Chapter 8

task analysis

Instructors: Dr. Churee Techawut

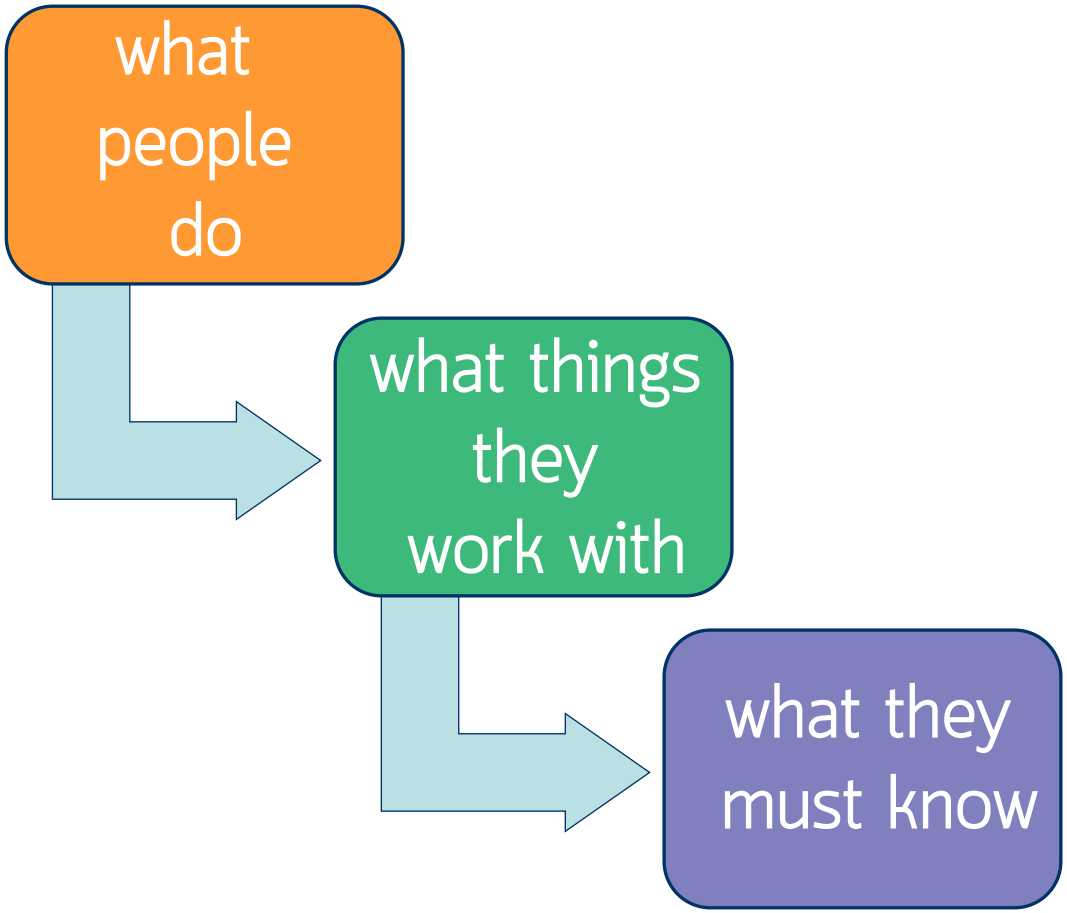
Reference :

1. Dix, A.J., Finlay, J.E., Abowd, G.D., and Beale, R. 2004. Human - Computer Interaction, 3rd ed. Prentice Hall Europe.

2. ชุรี เตชะวุฒิ. 2560. การปฏิสัมพันธ์ระหว่างมนุษย์และคอมพิวเตอร์เพื่อการออกแบบประสบการณ์ในการใช้งานหลายอุปกรณ์. พงษ์สวัสดิ์การพิมพ์.
ISBN: 978-616-478-333-1

Outline

Methods to analyse people's jobs:



An Example

in order to clean the house	must know about:
• 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	• vacuum cleaners, their attachments, dust bags, cupboards, rooms etc.

Approaches to task analysis

- **Task decomposition**
  - splitting task into (ordered) subtasks
- **Knowledge based techniques**
  - what the user knows about the task and how it is organised
- **Entity/object based analysis**
  - relationships between objects, actions and the people who perform them
- **lots of different notations/techniques**

general method

Differences from other techniques

Systems analysis vs. **Task analysis**

system design - focus - the user

Cognitive models vs. **Task analysis**

internal mental state - focus - external actions

practiced `unit' task - focus - whole job

Task Decomposition

Aims:

describe the actions people do

structure them within task subtask hhierarchy

describe order of subtasks

Variants:

Hierarchical Task Analysis (HTA)

most common

CTT (CNUCE, Pisa)

uses LOTOS temporal operators

Textual HTA description

Hierarchy description ...

0. in order to clean the house
    1. get the vacuum cleaner out
    2. get the appropriate attachment
    3. clean the rooms
        3.1. clean the hall
        3.2. clean the living rooms
        3.3. clean the bedrooms
    4. empty the dust bag
    5. put vacuum cleaner and attachments away

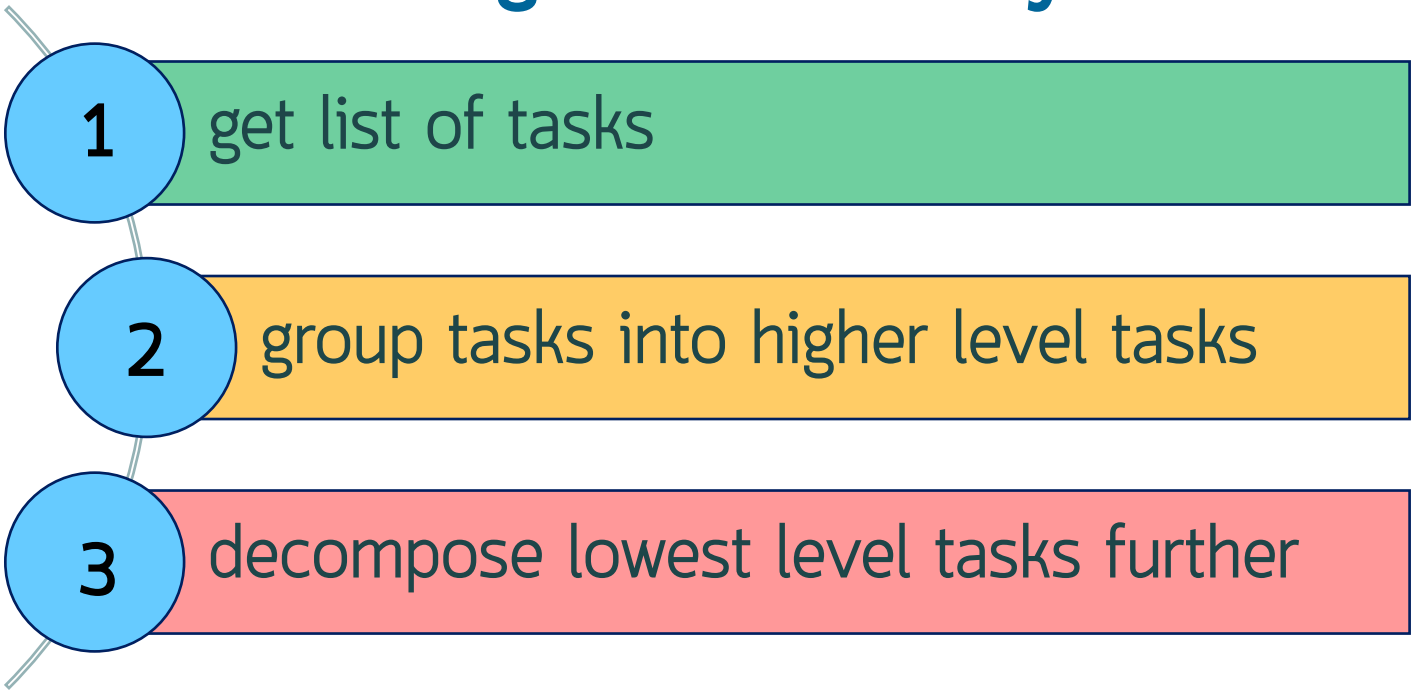
... and plans

Plan 0: do 1 - 2 - 3 - 5 in that order. when the dust bag gets full do 4

Plan 3: do any of 3.1, 3.2 or 3.3 in any order depending on which rooms need cleaning

N.B. only the plans denote order

Generating the hierarchy



Stopping rules

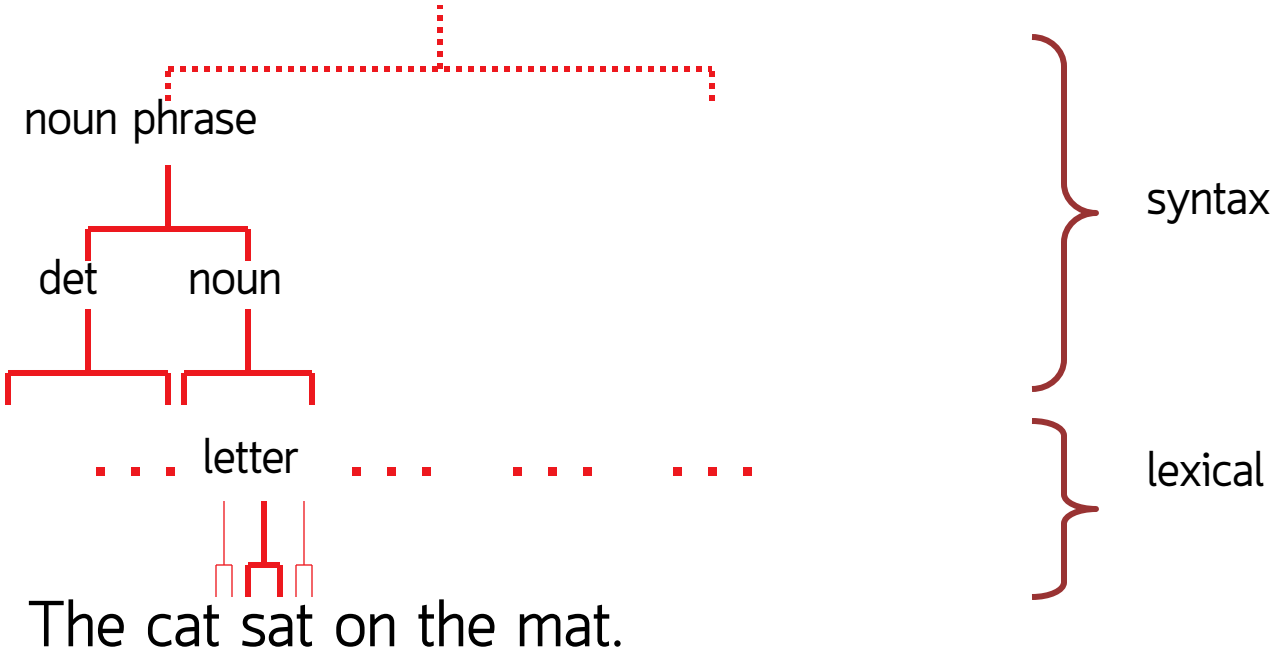
How do we know when to stop?
Is “empty the dust bag” simple enough?
Purpose: expand only relevant tasks
Motor actions: lowest sensible level

Tasks as explanation

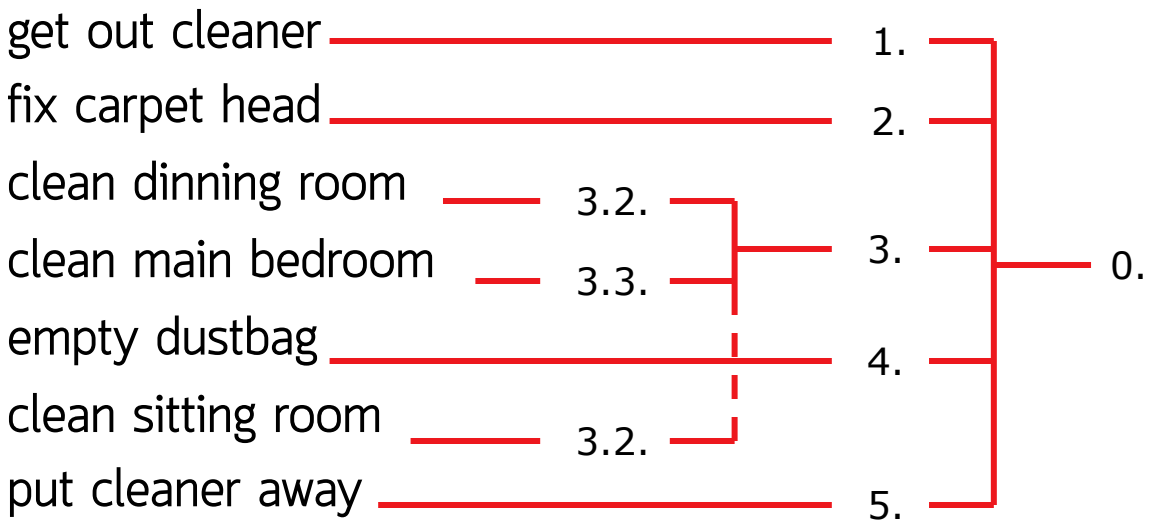
- **imagine asking the user the question:**
  what are you doing now?
- **for the same action the answer may be:**
  typing ctrl-B
  making a word bold
  emphasising a word
  editing a document
  writing a letter
  preparing a legal case

HTA as grammar

- can parse sentence into letters, nouns, noun phrase, etc.



parse scenario using HTA



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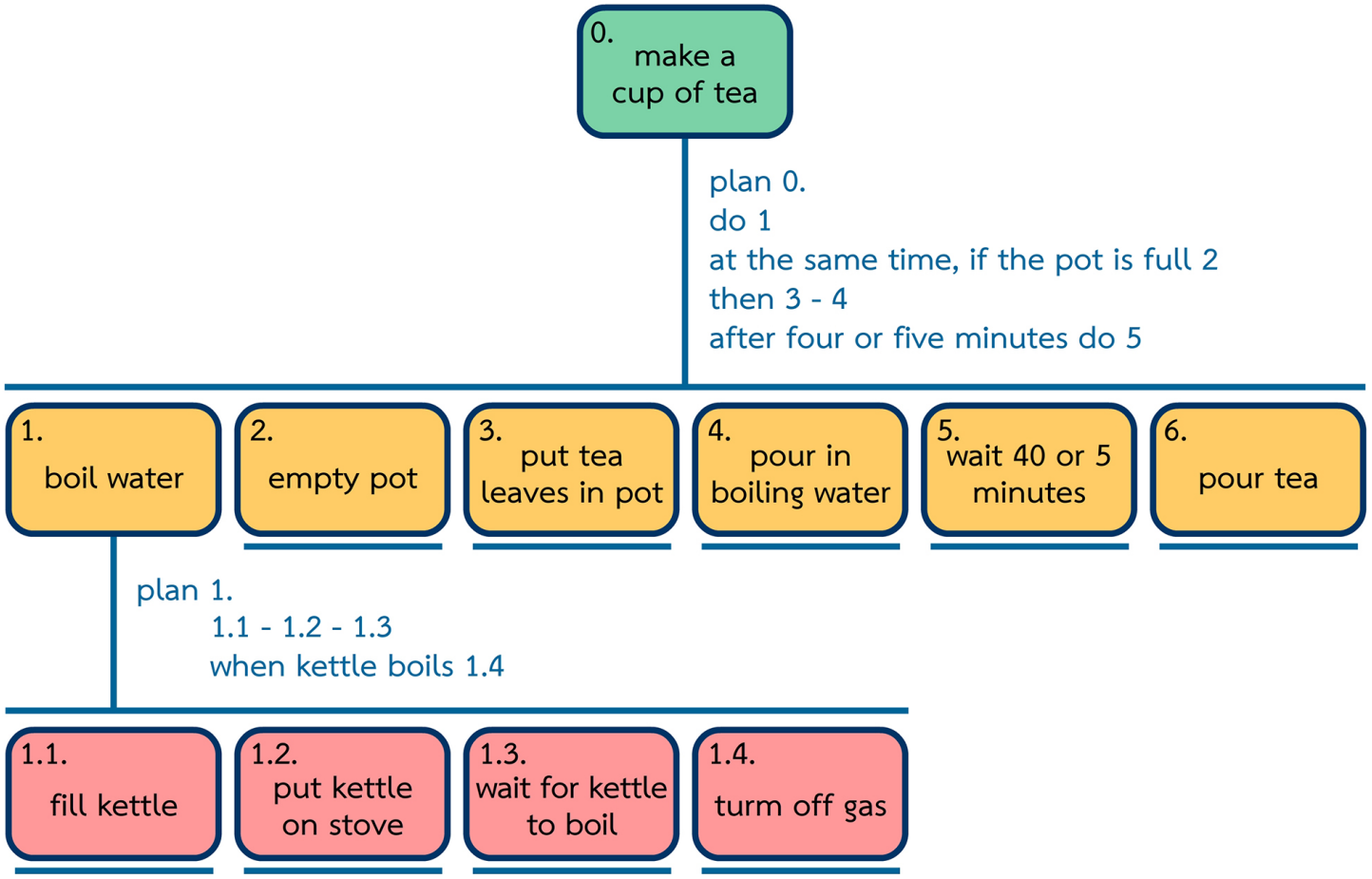
Diagrammatic HTA



Refining the description

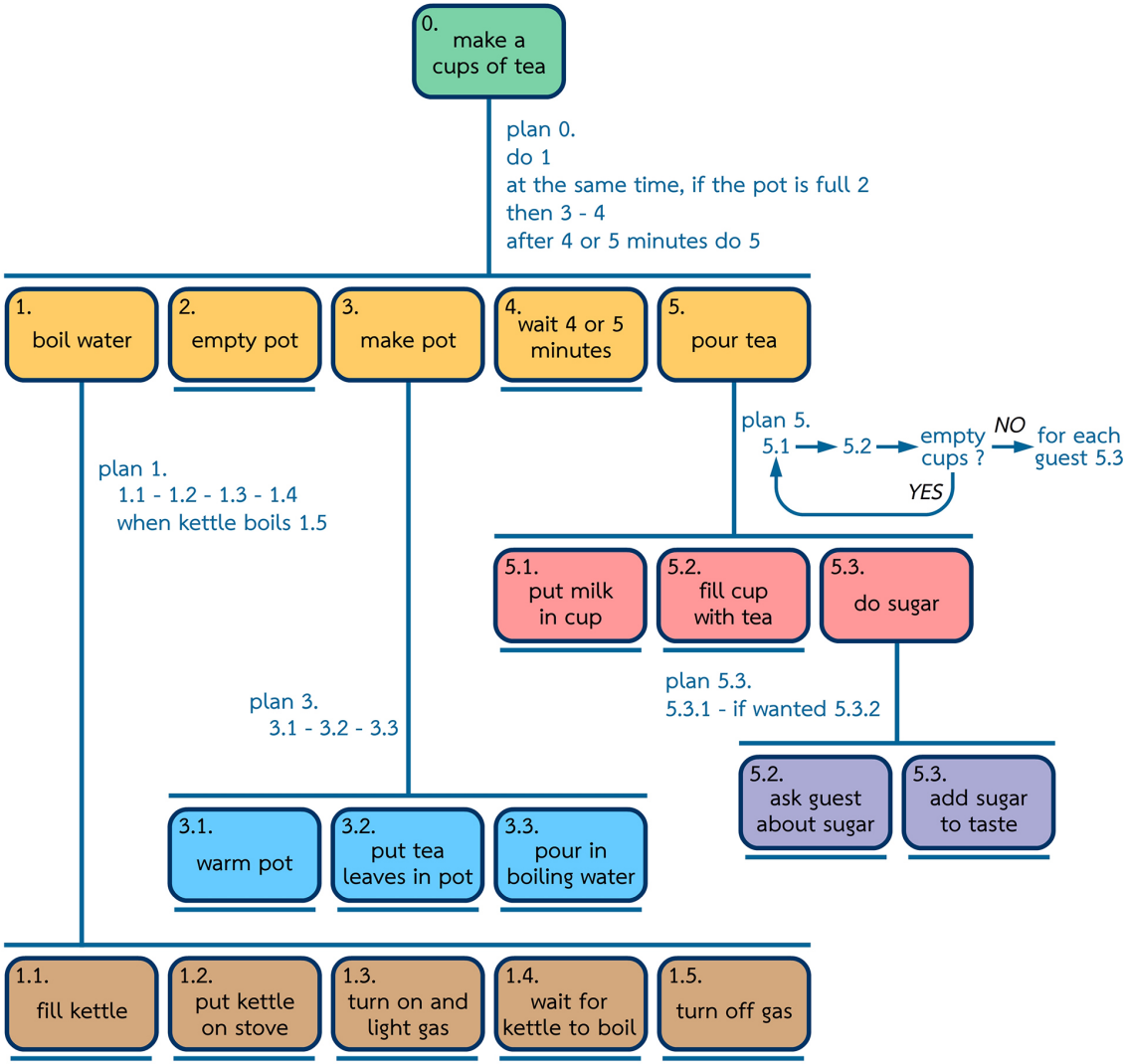
Given initial HTA (textual or diagram)

How to check / improve it?

Some heuristics:

paired actions	e.g., where is `turn on gas'
restructure	e.g., generate task `make pot'
balance	e.g., is `pour tea' simpler than making pot?
generalise	e.g., make one cup ..... or more

Refined HTA for making tea



Types of plan

fixed sequence - 1.1 then 1.2 then 1.3

optional tasks - if the pot is full 2

wait for events - when kettle boils 1.4

cycles - do 5.1 5.2 while there are still empty cups

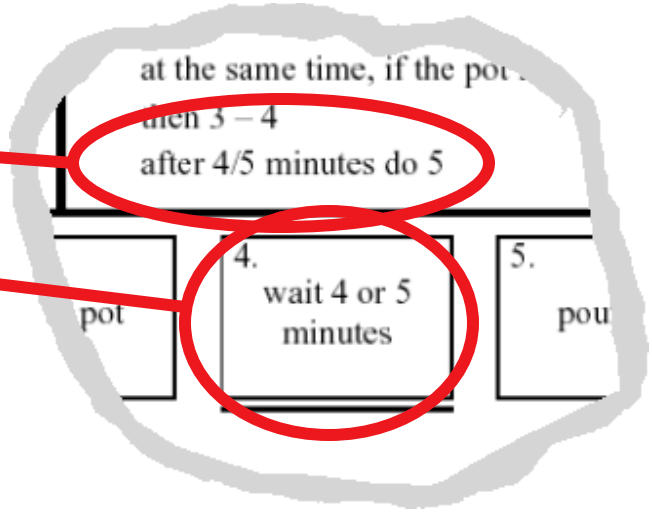
time-sharing - do 1; at the same time ...

discretionary - do any of 3.1, 3.2 or 3.3 in any order

mixtures - most plans involve several of the above

waiting …

- is waiting part of a plan?
  … or a task?
- generally
  - task - if 'busy' wait
    - you are actively waiting
  - plan - if end of delay is the event
    - e.g. "when alarm rings", "when reply arrives"
- in this example …
  - perhaps a little redundant …
  - TA not an exact science



see chapter 19 for more on delays!

Knowledge Based Analyses

Focus on:

Objects - used in task

Actions - performed

+ Taxonomies -

represent levels of abstraction

Knowledge-Based Example ...

motor controls

- steering *steering wheel, indicators*
- engine/speed
  - direct *ignition, accelerator, foot brake*
  - gearing *clutch, gear stick*
- lights
  - external *headlights, hazard lights*
  - internal *courtesy light*
- wash/wipe
  - wipers *front wipers, rear wipers*
  - washers *front washers, rear washers*
- heating *temperature control, air direction, fan, rear screen heater*
- parking *hand brake, door lock*
- radio *numerous!*

Task Description Hierarchy

Three types of branch point in taxonomy:

XOR - normal taxonomy
object in one and only one branch

AND - object must be in both
multiple classifications

OR - weakest case
can be in one, many or none

wash/wipe AND
function XOR
wipe *front wipers, rear wipers*
wash *front washers, rear washers*
position XOR
front *front wipers, front washers*
rear *rear wipers, rear washers*

Larger TDH example

kitchen item AND
/____shape XOR
/ |____dished mixing bowl, casserole, saucepan,
/ | soup bowl, glass
/ |____flat plate, chopping board, frying pan
/____function OR
{____preparation mixing bowl, plate, chopping board
{____cooking frying pan, casserole, saucepan
{____dining XOR
|____for food plate, soup bowl, casserole
|____for drink glass

N.B. '/|{' used for branch types.

More on TDH

Uniqueness rule:

- can the diagram distinguish all objects?

e.g., plate is:

kitchen item/shape(flat)/function{preparation,dining(for food)}/

nothing else fits this description

Actions have taxonomy too:

kitchen job OR

|___ preparation *beating, mixing*

|___ cooking *frying, boiling, baking*

|___ dining *pouring, eating, drinking*

Abstraction and cuts

After producing detailed taxonomy
'cut' to yield abstract view

That is, ignore lower level nodes

e.g. cutting above shape and below dining, plate becomes:

kitchen item/function{preparation,dining}/

This is a term in Knowledge Representation Grammar (KRG)

These can be more complex:

e.g. 'beating in a mixing bowl' becomes:

kitchen job(preparation) *using a*
kitchen item/function{preparation}/

Entity-Relationship Techniques

Focus on objects, actions and their relationships

Similar to OO analysis, but ...

- includes non-computer entities
- emphasises domain understanding not implementation

Running example

'Vera's Veggies' - a market gardening firm

owner/manager: Vera Bradshaw

employees: Sam Gummage and Tony Peagreen

various tools including a tractor `Fergie'

two fields and a glasshouse

new computer controlled irrigation system

Objects

Start with list of objects and classify them:

Concrete objects:

simple things : spade, plough, glasshouse

Actors:

human actors : Vera, Sam, Tony, the customers

what about the irrigation controller?

Composite objects:

sets : the team = Vera, Sam, Tony

tuples : tractor may be < Fergie, plough >

Attributes

To the objects add attributes:

Object Pump3 **simple** - irrigation pump

Attributes:

status : on/off/faulty

capacity : 100 litres/minute

N.B. need not be computationally complete

Actions

List actions and associate with each:

- **agent** - who performs the actions
- **patient** - which is changed by the action
- **instrument** - used to perform action

examples:

Sam (*agent*) planted (*action*) the leeks (*patient*)

Tony dug the field *with* the spade (*instrument*)

Actions (ctd)

implicit agents - read behind the words

`the field was ploughed' - *by whom?*

indirect agency - the real agent?

`*Vera* programmed the *controller* to irrigate the field'

messages - a special sort of action

`Vera *told* Sam to ... '

rôles - an agent acts in several rôles

Vera as *worker* or as *manager*

example - objects and actions

Object Sam **human actor**

Actions:

S1: drive tractor

S2: dig the carrots

Object Vera **human actor**

- the proprietor

Actions: as worker

V1: plant marrow seed

V2: program irrigation controller

Actions: as manager

V3: tell Sam to dig the carrots

Object the men **composite**

Comprises: Sam, Tony

Object glasshouse **simple**

Attribute:

humidity: 0-100%

Object Irrigation Controller **non-human actor**

Actions:

IC1: turn on Pump1

IC2: turn on Pump2

IC3: turn on Pump3

Object Marrow **simple**

Actions:

M1: germinate

M2: grow

Events

... when something happens

- performance of action

  'Sam dug the carrots'

- spontaneous events

  'the marrow seed germinated'

  'the humidity drops below 25%'

- timed events

  'at midnight the controller turns on'

Relationships

object-object	social - Sam is subordinate to Vera spatial - pump 3 is in the glasshouse
action-object	agent (listed with object) patient and instrument
actions and events	temporal and causal 'Sam digs the carrots because
temporal relations	use HTA or dialogue notations. show task sequence (normal HTA) show object lifecycle

example - events and relations

Events:

Ev1: humidity drops below 25%

Ev2: midnight

Relations: object-object

location (Pump3, glasshouse)

location (Pump1, Parker's Patch)

Relations: action-object

patient (V3, Sam)

- Vera tells *Sam* to dig

patient (S2, the carrots)

- Sam digs the *carrots* ...

instrument (S2, spade)

- ... *with* the spade

Relations: action-event

before (V1, M1)

- the marrow must be sown *before* it can germinate

triggers (Ev1, IC3)

- *when* humidity drops below 25%, the controller turns on pump 3

causes (V2, IC1)

- the controller turns on the pump *because* Vera programmed it

Sources of Information

Documentation — N.B. manuals say what is *supposed* to happen but, good for key words and prompting interviews

Observation — formal/informal, laboratory/ field (see Chapter 9)

Interviews — the expert: manager or worker? (ask both!)

Early analysis

Extraction from transcripts

- list nouns (objects) and verbs (actions)
- beware technical language and context:
  `the rain poured' vs. `I poured the tea'

Sorting and classifying

- grouping or arranging words on cards
- ranking objects/actions for task relevance (see ch. 9)
- use commercial outliner

Iterative process:

data sources ↔ analysis

... but costly, so use cheap sources where available

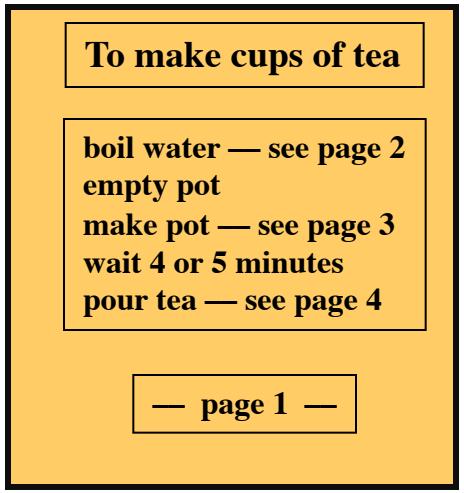
Uses - manuals & documentation

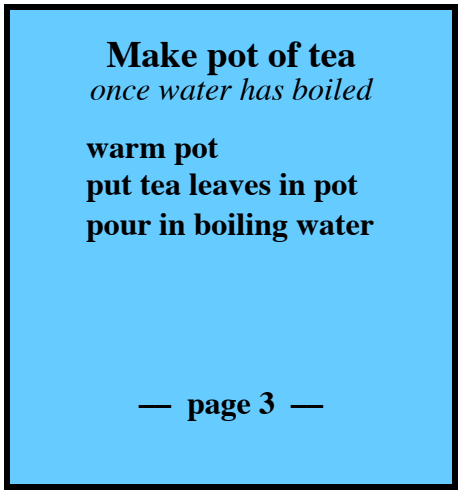
Conceptual Manual

- from knowledge or entity-relations based analysis
- good for open ended tasks

Procedural 'How to do it' Manual

- from HTA description
- good for novices
- assumes all tasks known





Uses - requirements & design

Requirements capture and systems design

- lifts focus from system to use
- suggests candidates for automation
- uncovers user's conceptual model

Detailed interface design

- taxonomies suggest menu layout
- object/action lists suggest interface objects
- task frequency guides default choices
- existing task sequences guide dialogue design

NOTE. task analysis is never complete

- rigid task based design $\Rightarrow$ inflexible system

Questions and Answers