User Interface Design & Evaluation

Hierarchical Task Analysis

Overview

- Scenario-based design
- Prototyping
- Task analysis

Hierarchical Task Analysis

Choose goals
Descend as far as you like
Specify actions

How do we talk about tasks?

- User goals map on to tasks that need to be accomplished to achieve the goal.

- Goals (and their associated tasks) can be divided into subgoals, with each subgoal needing to be completed before the top goal can be considered complete.

Introductions to tasks

- The user has goals and needs to know methods of achieving these goals

- The user needs feedback when the goals are achieved

- We need to understand the user needs and their goals to analyze their interaction with complex systems.

What is a task?

•A task is the set of activities (physical and/or cognitive) in which a user engages to achieve a goal.

Therefore we can distinguish:

– *Goal*: the desired state of a system
– *Task*: the 'sequence' of actions performed to achieve a goal, i.e. it is a structured set of activities

•Goals, tasks and actions will be different for different people.

•Procedures allow us to standardize tasks.

Task Analysis and Modelling

- Techniques for investigating and representing the way people perform activities: what people do, why they do it, what they know, etc.

- Primarily about understanding, clarifying and organising knowledge about existing systems and work.

- Much in common with systems analysis techniques, except that the focus is squarely on the user and includes tasks other than those performed with an interactive system.

- Applied in design and evaluation of training, jobs and work, equipment and systems; notably, to inform interactive system design.

Approaches to task analysis

We will focus only on:

– Task decomposition which is a method of splitting a task into (ordered) subtasks

But there are other more advanced techniques (covered by Dix et al)

- Knowledge based techniques deal with what the user knows about the task and how it is organised

- Entity/object based analysis explains the relationships between objects, actions and the people who perform them

Task Analysis

- Employs data collection techniques to elicit information about users' tasks.

- Level of granularity of task analysis depends on various factors, notably the purpose of the analysis

- How detailed should a task analysis be?

'Stopping rules' can be specified to determine the level at which it is appropriate to cease decomposing the task.

As simple example: hoovering

In order to clean the house a user must:

– Get the vacuum cleaner out; fix the appropriate attachments; clean the rooms; when the dust bag gets full, empty it; put the vacuum cleaner and tools away.

A user must know about:
– Vacuum cleaners, cleaner attachments, dust bags, cupboards, rooms etc.

A user does not need to know about:
– How power gets into the house.
– How the button on the cleaner connects to the motor.
– Many many other things ...

Distinguish: Analysis & Modelling

Task analysis:

– analysis of work and jobs
– involves collecting data (using techniques such as interviews, observations) and then decomposing into tasks

Task modelling:

– representing results of task analyses as task models
– there is no single 'correct' model
– a specific task model describes one instance of a task as performed by one person
– a generic task model generalises across many instances to represent the variations in the task

Hierarchical Task Analysis

Concerned with observable behaviour and the reason for this behaviour

– Less detailed than some techniques
– A keystone for understanding what users do and is a critical part of understanding users, their requirements, goals etc.

Hierarchical Task Analysis

HTA represents tasks as a hierarchical decomposition of subtasks and operations, with associated plans to describe sequencing:

– *Tasks and Subtasks:* activities to achieve particular goals/subgoals

– *Operations:* the lowest level of decomposition; level determined by a 'stopping rule'

– *Plans:* specify the sequencing of activities associated with a task and the conditions under which the activities are carried out

- Written either as structured, indented text or using a structured chart notation

Task Analysis Process

• Identify user groups; select representatives; identify main tasks of concern.
• Design and conduct data collection to elicit information about these tasks:

- The goals that users are trying to achieve
- The activities they engage in to achieve these goals
- The reasons underlying these activities
- The information resources they use
- Use documentation, interviews, questionnaires, focus groups, observation, ethnography, experiments etc.

Task Analysis Process

• Analyse the data to create *specific task models* initially. Consider decomposition of tasks, balance of the models, and stopping rules.

• Generalise across the specific task models to create a *generic task model*: from each task model for the same goal produce a generic model that includes all the different ways of achieving the goal.

• Check models with users, other stakeholders, analysts and iterate.

Example: Photocopying

• If a person has the goal "to photocopy a sheet of A4 paper", then a simple description of a task to achieve that goal might be. To photocopy a sheet of A4 paper:

– Enter PIN number on the photocopier
– Place document face down on glass
– Select copy details
– Select A4 paper
– Select 1 copy
– Press copy button – Collect output

Task Modelling: Goals/Tasks

- Gather goals from elicitation activities
- Group goals into a part-whole structure
- Decompose further where necessary
  - Apply stopping rules as appropriate

Stopping Rules

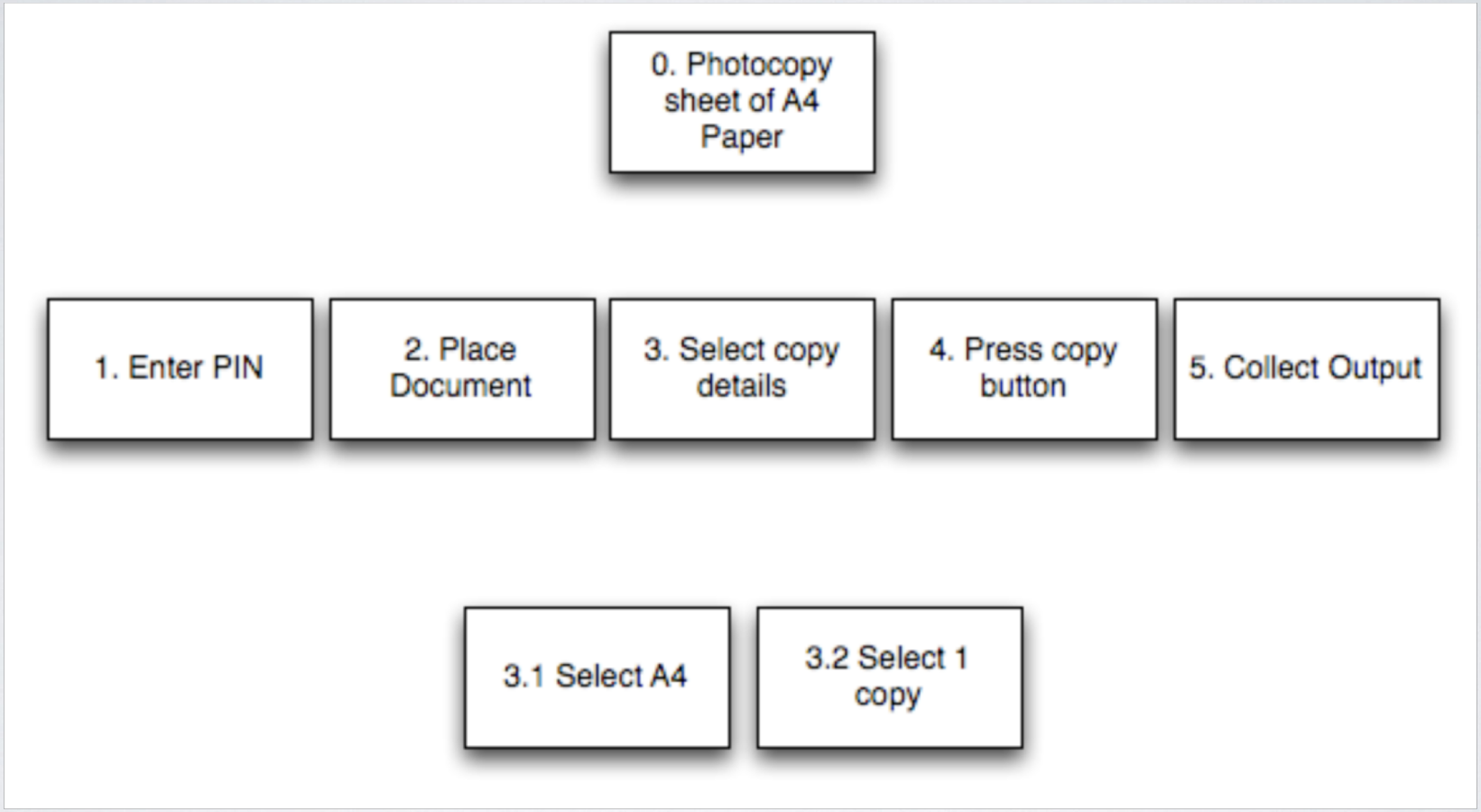
• How do we know when to stop decomposing?

– Is “Select A4 paper” simple enough?

Possible stopping rules in complex systems include:

– Expand only relevant tasks (e.g. aircraft vs. air traffic)control tower)
- Action is a skill (complex motor action
•– No problem solving is required
•– Users/Documentation do not articulate any lower level activities
•– Level of procedure operations
•– Likelihood and cost of error in the task are below a threshold

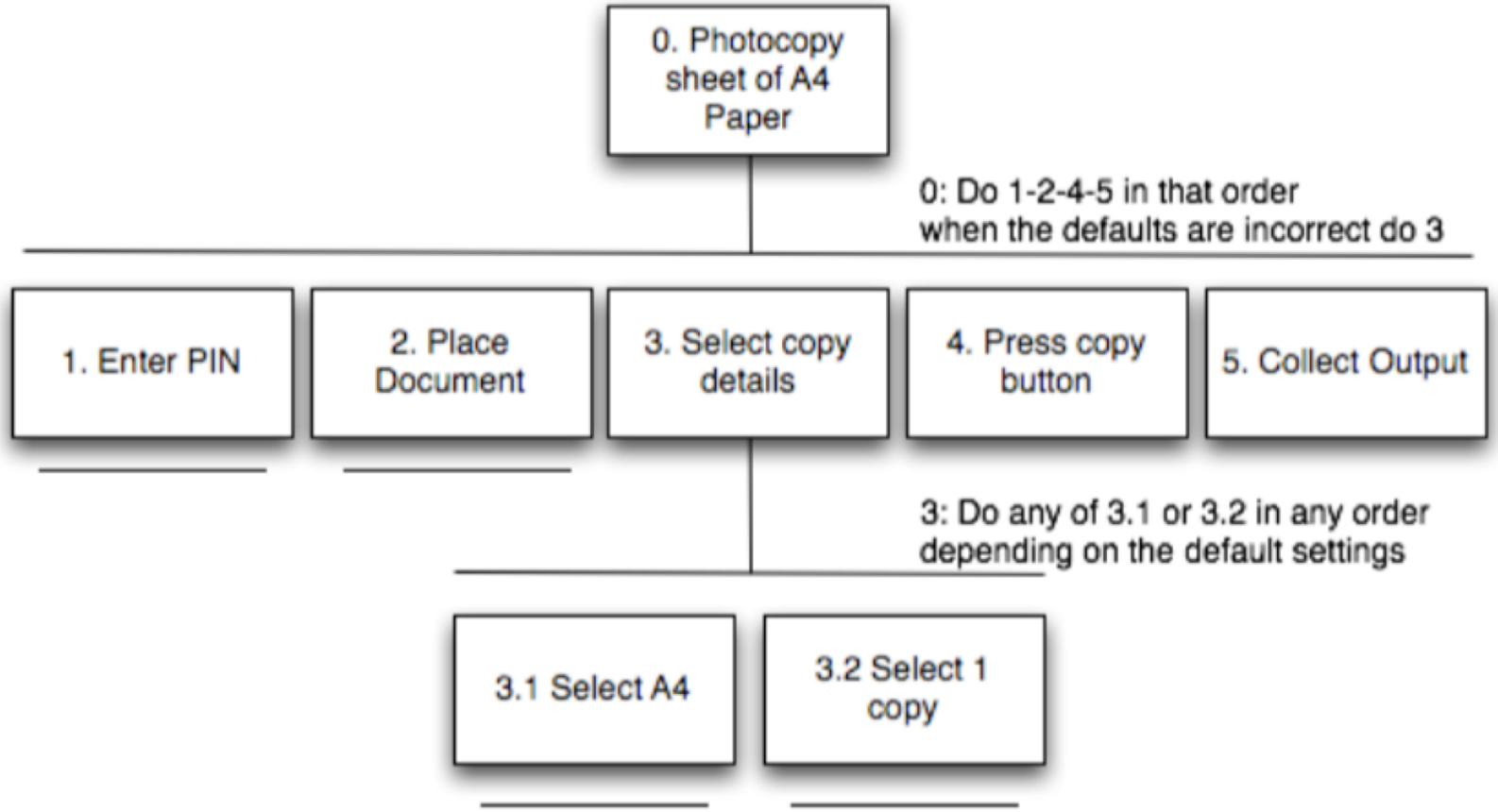
Task Model: Goals/Tasks



Types of plans

- Fixed sequence – 3.1, 3.2, and 3.3 in order
- Optional tasks – if the default settings are incorrect
- Wait for events – when output has been received
- Cycles- do 5.1-5.2 while there are items to be processed
- Parallelism - do1;at the same time do 2
- Discretionary-do any of 3.1,3.2 or 3.3 in any order
- Aggregates-most plans involve several of the above

Task Model: Goals/Tasks



Structured Text Task Model for Photocopying

0. Photocopy a sheet of A4 paper:
1. Enter PIN number on the photocopier
2. Place document face down on glass
3. Select copy details
3.1 Select A4 paper
3.2 Select 1 copy
4. Press copy button
5. Collect output

Plan 0: Do 1-2-4-5 in that order; when the defaults are incorrect, do 3

Plan 3: Do any of 3.1 or 3.2 in any order; depending on the default settings

Things to Remember

- Model specific tasks first, then generalise
- Base models on real data to capture all the wonderful variations in how people do tasks
- Model *why* people do things as well as *how*
- Remember, there is no single correct model
- Requires insight and experience to analyse and model tasks effectively and to then use the models to inform design

Limitations

- Focuses on a single user, but many tasks involve the interaction of *groups* of people (hence the current shift towards emphasising the social and distributed nature of much cognitive activity) .

- Poor at capturing contextual information and sometimes the ‘why’ information.

- Can encourage a focus on getting the model and notation ‘right’ which detracts from the content.

- Danger of designing systems which place too much emphasis on current tasks or which are too rigid in the ways they support task.

Scenarios

- Scenarios provide a way to attach context to the tasks that are documented in the model.

- Conversely, scenarios can be used to generate a task model.
  – This is common in design of systems.

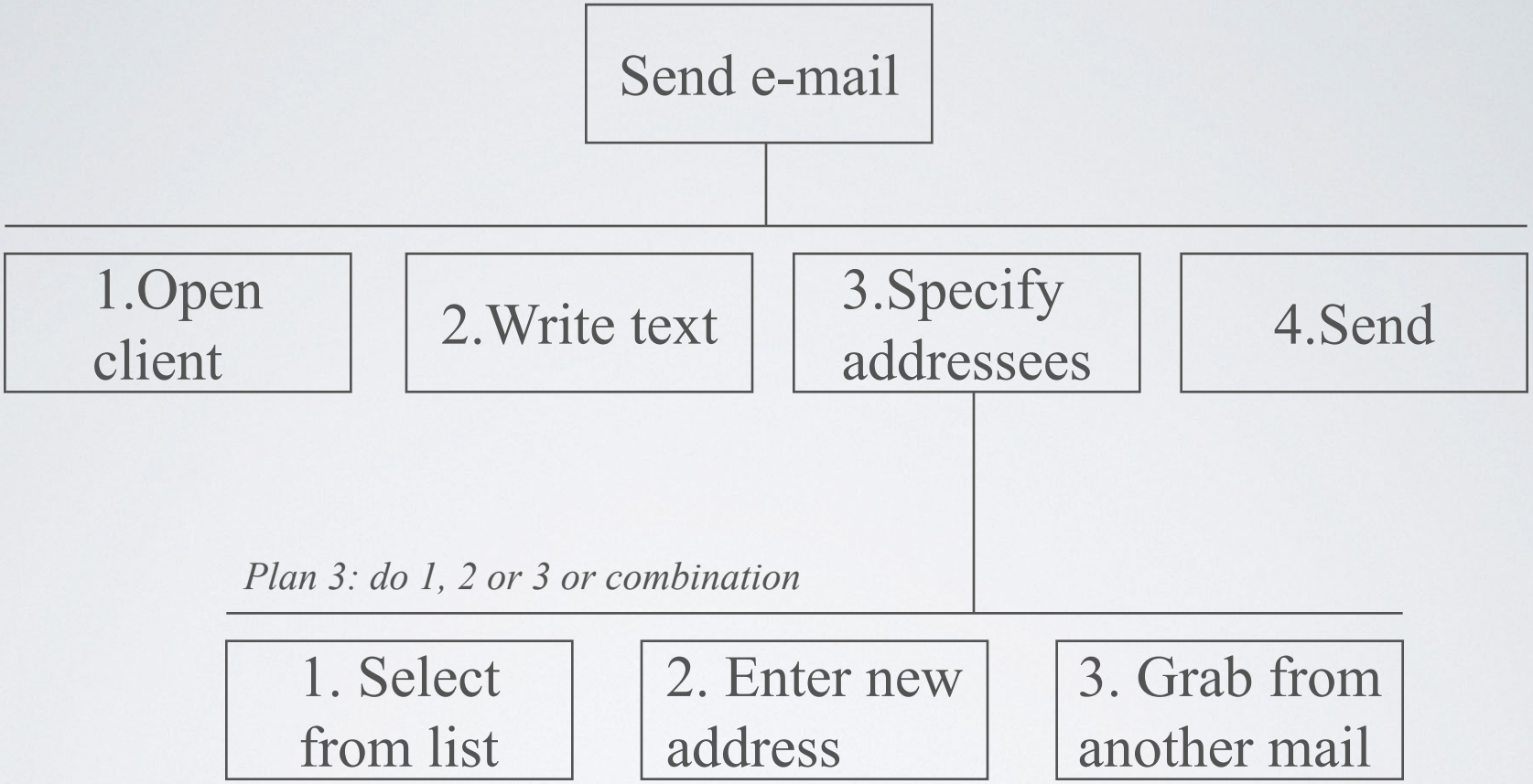
- Usage scenarios represent the system in *context;*
  – Need enough scenarios to provide “appropriate” level of coverage; a term that is undefined...
  – Trade-off quantity vs. quality.

Conclusions

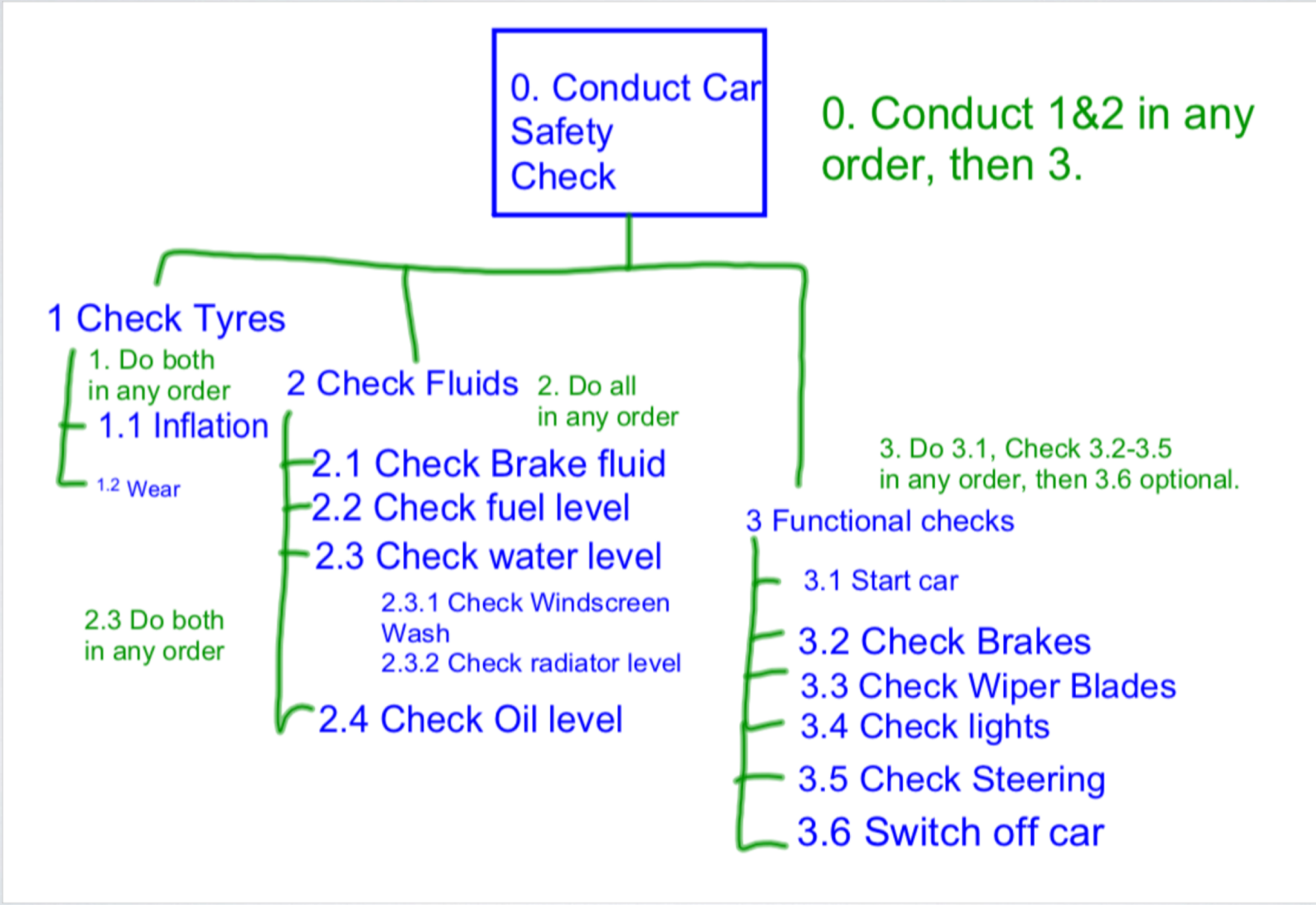
- Task analysis provides a way to represent work.

- Representing work is the first step to being able to analyse possible places of error.

- Each sub-task introduces a place where error could be introduced.


Send e-mail
1.Open client
2.Write text
3.Specify addressees
4.Send
Plan 3: do 1, 2 or 3 or combination
1. Select from list
2. Enter new address
3. Grab from another mail

Hierarchical Task Analysis



Norman's Human-Action cycle

- Goals
- Intentions, specification, execution
- Perception, interpretation, evaluation

Interrogate a scenario
Exhaust claims

READING

- Carroll and Rosson (2002) Getting around the task-artifact cycle