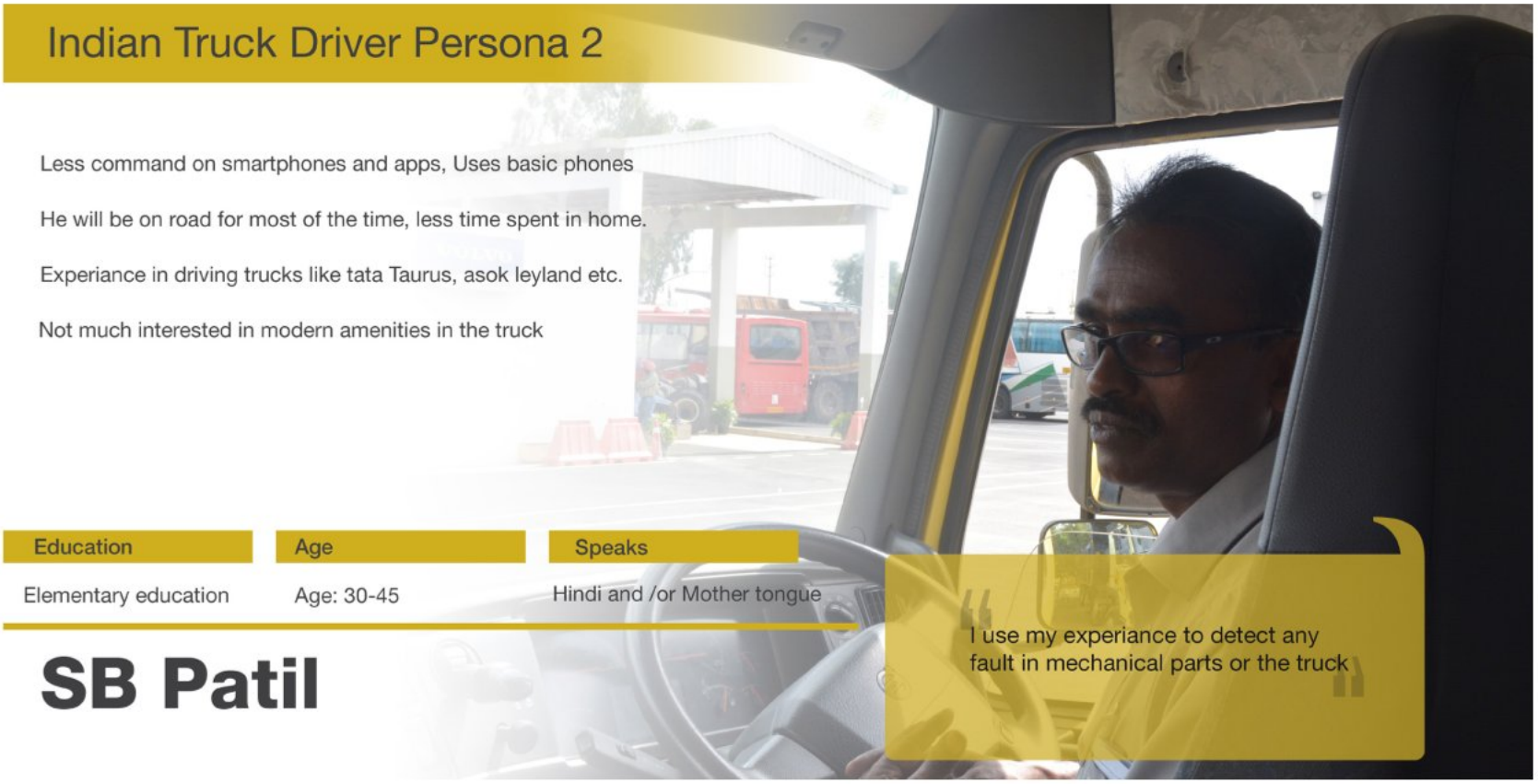
- Most of them write and speak hindi but not so sure on having hindi on the information display
- Educational qualification is 10th , at least for Volvo.
- Can successfully associate red with danger and green with safe, regarding warnings on the screen
- By hearts the menu order as they taught in the class, often refer the number on the right upper corner
- Most of them uses base phones while driving, though some of them have good experience in using smartphone and knows how to install and use apps.
- Prefers a pen drive plugged into the system for playing music as it is handy, instead of using their phone to play music or connecting the same to the system.
- All drivers wanted on board info about mechanical parts failure
- Wanted colors like red but dim light from the console
- RPM and air pressure are more important compared to speed, oil pressure, battery etc.
- Changing gears at ideal RPM will improve mileage

- Want GPS module right on the console, especially for longer routes
- The image of truck drivers are no longer the same, they were portrayed in dirty clothes and villain looks. But many drivers are more educated and aware about the technologies, they want more from their trucks.

4.2 Persona of an Indian Truck driver



Indian Truck Driver Persona 2



Less command on smartphones and apps, Uses basic phones

He will be on road for most of the time, less time spent in home.

Experiance in driving trucks like tata Taurus, asok leyland etc.

Not much interested in modern amenities in the truck

Education	Age	Speaks
Elementary education	Age: 30-45	Hindi and /or Mother tongue

SB Patil

"I use my experiance to detect any fault in mechanical parts or the truck"

5. VOLVO HMI

Volvo trucks are designed with the driver in focus.The modern instruments pannel angled towards driver together with the integrated controls in the steering wheel creates an ergonomic working environment.

The Instrument cluster

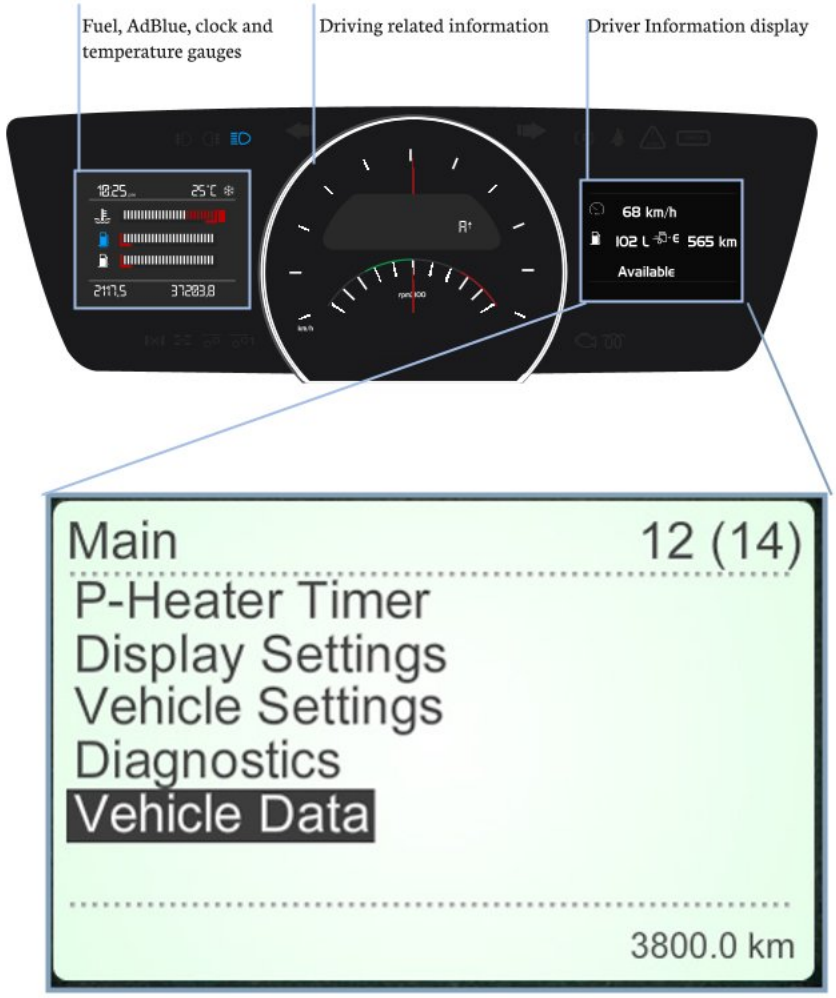
The instrument cluster contains one center dial which shows speed and RPM, an auxillary display which shows important information about the truck such as coolant level, Adblue level, fuel level etc.

Driver Information Display (DID)

Driver Information Display or DIS is the driver's window to the vehicle settings and accessing informations about the engine or the truck as a whole

Secondary Information Display SID)

The role of secondary information display is infotainment. It is a 7 inch. color screen which is used for navigation, dynafleet (VOLVO's fleet management system), playing music etc.



Menu home page

Steering wheel controls

All the functions of the instrument cluster can be accessed through the controls on the steering wheel. The left side controls are for phone, cruise control and activating Adaptive Cruise Control (ACC). The right side controls the audio sytem, Driver Information Display(DID) and secondary Infromation Display(SID)

5.1 Driver Information Display (DID)

The drivers information display shows all the informations about the vehicle, its settings, distance to empty etc. It also flashes warnings and error messages dynamically on the screen. It is a four inch display. DID also displays the menu for vehicle settings which can be accessed using the buttons on the right side of the steering wheel

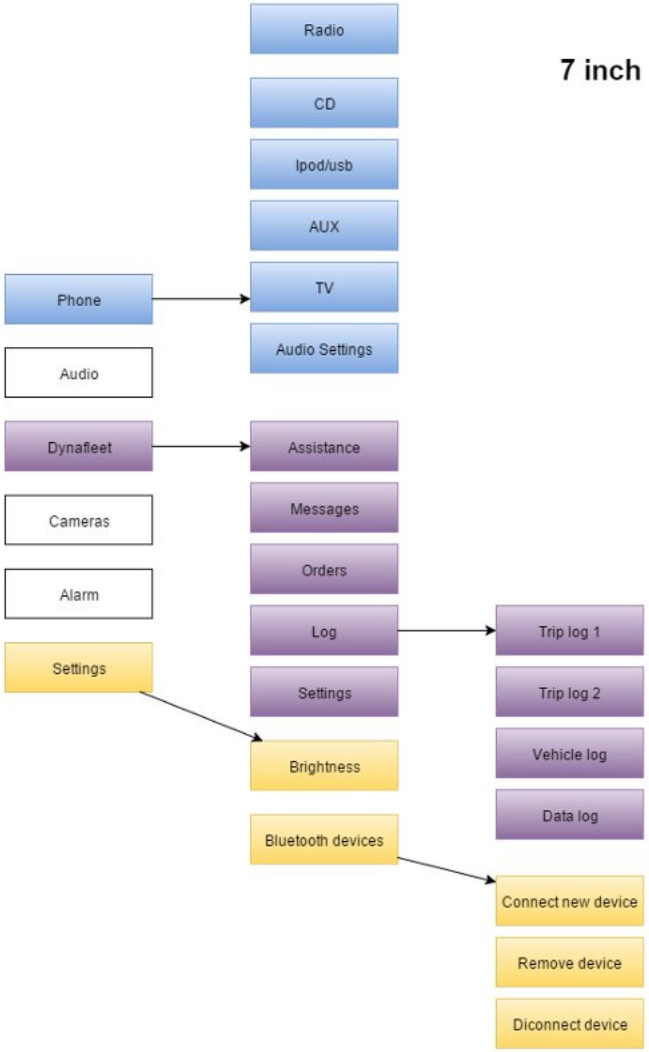
The home screen

The homescreen is divided into three sections the top section shows the clock, average speed and mileage. The next two sections can be configured by user. This part of the screen can display informations like battery information, coolant temperature or time

Menu Hierarchy

The DID menu have 14 elements on its first hierarchy then expands to morethan 40 functions on second level. It follows a tree hieracrhy, the driver have to comeback to first level to access another branch of the menu.

5.2 Secondary Information Display



The menu hierarchy is based on tree structure. It have 6 main menu elements. It is a 7 inch color display. SID can show the rear camera feed while reversing. It have vast functionality that driver can even install 3rd party apps into it.

6. Cultural dimensions

Professor **Geert Hofstede** conducted one of the most comprehensive studies of how values in the workplace are influenced by culture. He came up with the idea of cultural dimensions

Based on his findings and books **Gabrielle Ford** and **Paula Kotze** published a paper on Designing Usable interfaces with cultural dimensions.

Definition of culture

System of meaning that underlies routine and behavior in everyday working life, Includes race and ethnicity, assumption, values & patterns of thinking. Culture is communication. The collective programing of mind that distinguishes members of one group or category of people from another

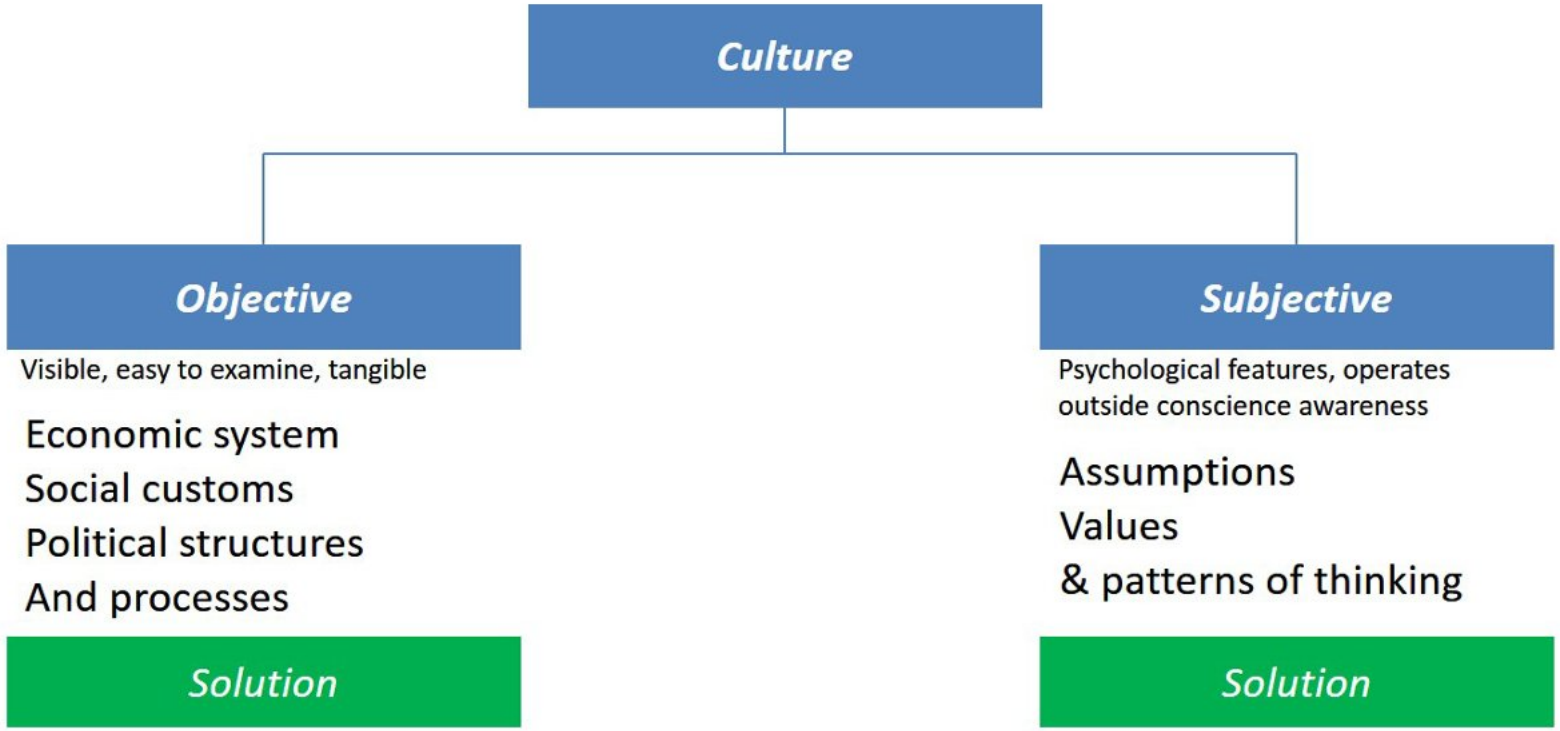
For this context it can be defined as

Patterns of thinking, feeling and acting that influence the way in which people communicate amongst themselves and with computers.

6.1 Preparing a product for use by diverse culture

1. Internationalization : Identifying Culturally specific elements of the product

2. Localization : Substituting those cultural specific elements with a local context

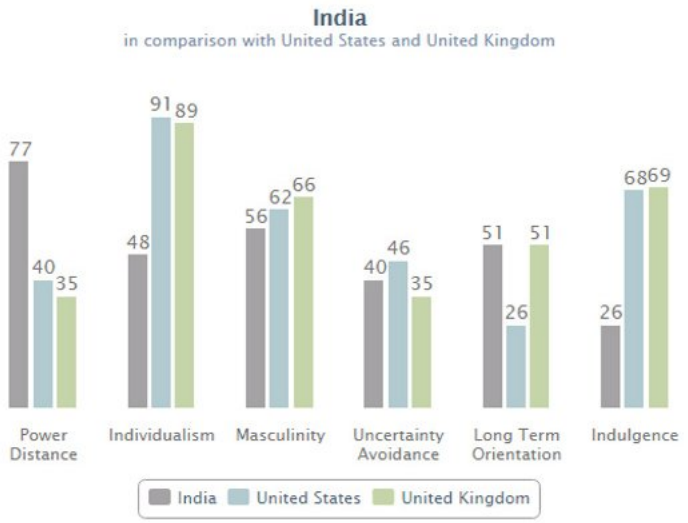


Classification of culture and methods for designing for each of them

6.2 Adapting subjective cultural aspects
6D evaluation model by Hofstede

Power Distance:
The extend to which the less powerful members of a institutional organization expect & accept that the power is distributed un-equally

[11]



6d Evaluation of India vs UK vs US as per **Geert Hofstede**'s data

Individualism:
The degree of independence members of a society have.

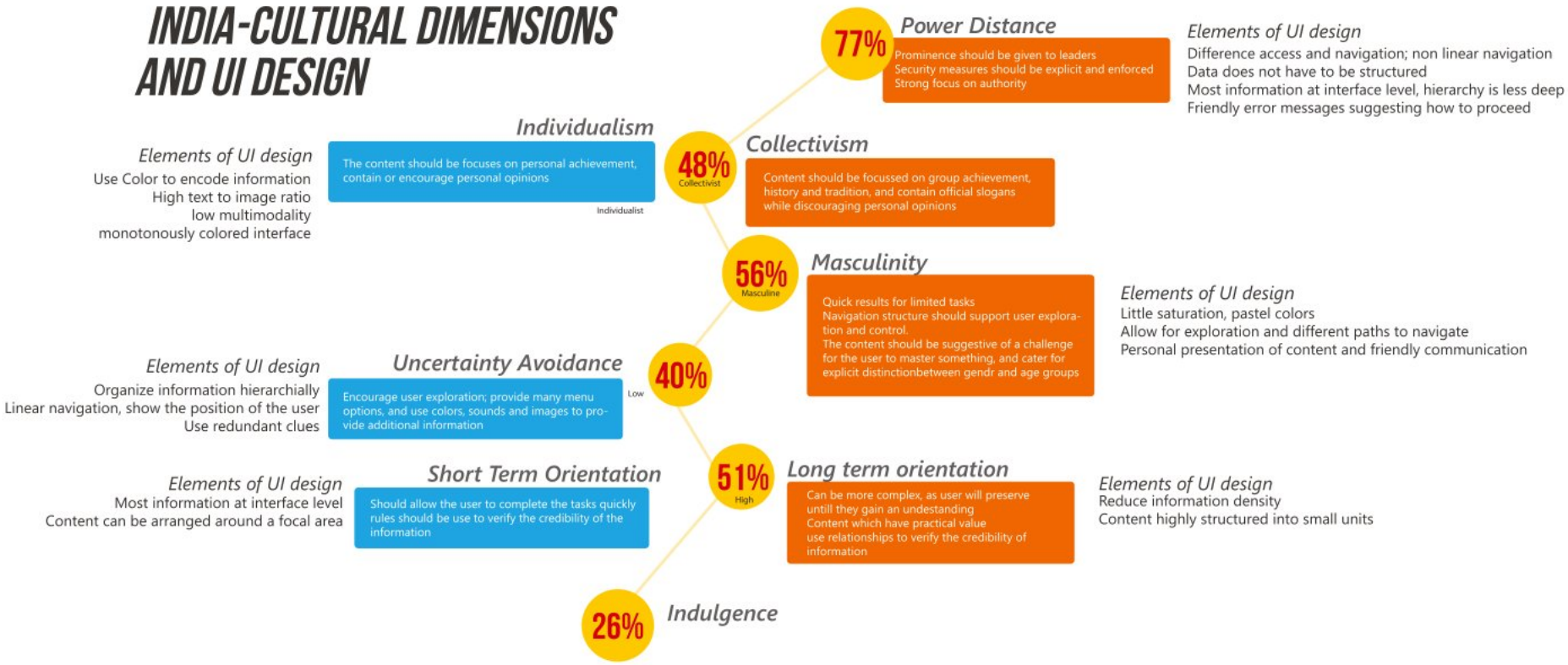
Masculinity:
A society that driven by competition, achievement and success. Feminine: quality of life is the sign of success and standing out from the crowd is not admirable

Uncertainty Avoidance: the extend to which members of a society or culture feel threatened by unambiguous or unknown situations

Long term orientation:
how every society has to maintain some links with its own past while dealing with the challenges of the present and future,

Indulgence:
People with this orientation have the perception that their actions are Restrained by social norms and feel that indulging themselves is somewhat wrong

The research paper by **Gabrielle Ford** and **Paula Kotze** explains how these cultural dimensions affect interface design. Fig on left explains how their interpretations affect the indian cultural scenario.



Summary of cultural dimensions of India and effect on UI Design

6.3 Further reasearch into cultural dimensions

Further reasearch on cultural dimension showed that there are more dimensions conceptualized by others. There are more parameters that can affect interaction design in a cultural perspective. More information on cultural dimension is tabulated in the appendix.

II. Brief

Objective & Goals :
To redesign Human machine interface (Digital) of volvo trucks for Indian market.

Components to consider:
1. Driver Information Display (DID)
2. Secondary Information Display (SID)
3. Icons
4. Colors & Navigation

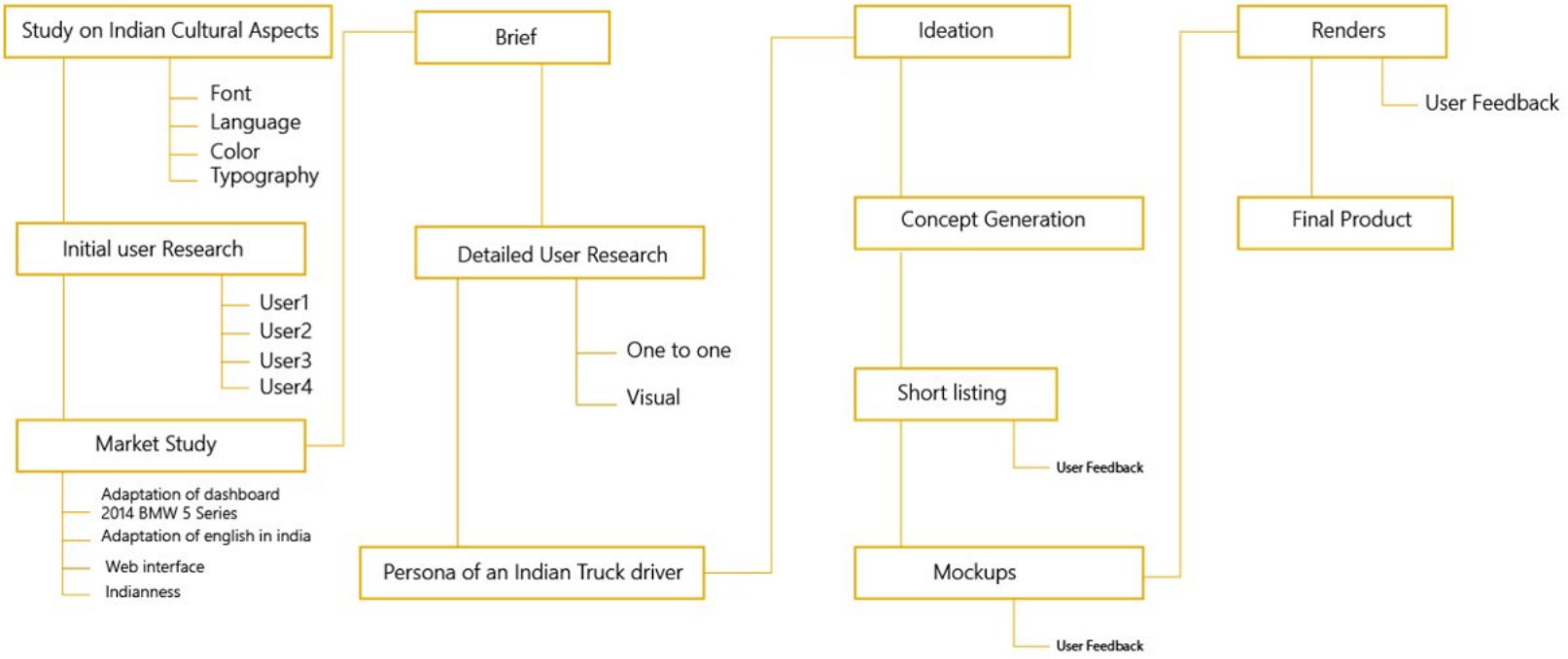
Target Audience :
Indian Truck Drivers

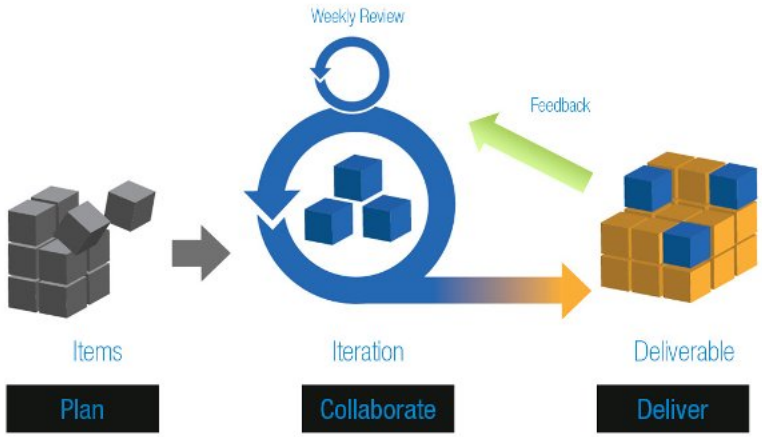
Scope :
The scope of the project extends up to the month of December and delivering the Project Results as mentioned below.
1. Digital interactive Protoype of DID
2. Digital interactive Prototype of SID

1. Why India spec design

Indian Trucks operate in much different Environment
Literacy rate of Drivers
Income Level of drivers
Social Conditions
Indian Economy

1.1 Plan of action



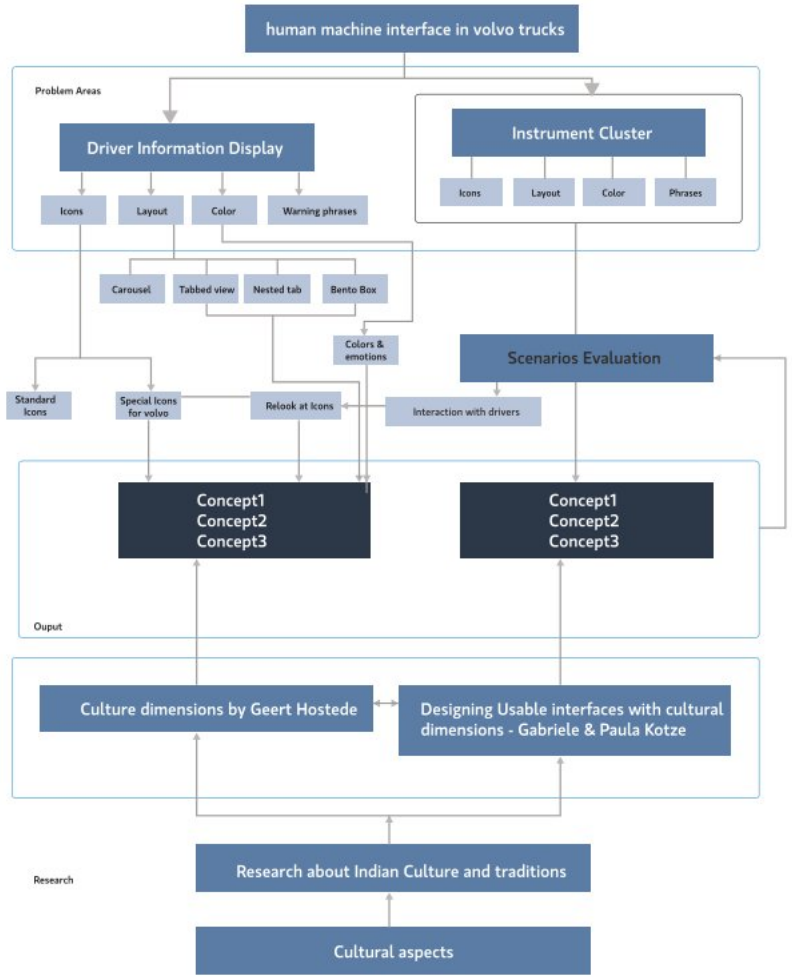


Agile Project Management

1.2 Methodology

Agile project management encompasses several iterative approaches based on the principles of human interaction management and founded on a process view of human collaboration. Agile-based methodologies are “most typically” employed in software development as well as the “website, technology, creative, and marketing industries.” This sharply contrasts with traditional approaches such as the Waterfall method. In agile development or flexible product development, the project is seen as a series of relatively small tasks conceived and executed to conclusion as the situation demands in an adaptive manner, rather than as a completely pre-planned process.

Based on these methodology the project is broken down into small parts such as Driver information display, secondary information display, icons etc. And the the process is iterative and feedback oriented. The final product will be deployed to user and will be integrated into the existing system (dashboard)



Approach to redesign

III. Redesign

With the help of all the resources and the user interviews I started to cluster elements that needed a redesign and started working individually in a diverging manner. The main areas i found was

1. Driver Information Display (DID)
2. Secondary Information Display (SID)
3. Icons
4. Phrases and commands
5. The instrument cluster as a whole unit

Approach to redesign

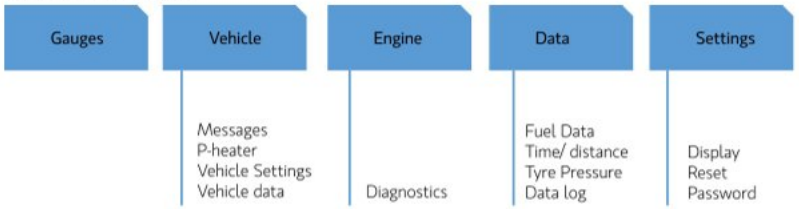
The approach was to look at different components of the instrument pannel and use a number of scenarios to evaluate problems with indian way of doing things and how it will affect volvo's IP design. From other aspects there is user research and internet research that influence the concepts.

1. Scenario evaluation

More than 10 scenarios are developed that a truck driver will encounter in everyday situation. These scenarios will lead to the problems in that area. Each scenario was evaluated in the context of an Indian truck driver and VOLVO HMI (appendix).

Existing driver information display

DID 1 Menu Hierarchy



The menu hierarchy was split into five categories to make the operations faster

DID 1 Home screens

2. Driver Information Display

2.1 Concept 0

Using the insights from the scenarios evaluation(appendix) and the existing menu hierarchy, started with working on the Driver Information display(DID). Tried to break down the 14 main menu elements and grouping them. In the first concept I and grouped them into

1. Gauges
2. Vehicle
3. Engine
4. Data
5. Settings

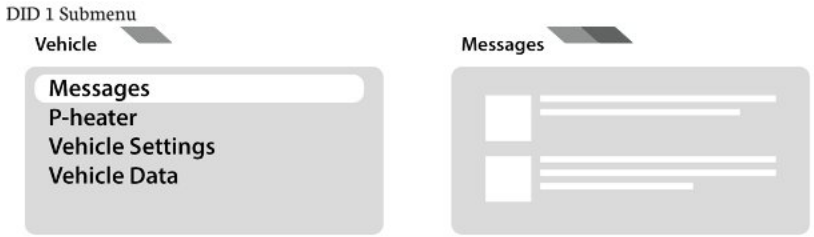
This method substantially reduced the turnaround time taken to complete an action using the Driver information display. In this concept driver have 5 main screens which display a short summary of what is inside the menu so driver cab have a glance at the image without even going deep into the menu.

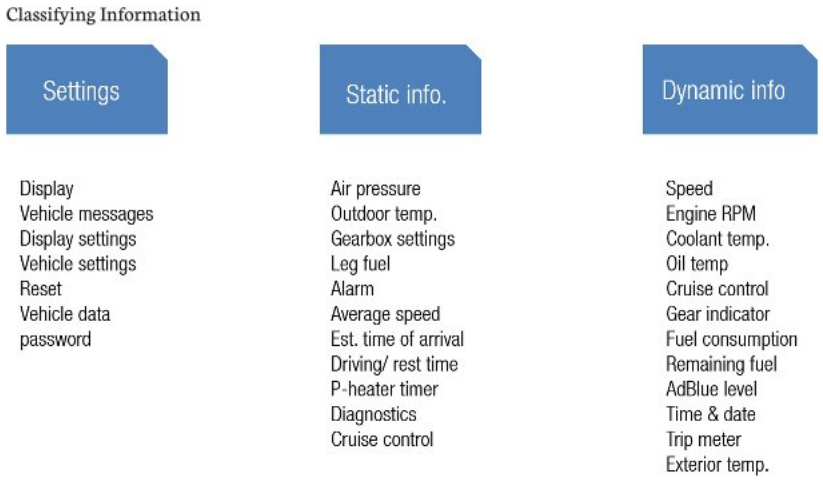
Each tab have main icon indicates what it is about and a short glance of inner menu elements. Used muted colors since the display does't support any color, still the informatin displayed was legible and in contrast with the background color.

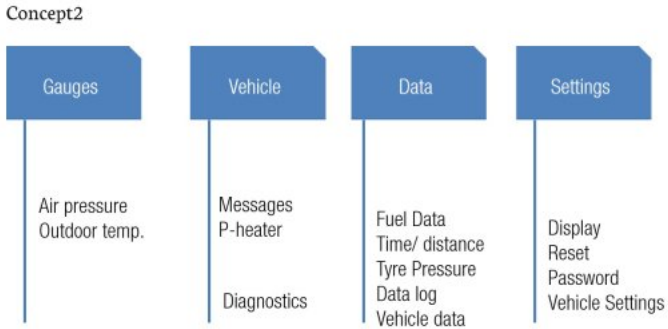
The breakdown done by referring the driver preferences combined with the results of the scenario evaluation.

Menu hiearchy

It uses a hierarchial navigation structure, where user have







to come back to homescreen for going into another page in the menu.

Sub menus

The sub menus are tabbed for indicating the position of the user. Small dots on top of the page indicates the user position in the menu hierarchy. Inner tabs have alight color variation to easily distinguish them from the page in focus

2.2 Concept 1

When finished the first concept with five home screens, some of the home screens don't have much information to show. Most of them remained blank and the inner hierarchy also became too shallow. To utilize the home screen space maximum made another concept with four Home screens which is easy to remember. The home screen utilization improved.

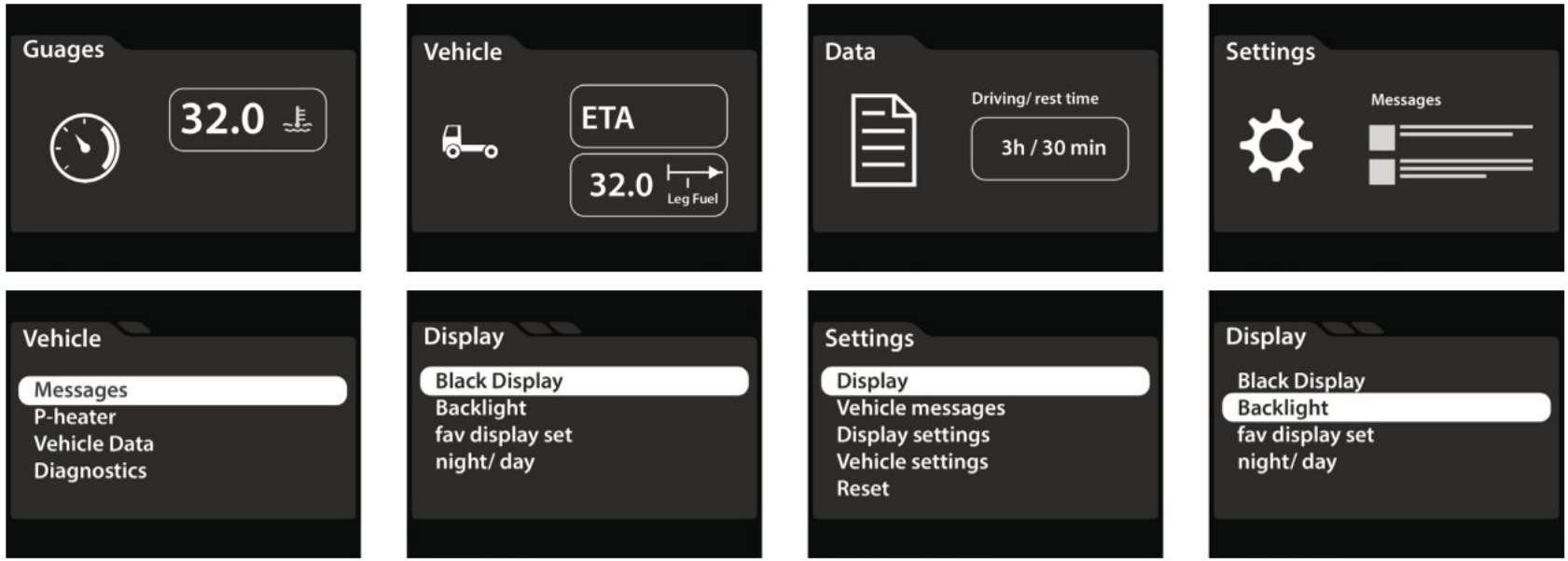
Classifying the information into static dynamic and settings

The next step was to clasify each information from the driver information display into **static**, **dynamic** and **settings.** Static info are the information which will shown on the screen permanently, while dynamic could be a warning which appears for few moment and fades away. settings includes vehicle settings, display settings, sound setting etc.

Philosophy

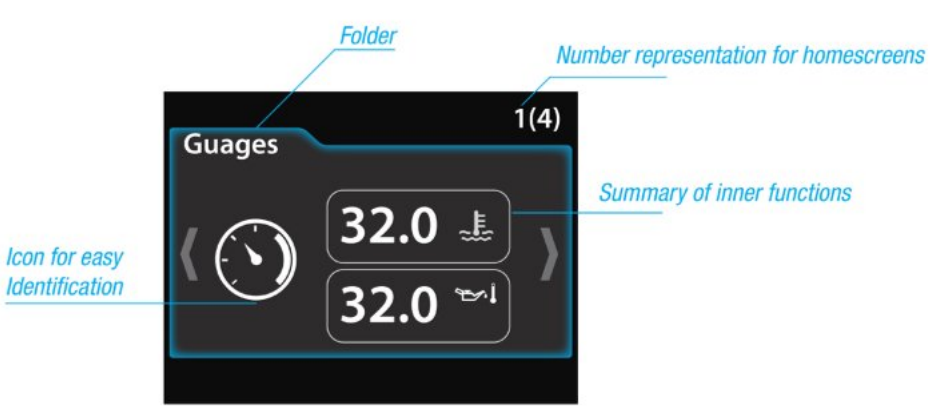
The screen is composed of layers of transparent glss sheets stacked on top of another.

The base or first sheet is the background for the display.

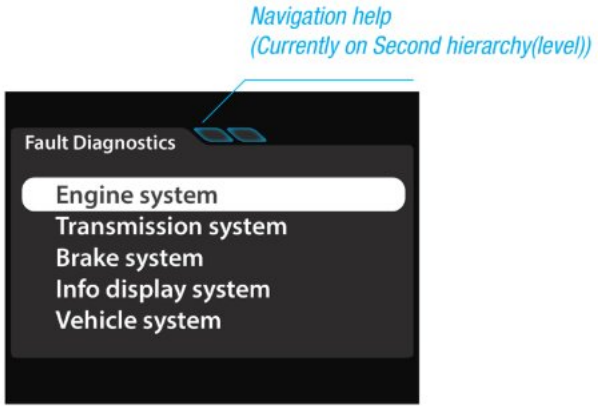


The second layer contains the folders, through which driver can navigate. Each folder will contain a new home screen and information related to that particular home

The third layer is the text and graphics layer, it conatins all the text and icons appearing on the screen which is the topmost layer



Home Screen



Inner Screens

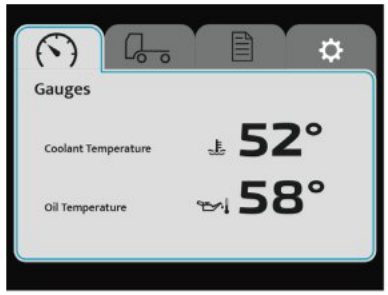
Cultural Aspects

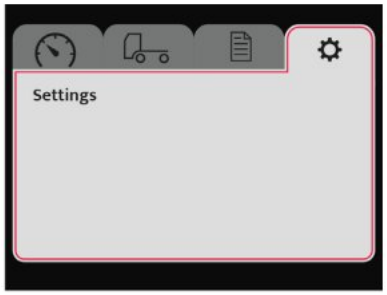
Little saturation
Pastel colors

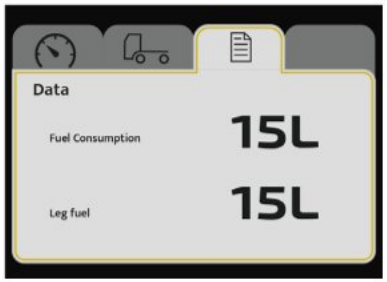
Less deep hierarchy

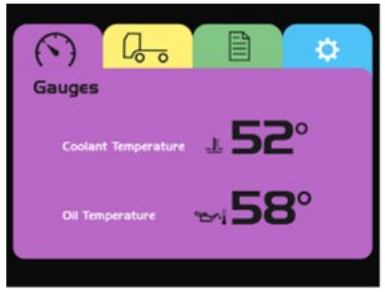
Interface for novice users

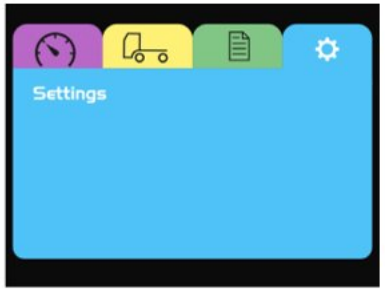
High Text to image ratio

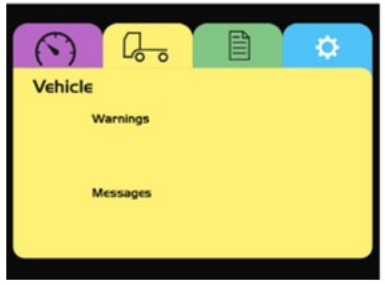












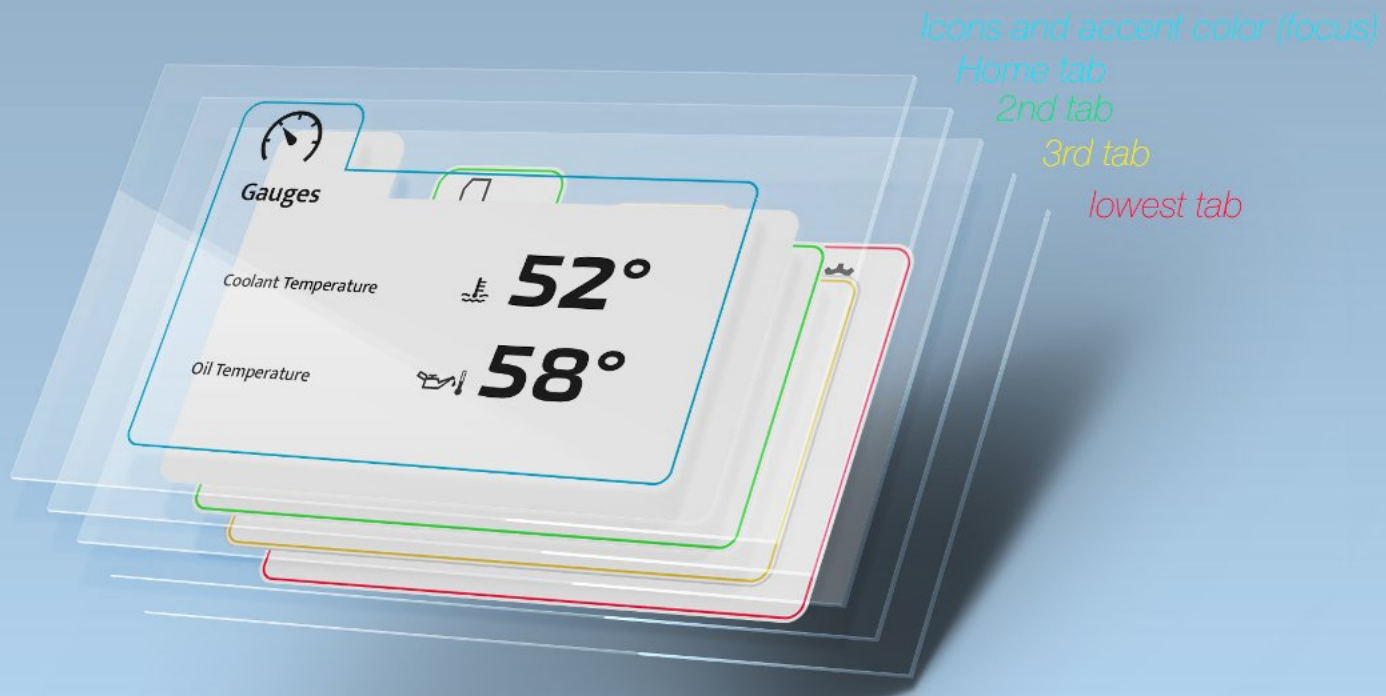
2.3 Concept 2

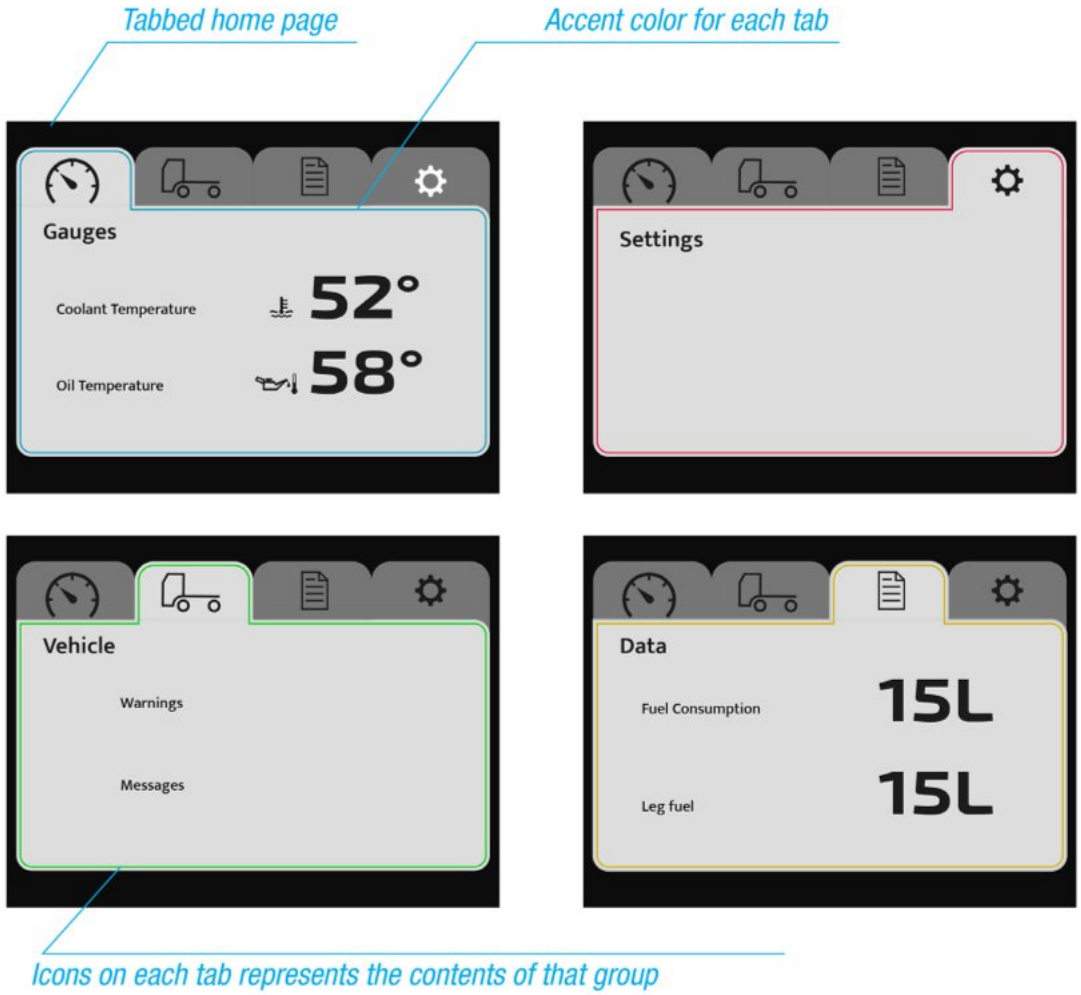
Concept 2 is based on concept one but experimented with color coding the information. In one variation different colors are used for different tabs/home screens. It not merely a color change, but user can have a glance at all the four home screens at same time. It is like like bookmarks placed on various pages in a hige book. User can easily go to anychapter using the navigation buttons.

Experimentations with color

This concept is not shy to experiment with bright colors to distingush the tabs/home screens

Driver Information Display 2



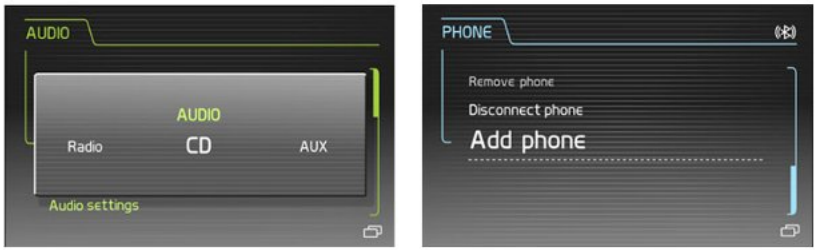


Cultural aspects

Less deep hierarchy

Use colors to encode information
High text to image ratio
Monotonously colores interface

Linear Navigation
Show the position of the user
Use redundant clues



Existing SID screens

3. Secondary Information display (SID)

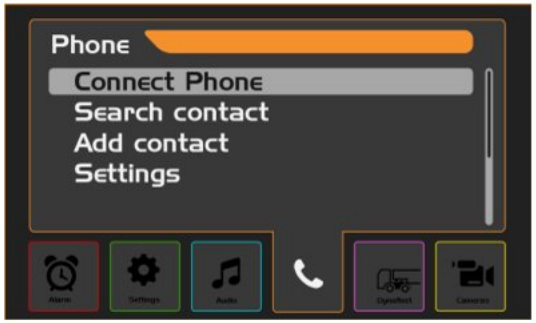
The secondary information display is a 7 inch color screen, similar to the infotainment screen in passenger cars. It handles

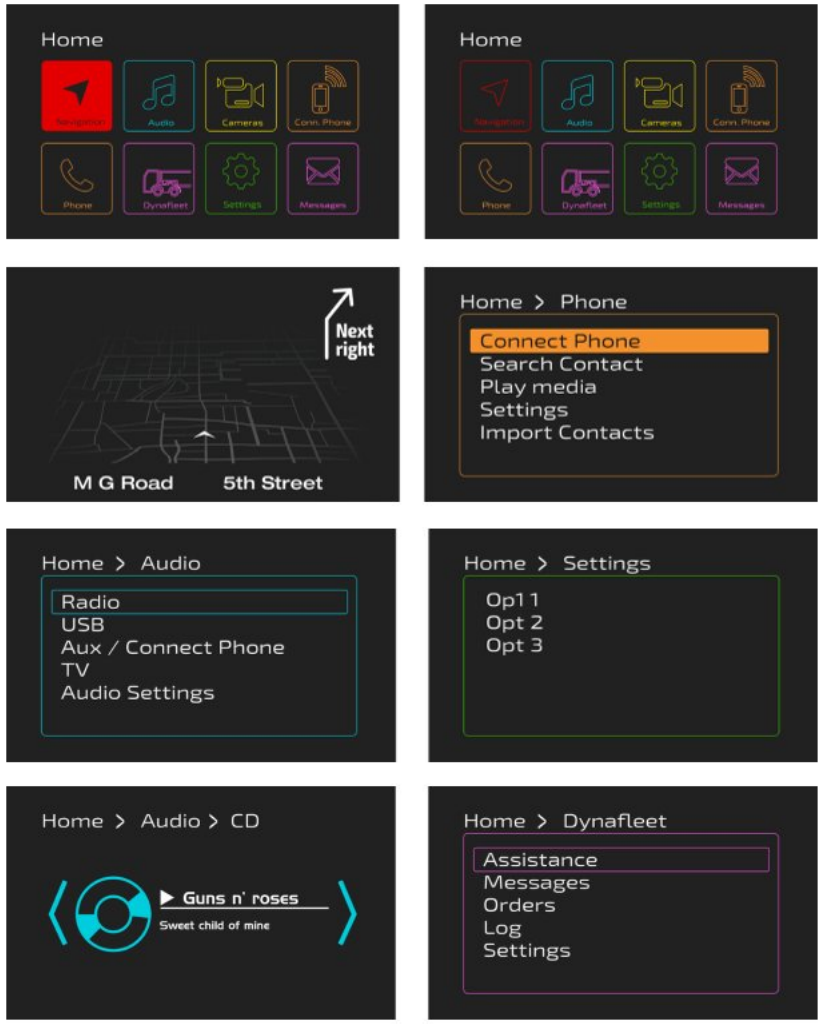
1. GPS,
2. audio player,
3. dynafleet,
4. Phone and
5. Reverse camera

These are also imporatant for the operation of the truck. Accepting and making phone calls are very important in a consignment. Dynafleet is VOLVO's fleet management system which avoids the hassles of need to call the driver frequently for enquiring about the load or his location.

Dynafleet is the black box of the truck, it calculates the distance driven, total trip time, rest time etc. Fleet owner can see this data on his personal computer. He can also send messages related to the job to the driver.

3.1 Initial Ideas (Home screen)





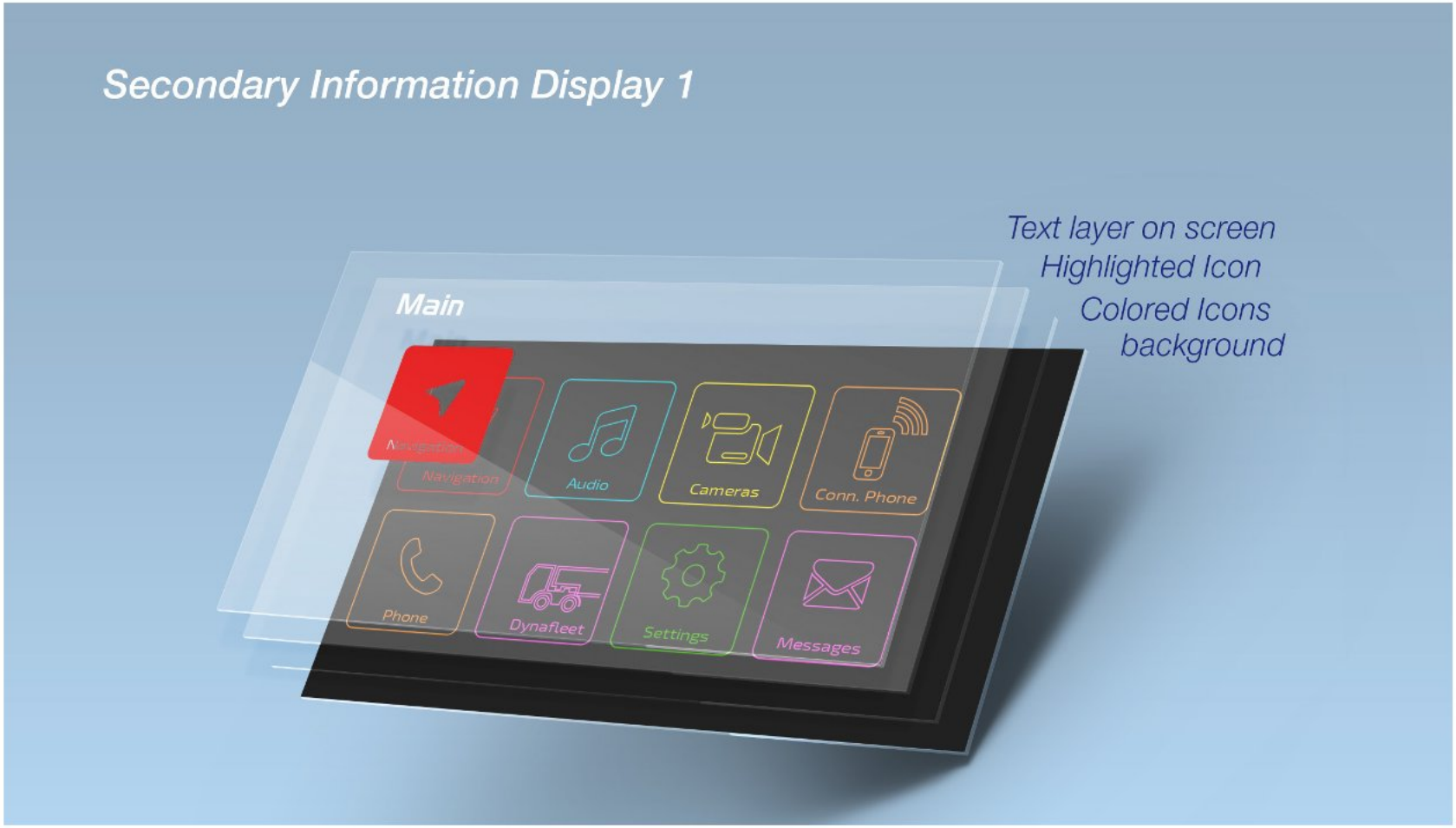
3.2 Concept 1

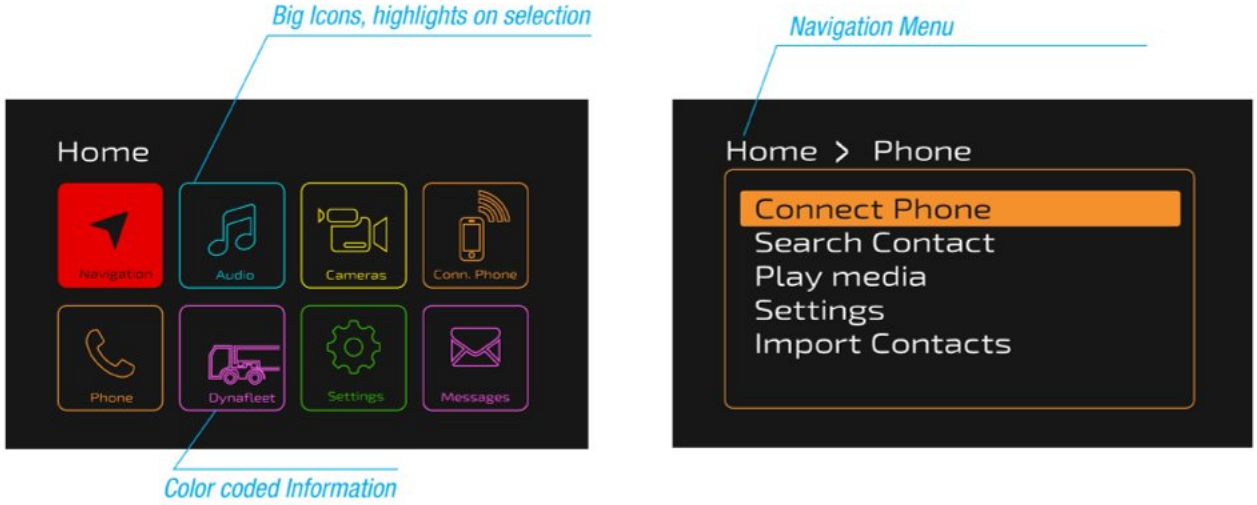
This concept is based on springboard theme populated by ios. It have a main homescreen where the driver can see big icons. He can navigate through the icons using buttons on the steering whee. Each icon is accented with a color and the same accent color is applied to various elements in the inner menu elements. Accent color helps to identify and memorize each submenu. The navigation architecture is hierarchial, where the user have to come back to main/home screen to navigate another branch of the tree.

The philosophy

This concept is four layered architecture. Base layer is the screen surface next laye is accented icons, thirs layer is the currently selected or highlighted button. Above all is the text layer which gives hint to the user on which page it is.

Secondary Information Display 1





Cultural Aspects

Less deep hierarchy

Quick results for limited tasks

Organize into Hierarchy

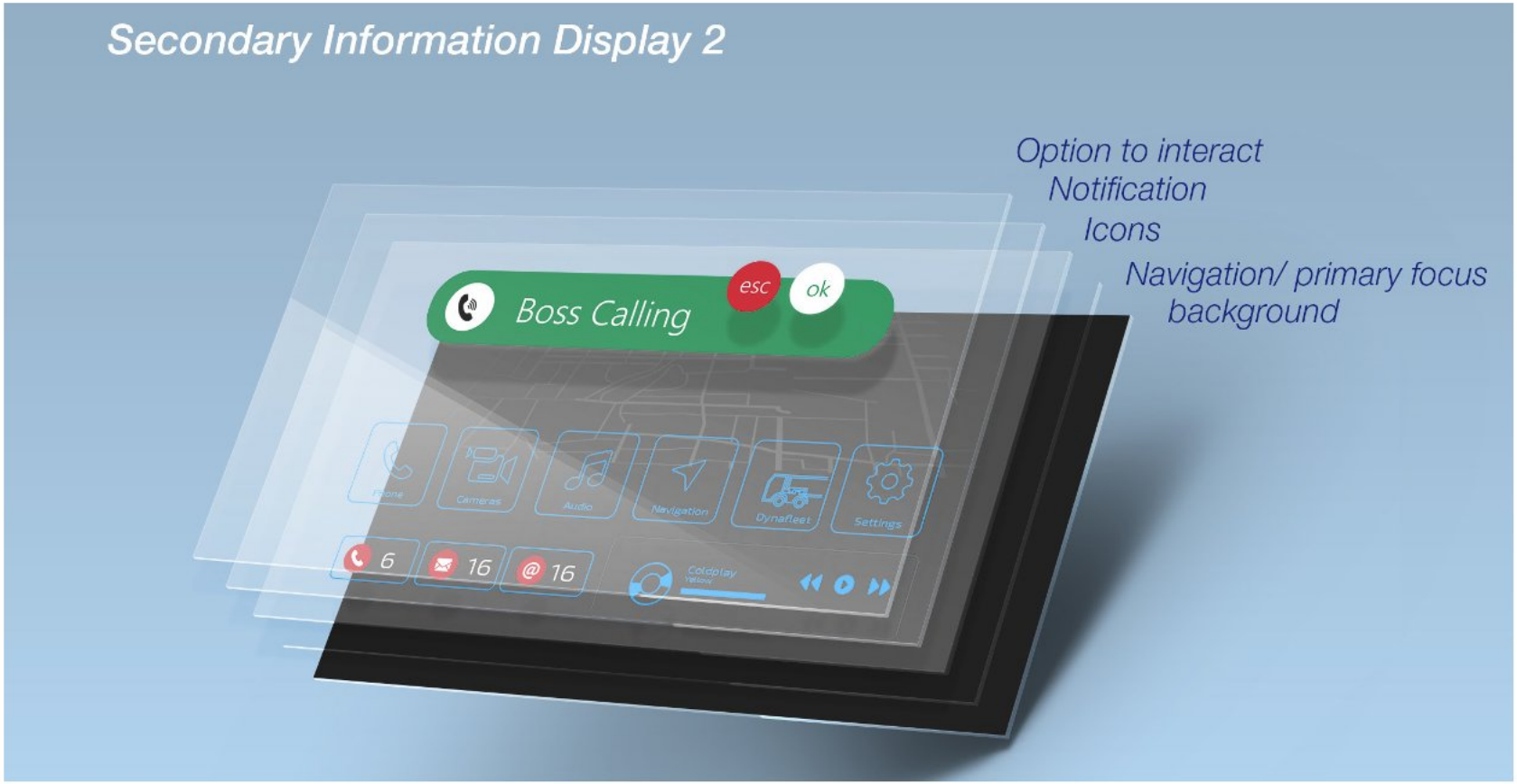
3.3 Concept 2

Concept 2 is inspired from the Indian thali meals. It is a visual treat, main portion of the plate will be occupied by the rice or roti. All the other side dishes will be around the main portion. In this concept, there will be main focal point where the most important information for that instant will be displayed. The clear divisions on the screen will guide the driver for easy navigation. The colors are inspired from volvo's interface design and websites.

Uses Navigation and music more often
Uses phone for making calls in emergency
Like to see summary at the homescreen

Devnagari version

Replaced all the text with devnagari type. I used ek muktha font for the menu and interfface. Devnagari font requires one or two pts more compared to latin fonts.



The philosophy

This concept is five layered architecture. Base layer is the screen surface next laye is primary focus area, thirs layer is the icons layer which will bw in focus by default so that the driver can access menu easily. Above that is the notification layer where the driver can receive calls messages or email. The top most layer adds interaction for the notification where the driver can accept the call or dismiss.

Cultural Aspects

Less deep hierarchy

Most Information at interface level

Non linear navigation
Feedback mechanism does not have to be structured

The content is suggestive of a change for the user to master something

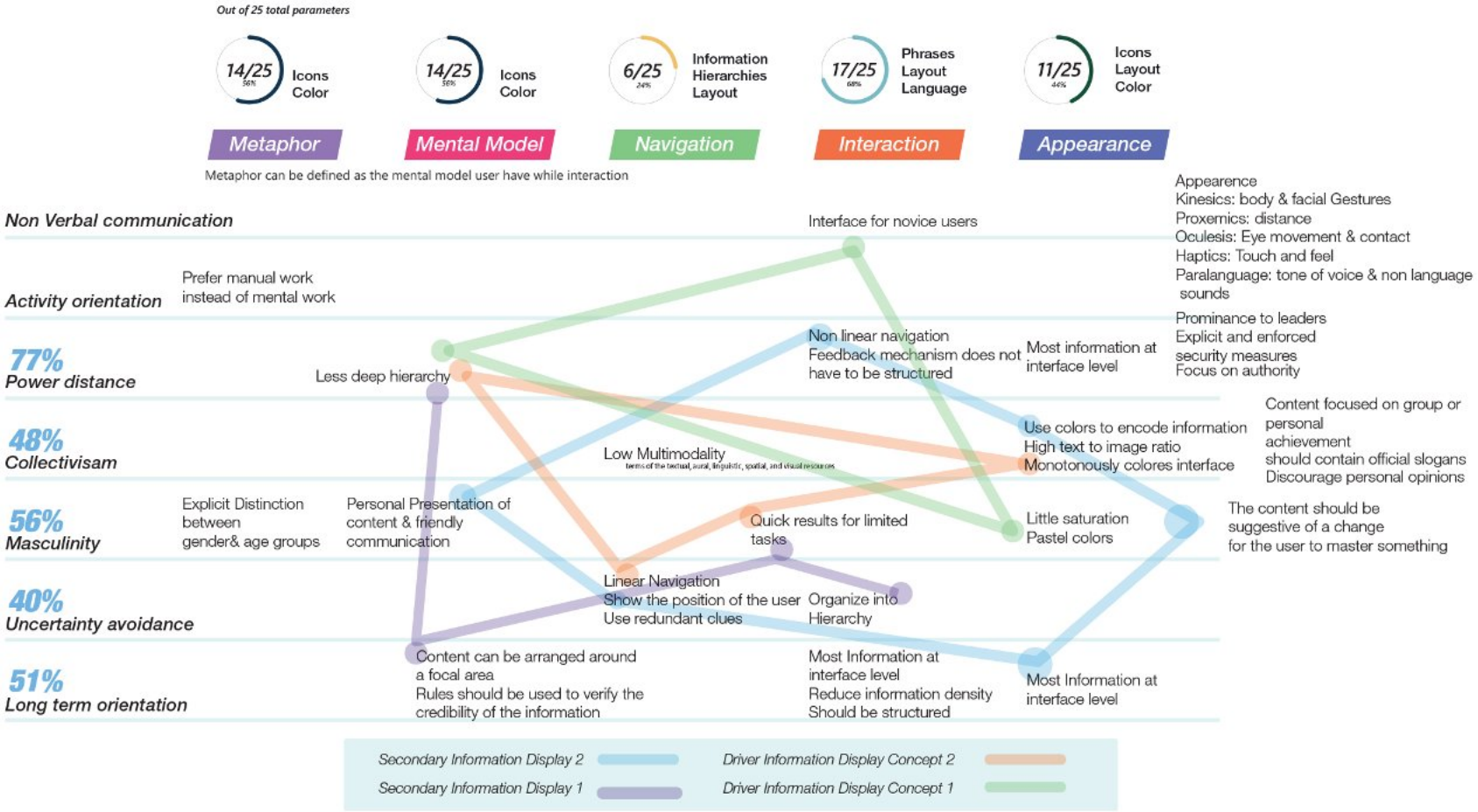
Use colors to encode information
High text to image ratio
Monotonously colores interface

4. Cultural significance

From the cultural dimensions table, selected most important dimensions and analysed each elements of interaction design and found out that Interaction is more important then metaphor and mental model. The results are given below

Looking at the concepts based on the score

These scores are used to evaluate the concepts for their cultural significance. The table below evaluates the concepts based on the cultural dimensions plotted against the elements of interaction design. The score for each element is obtained from the cultural dimensions table (refer appendix).

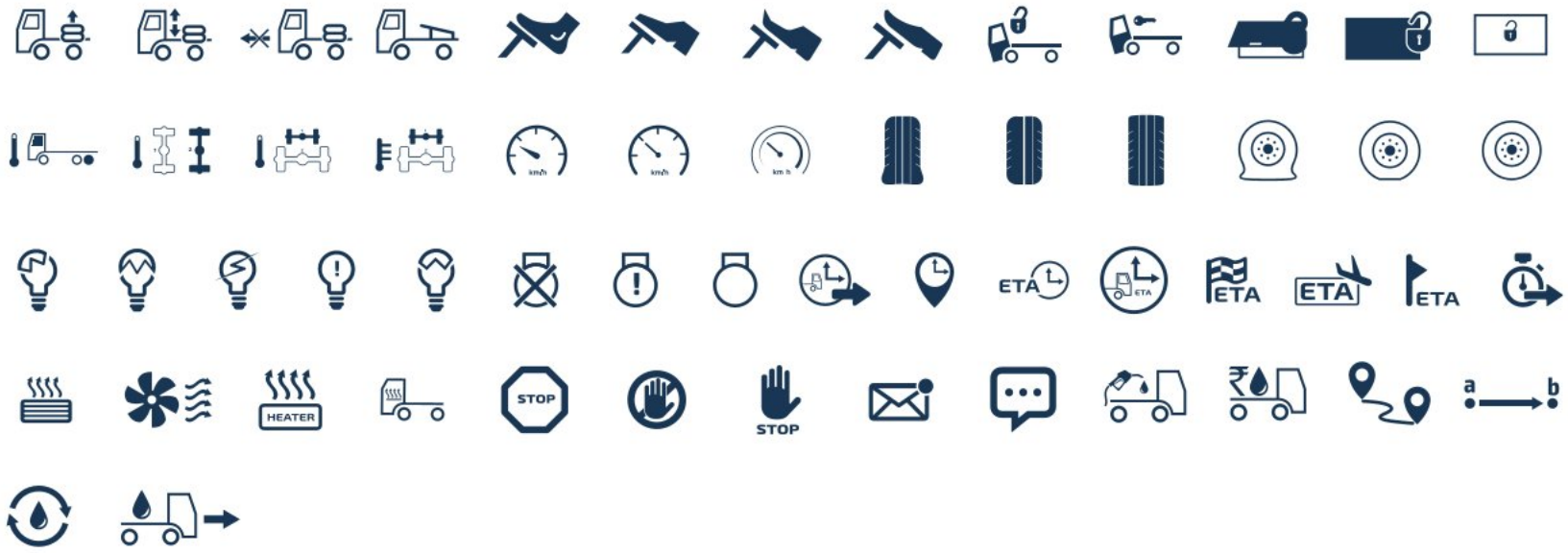


4.1 Icons exploration using mental models

A mental model is an explanation of someone's thought process about how something works in the real world. It is a representation of the surrounding world. For each set of icons, Collected a set of images which may represent the mental model of the user and came up with ideas referring to the images(Appendix).

users's mental model will be polished real life situations or objects, but the underlying structure of the UI/UX may be so complex. The underlying structure is known as Implementation model. The success of an interface depend upon how far the implementation model can travel towards the mental model of the user.

Set of Icons developed for DID and dashboard, Refer Appendix 6 fro process.



IV. User review

1. DID Concept 1

After the prototypes of the driver information display (DID) and Secondary information display(SID) were ready, a user review was conducted at volvo drivers training centre, Bengaluru. Driver's were shown the paper protoypes of secondary information display, which they are not familiar with. They like the idea of color coding the information, but insisted on numbering the menu elements for easy identification. Chief trainer Mr. Somarajan had a look at the SID concept and suggested the idea of assigning numbers to the menu elements, because most of the candidates were barely 10th pass or having elementary education

2. Refinements

based on the inputs from the drivers and the trainers many changes made in the concepts and are re evaluated. The focus was on numbering the menu elements for easy identificaion. Number based identification is included in both DID and SID

V. Final Prototypes

Work In Progress

The final prototype is a HTML based page which is interactive and can simulate the operations performed by the driver. Menu navigation is possible through the prototype.

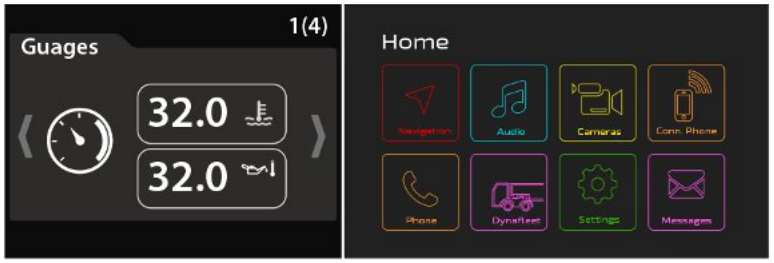
1. Concept 1(Screenshots)

This Prototype shows the drivers working environment and th whole Cluster. One can interact through clicking on the screen. The screen will be zoomed in during navigation to have better visibility on screen

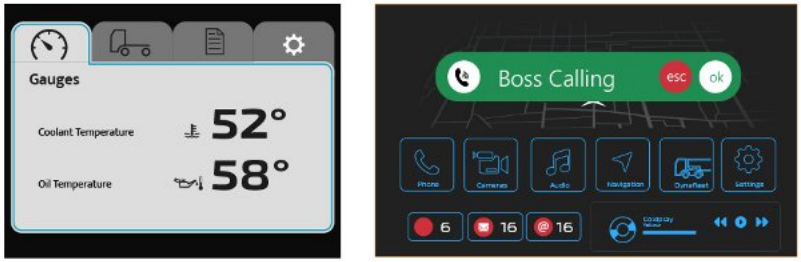
2. Concept 2 in Focus

3. DID in focus

DID Navigation



Color coding information and dark backgrounds from Concept 1



Tabbed view from DID2 and Information layout from SID 2

Conclusion

Final Concept Work in Progress

From the two concepts there are some elements that can be included in the driver HMI of volvo trucks. Primarily the icons based navigation and the color coding of the information. The things which can implemented considering the Indian scenario are

1. Concept 1 DID (Dark Background)
2. Concept 2 SID
3. Color coding of SID (Color coding Information)
4. Icons

And improve the driver's training program to train the drivers to handle the digital HMI. The training may include live demos using animations and explanation videos before letting them handle the truck.

VI. References

[1] http://www.handpaintedtype.com/
[2] http://www.projecthornplease.com/
[3] http://www.languageinindia.com/junjul2002/baldridgeindi-anenglish.html
[4] http://www.amazon.in/
[5] http://www.bmw.in/in/en/
[6] Teambhp.in
[7] http://www.volvotrucks.com/
[8] http://www.team-bhp.com/forum/commercial-vehicles-india/73521-heavy-trucks-thread-29.html
[9] http://indianautosblog.com/
[10] http://www.volvotrucks.com/trucks/india-market/en-in/Pages/home.aspx
[11] Geert Hofstede, Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations. Second Edition, Thousand Oaks CA: Sage Publications, 2001
[12] https://en.wikipedia.org/wiki/Project_management
[13] https://en.wikipedia.org/wiki/Mental_model

VII. Appendices

1. Adaptation of car interface-2014 BMW 5 Series

A Indian version of BMW 5 series will have changes in its dashboard, iDrive screen and the control knob. The indian model is visually same as global variant but lacks many functionalities in the iDrive screen. A base model with smaller iDrive is also available in india.

Smaller iDrive Screen (no split screen)

The new 5 Series gives rise to a more luxuries and user friendly interior. To begin, it offers a new instrument cluster that caters to both analogue as well as digital dials. The analogue meters are visible in the Eco-pro and Comfort mode, while in Sports and Sports Plus mode the instrument panel changes to red with digital meters giving it that much needed sporty look

Comfort

Eco-Pro

Sport

Comfort
Normal drive
More Information
Less Sporty

Eco Pro
For Efficient driving
Tacho Meter is replaced by charge power meter

Sport
Sporty Driving
Importance to speed and RPM

		India specific	Global variant	Remarks
1	iDrive Screen	6.5 inch (520d)	7.8 inch	Cost Reduction
2	Drive Mode selection	Available	Available	
3	M badge	Available in higher models	Available	Premium feel
4	Touch control for iDrive	Not Available (520d)	Available	
5	Fully Digital Console	Available	Available	
6	Rear temperature control	Not Available	Available	
7	Heads up Display	Available	Available	
8	Speakers	Alpine	Bang & olufsen	

1.1 iDrive Services

iDrive services are analyzed in order to get an idea of what facilities they are bringing into indi without any cultural adaptation. Most of the sophisticated services are not available may be because of lack of technology or to reduce cost. The services which are present are marked with green dot and not available are marked in red.

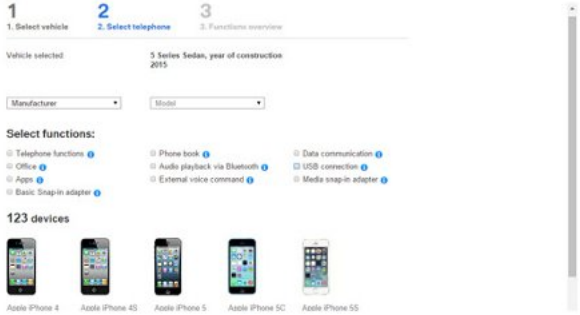
ConnectedDrive Services

Message Dictation

Dictates messages received on your Mobile phones

Bluetooth Office

Allows a Professional to spend time in car effectively. Connect phones to organize Emails, Dates, Tasks & Text messages on the iDrive. Read them out loud



Number of handsets which support these Functionalities in India

Intelligent Emergency call

Automatically dials a predefined number in case of accidents involve activation of airbags

Online Entertainment

Access to 12 Million plus songs

Remote services

Enables a customer to use a smartphone to locate his car in the parking lot.

Real time traffic

Provides Real-time Traffic Info

Traffic Jam Assistant

Maintains the distance from the front vehicle without driver involvement

Heads up Display

iDrive Touch Control

BMW Night vision with dynamic light spot

BMW Night Vision with Dynamic Light Spot can detect people and larger animals at night – even at a significant distance – and illuminate them.

Park Assistant

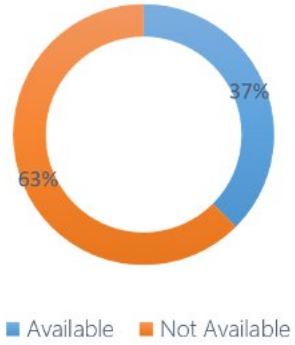
Camera Systems

Multifunction instrument Console

Active Protection

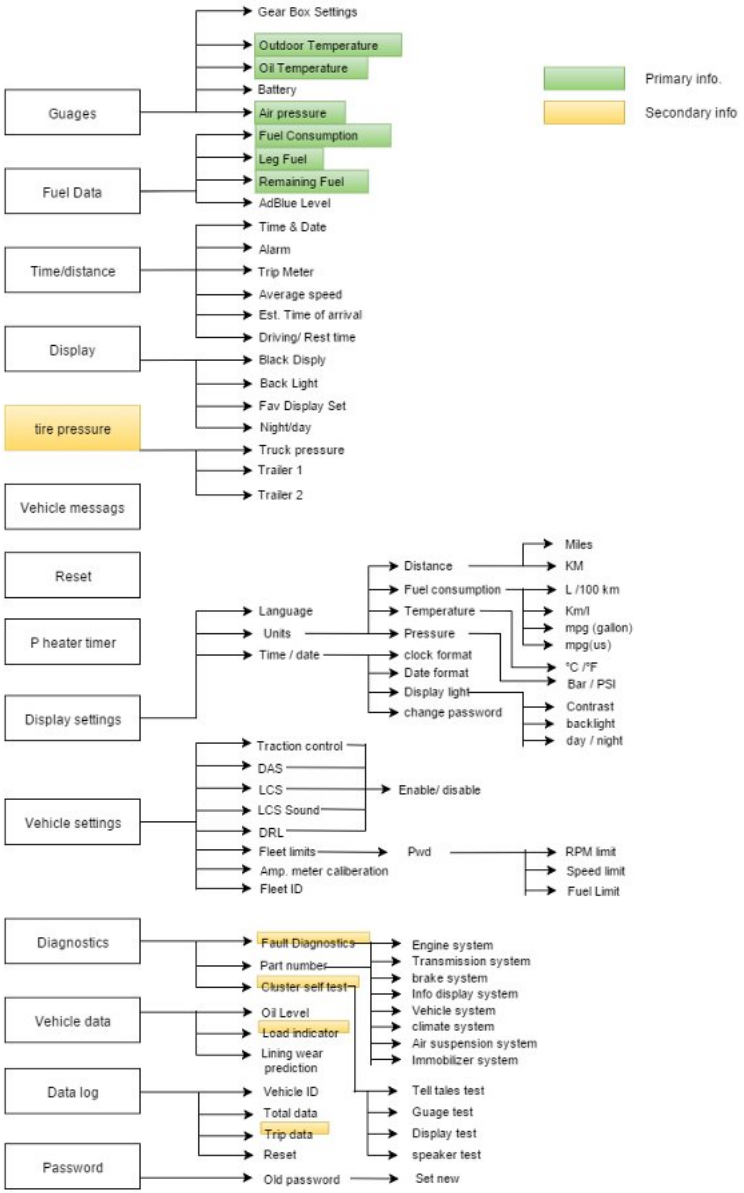
The Attentiveness Assistant also monitors your behaviour for signs of fatigue. Your steering responses are analysed and the system reacts to irregular driving behaviour. A notification appears in the Control Display suggesting you take a break.

Interface adaptation in BMW 5 Series sedan

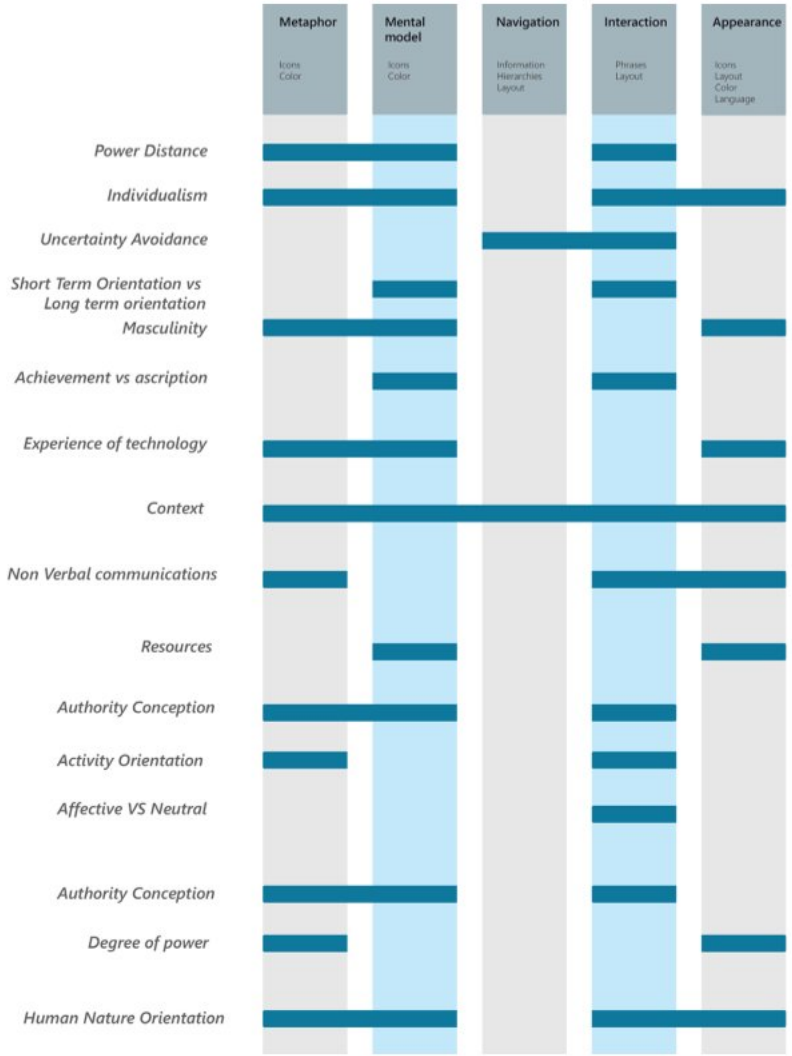


[5] [6]

2.DID Breakdown

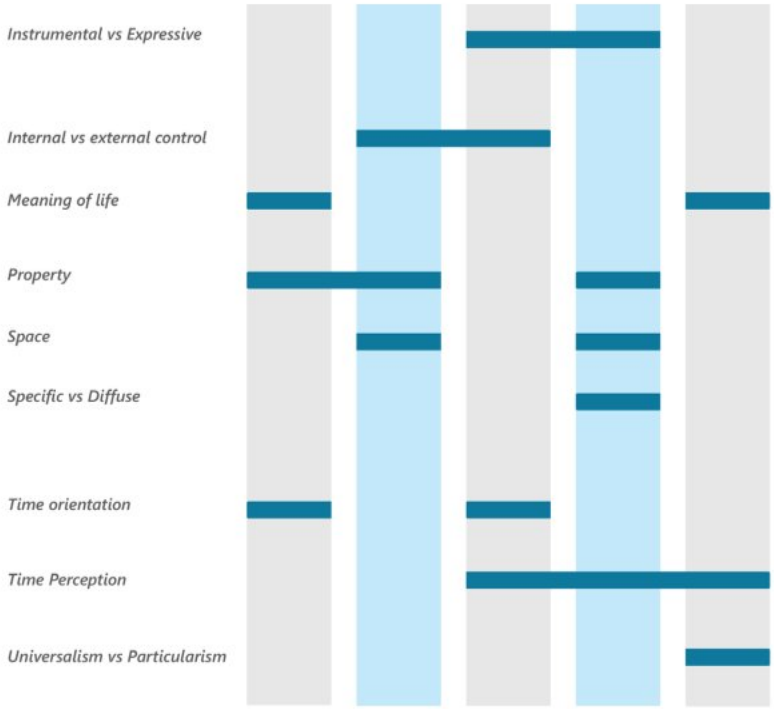


3. Cultural Dimensions and elements of Interaction Design



ELEMENTS OF UI DESIGN VS ASPECTS OF CULTURE

The extend to which less powerful members accept that power is distributed unequally	India have high power distance score	Fields of feedback mechanism, structuring, open/restricted access, error messages, and the use of colors
Role of individual and group and which interest prevails over other	India is a collectivist society	
Achievement- value people depends on what they achieved Ascriptive- status of birth, age, gender or wealth		
How technology is perceived by members of a culture		
Refers to the amount of specificity of information in a given situation	India is High contextual There are unwritten rules eg. Respect for parents	
Body movements and facial gestures, eye movements and eye contact, touching behaviour tone of voice and non language sounds, dress and groming	India have very less personal space or no personal space at all	
Resources a country owns. Ranges from resources rich to poverty	People need to feel comfortable about the look and feel of the interface reflects familiar aspirations and and their experience of reality	
Resources a country owns. Ranges from resources rich to poverty		
How culture express their emotions Affective- people should express their feelings openly Neutral- Hides expression of feelings in public	India is an Affective community	
Degree of strength or weakness of a country compared to other countries. An internationally strong country have influence in international developments	Intermediate	
Describes the way people can be seen good, evil or mixture of both		



Goals which people seek through their interaction with others
Instrumental: tend to value relationships for what they can do for them rather than the relationship itself

Relationship a culture has to nature
Externalist: Nature as a force more powerful than individual

Physical oriented- accumulation of money or material goods
Spirit oriented- Gaining spiritual maturity

The way society sees property. The scale rabges from private to utilitarian to commmunity

UI Branding

Invisible boundary around an individual. Personal space

Overcrowded trains and streets does't respect personal space

Interfaces in public space

How far people get involved with others' life space
Specifists believe relationship with others should be explicit, delinated and regulated. Diffuse oriented people emphasis the real and personal contact of the whole person in a relationship

Fields of customer care, where people interact with each other sharing personal information

Way cultures conform to time. Past orientation, present oriented and future oriented.

Important when designing interfaces providing historical vision, background or motivation

Degree of adhering to particular standards
Universalists: good and right are definite and always applicable. Particularists place more emphasis on the obligations and unique circumstances

4. Scenarios Evaluation

SCENARIO 1

There is some issue with engine, it is overheating. Ho will be the driver will come to know about this

Coolant temperature is displayed on the left side display, the coolant temperature enters red zone and the driver will be notified with visual and auditory warning

Engine temperature indicator
by seeing on dashboard
by watching meter

SCENARIO 2

Driver is parking the vehicle by backing up, and there is't enough sapce in the rear side

Reversing camera can be used as an aid while reversing, the video will be displayed right on the infotainmrnt screen.

Check the back side by himself to get an idea of the space and then driving reverse adjusting side mirrors or some one should be there in back.

SCENARIO 3

Driver wants to play music and skip through the songs

Driver can play music via USB/ipod, CD, Aux or Radio using the secondary infotainment screen

No music player.

SCENARIO 4

How do you come to know about the pressure difference in the tyres

Through driver information display

Mostly insight
When it is difficult to control the vehicle

SCENARIO 5

Driver have to switch on cruise control and set a particular speed

Driver can set the speed using the buttons on Left side of the steering wheel. Confirmation is shown on the aux display.

No such provision

SCENARIO 6

Driver is feeling dizzy and he have to contact someone

Phone can be accessed via infotainment screen and using the phonepad on the dashboard. The driver can either go through the contact list, search contact or directly input the number through the num pad.

Using Mobile phones

SCENARIO 7

The truck is reaching an up-slope and the driver should be notified before

Volvo trucks have I-See system which remembers gradients and up-hill slopes and selects appropriate gears well before approaching the slope
Automatic mode is recommended durind uphill. In automatic mode, it is also possible adjust the gears up or down manually. The arrows in the centre display indicate how many steps you can change up or down.

Advance gearing without reducing the speed in which he is driving.
drive in lower gears

SCENARIO 8

Communicate some defects in airbag system through icons

Any defects in the system is notified through caution or stop symbols and verbal reference to the problem

For exterior damages there are no indicators, he knows it when he does his routine vehicle inspection.
Engine over heating is warned through warning lights.
only engine or oil complaints can seen on board

SCENARIO 9

Brake is not working properly, how the driver will come to know about it

Brake pad wear out warning will be displayed on drivers indormation display (DIS)

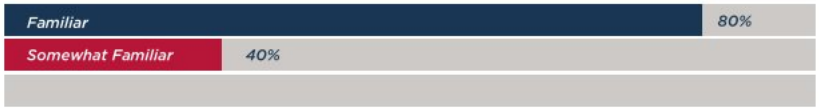
Drives the truck forward in a medium speed and breaks suddenly and repeats this for 2,3 times.

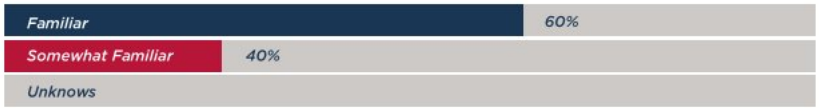
4.1 Summary of scenarios evaluation

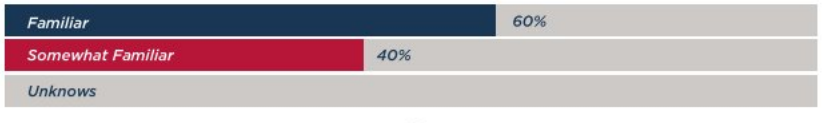
Sl.no	Driver	Instrument cluster icons or alert	Driver information display	Secondary information display	problem	possible solution	Cultural aspect
1	Engine overheat issue	coolant temperature reaches red zone, warning to stop					
2	Driver have to switch on cruise control- Use buttons on steering wheel to select speed and turn on cruise control	confirmation showed in the console			digits are not big enough	increase the font size or change location	
3	Driver want to play music and skip through tracks- Use controls on the right side of the steering wheel			Playback preview on secondary display	possible distraction from driving	Preview of music player in front of driver	
4	low pressure in tyres		Warning light with description of the problem, Orange light check signal		Symbol unknown for tyre pressure warning	Change of symbol	
5	Reversing and parking the vehicle		Reverse warning indicator whch beeps when the truck is close to an object	Reversing camera feed on display			
6	Driver have to contact someone in emergency			Search contact or dial via number pad	takes too much time	SOS or emergency button	
7	Truck reaching upslope & the driver should be notified about the downshift	When the truck is at right rpm it shows downshift or upshift indicator			Drivers are not used to automatic gear shifters	verbal warning for gear change	
8	Communicate some defects in airbag system	Any defect communicated through warning lights Stop/check/info		Warning light can be easily ignored			
9	Some damage to the diesel tank	Communicate through warning message and auditory warning					
10	Brake is not working properly		Warning displyed on the disply, can be dismissed and later accessed from messages		misssing warning sign		
11	Long night drive and the driver want to reduce the brightness of the display		Navigate through menu		takes 7-8 steps	5-6 steps in new	
12	Ensure trailer connection	warning displayed on the console					
13	Check condition of the brakes		Navigate through menu		takes 16 steps	7 steps in new	
14	Driver want to know average speed		Navigate through menu		takes 7 steps	7 steps new	
15	Want to check battery condition		Navigate through menu		takes 6 steps		
16	change langusge		Navigate through menu		11 steps	8 steps new	
17	Check tyr pressure on trailer		Navigate through menu		8 steps	5 steps	

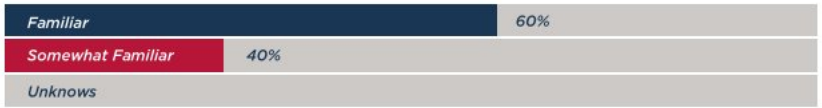
5. Icons Survey

Listed almost over 60 icons from the driver information display and the secondary information display. Categorized them and conducted a small survey among truck drivers to understand their familiarity with the icons.







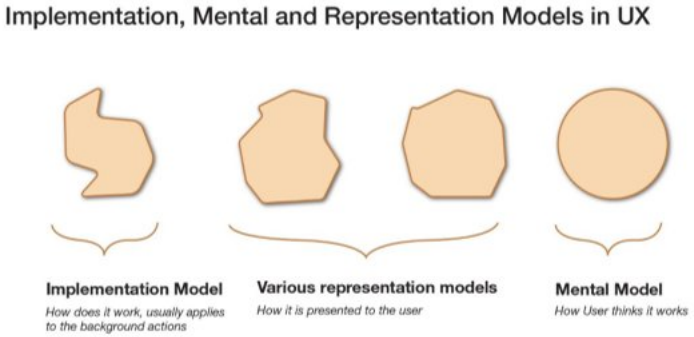


Familiar	
Somewhat Familiar	
Unknows	100%

Familiar	
Somewhat Familiar	40%
Unknows	60%

Familiar	100%
Somewhat Familiar	0%
Unknows	

Familiar	
Somewhat Familiar	
Unknows	100%



6. Mental models and Icons

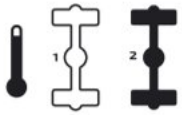
A mental model is an explanation of someone's thought process about how something works in the real world. It is a representation of the surrounding world. For each set of icons, Collected a set of images which may represent the mental model of the user and came up with ideas referring to the images.

Low pressure in air suspension

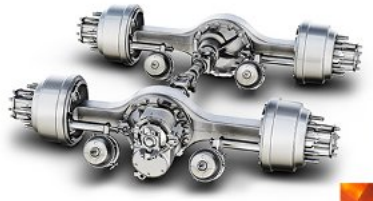
Airsuspension in manual mode

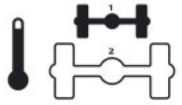
Air suspension not in drive mode

Fifth wheel not locked

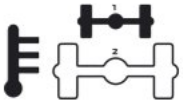


High temperature Axle 1



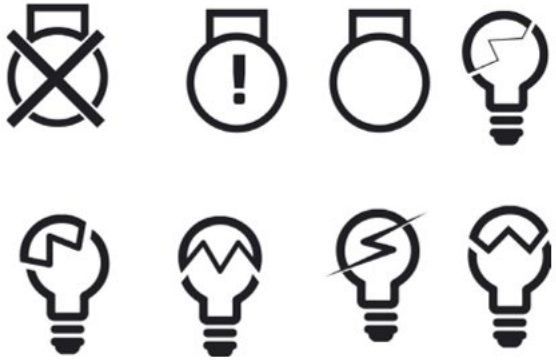


High temperature Axle 2



Estimated Time of Arrival

Broken or defective bulb



A/C

Blower

Cab Heater

Stop

Messages

cab lock open

side locker open

Tire Pressure low,

Leg fuel

Estimated range