USABILITY RECOMMENDATIONS FOR THE SKA CONTROL ROOM OBTAINED BY A USER-CENTRED DESIGN APPROACH

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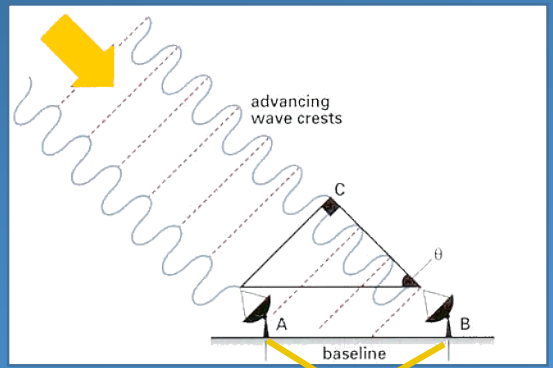
ICALEPCS 2017

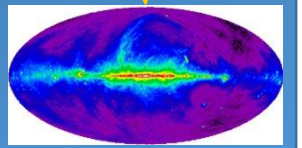
GOAL

To develop the UIs for the CONTROL ROOM of the WORLD'S LARGEST RADIO TELESCOPE

SKA – Square Kilometer Array

SKA1	South Africa	Australia
Receptors/stations	200	512
Raw data output	2 TB/s	157 TB/s





SDP

CORRELATOR

METHOD

We adopted UCD approach in order to

- Identify the operators' tasks;
- Identify those features that support them in running the telescope;
- Prevent the development of bottom-up UIs that could lead to unsatisfactory performances of the operators and then to possible:
  - Loss of observational time
  - Poor quality of observations
  - Increased operational costs
  - Damages to the equipment
  - Safety problems

User Centered Design

Appropriate Analysis

Semi-structured Interviews
Affinity Diagrams
User Profiling
Personas
Scenarios
Tasks Model and Essential UCs

Artifacts that present solutions

Content Modelling
Sketching and Storyboarding
Prototyping

Usability Evaluation

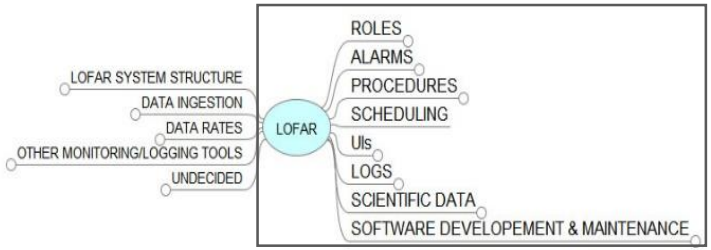
User Testing
Heuristic Evaluation

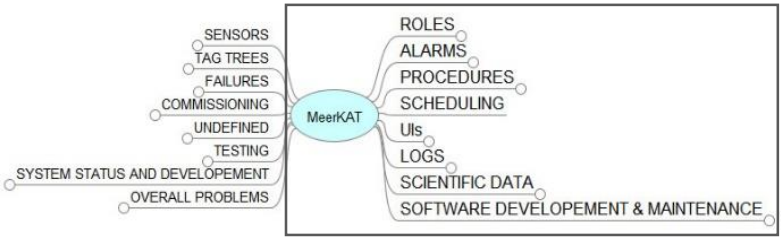
SEMI-STRUCTURED INTERVIEWS

- Interviewed personnel at **LOFAR** and **MeerKAT**
  - Field trips (2016)
- With the aim of understanding
  - Which **roles** can a person in the control room play
  - What are the **relationships** between these roles
  - What are the followed **procedures** (for scheduling, for responding to alarms..)
  - What are the **operator's tasks**
  - Which are the **strengths and weaknesses** of the used UIs

AFFINITY DIAGRAMS

TELESCOPE	INTERVIEWEES	ROLES	NOTES	CLUSTERS	CATEGORIES
LOFAR	7	1 Operator 2 Scientists 1 Sys. Admin. 2 Software Dev. 1 Software Support Person	550	155	14
MeerKAT	8	3 Operator 2 Scientists 1 Chief Scientist 1 Software/UI Dev. 1 Operation Supervisor	1460	434	16





AFFINITY DIAGRAMS

Users' Profile - Contex

Operators:

- Quiet control rooms, high rate of visual (audible) input, several screens, a few mice, keyboards;
- Overall job:
  - To monitor health of telescope,
  - To monitor the status of the observations,
  - To respond to alarms,
  - To analyse problems,
  - To collect all the info needed to diagnose a failure to contact the right person to solve it.
- High responsibility tasks, stressful situations.

Design Objectives

- Reliability of Interactions
- Completeness
- Error tolerance/Protection

OVERALL PROBLEM: lack of a rapid and efficient way to access all the information needed:

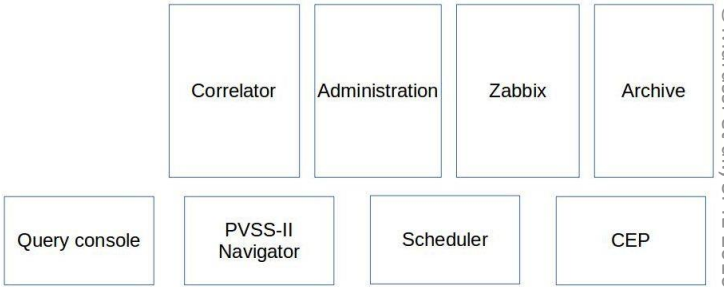
- To diagnose a problem and
- To understand its impact on the observation that is being carried on

FRAGMENTATION

The lack of integration between different UI components

Example:
3 different systems to monitor what is happening:

- The “navigator”, to monitor antennas and devices;
- Zabbix, to monitor processes, pipelines, disks;
- The “MOM”, to monitor currently running observations.



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FRAGMENTATION

Different tools have different behavior, for example:

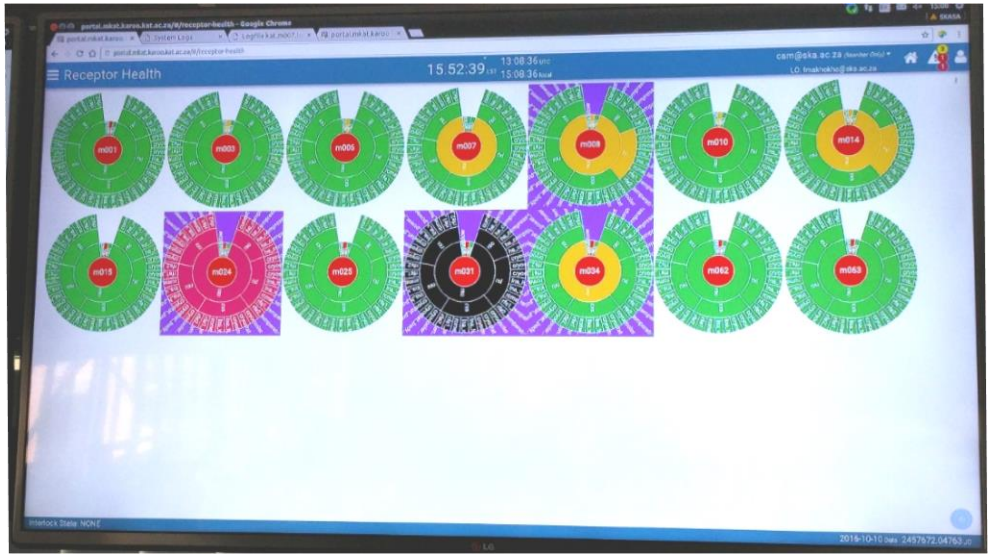
- Different and conflicting shortcuts, conflicting habits
- Different methods for navigation
- Different notifications
- Different layouts
- Different look and feel

SCALABILITY

The capability of the UI of adapting to the **amount of information** to be shown and of effectively visualizing **different scales** of the system.

Example:
Very effective for capturing attention and leading the gaze of the viewer but:

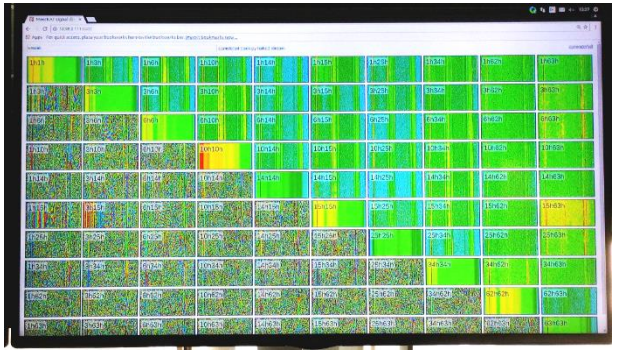
- It will fail to represent a large number of receptors
- It gives no information about the context (physical location of the receptor in the array)



SCALABILITY

The chosen representation will not be effective for a large number of data.

Moreover, the amount of information that can be retained from one fixation to the next is limited and the user will have to continuously alternate the focus on the legend and on the lines.



ESTENDABILITY

The ability of the UI of incorporating a new feature or functionality as the system grows and evolve.

Examples are:

- New tabs
- New functionalities
- New toolbars
- New actions on devices
- New menus
- …

GAPS

Features that the operators feel like useful but that are missing

Examples:

- A tool for analysing raw data
- An integrated scheduling tool
- A direct link between problems and procedures to solve them
- An integrated tool to verify the position of a source
- An efficient contact tool

CONCLUSIONS

The application of a UCD approach to the problem of developing UIs for SKA control room helped us to:

- Understand the context in which the operators work and their tasks;
- Analyse the currently-in-use UIs at LOFAR and MeerKAT;
- Identify 4 possible causes of low usability for the SKA control room UI
  - Fragmentation
  - Scalability
  - Extendability
  - Gaps

This reduce the risk of developing not optimal UIs that have to be redesigned in a later time.

CONTACTS

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