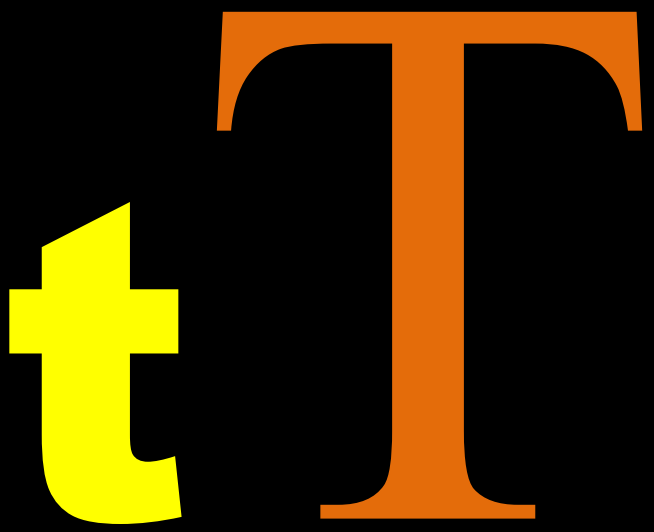


GEOM20007

SPATIAL VISUALISATION

LECTURE 13:
CARTOGRAPHY 4

TOWARDS GREATER INTERACTION

REVISITING THE CARTOGRAPHIC PROCESS

Cartography has a very long history

A cartographic map is a **representation**

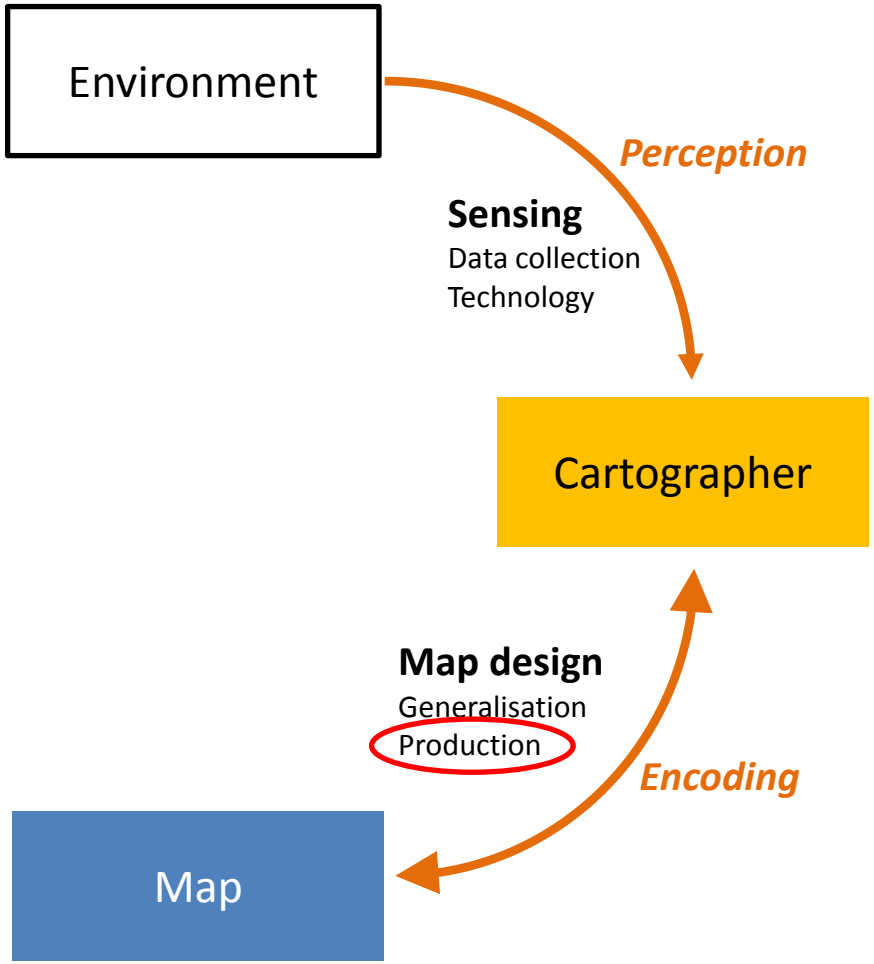
- Visual language (marks and visual variables)
- Abstract, symbolic representation of the real world*

It essentially has two core functions

- Storage and recording (**spatial** aspect)
- Presentation and analysis (**graphical** aspect)

REVISITING THE CARTOGRAPHIC PROCESS

COMMUNICATION MODEL



Step 1
Consider the real world phenomena

Step 2
Determine the map's purpose and its intended users

Step 3
Collect data and perform modelling/selection

Step 4
Determine suitable encodings, design and construct the map

Step 5
Determine if users can decode the information and find it useful

PUTTING THINGS TOGETHER

1. Map elements
2. Typography and placement of labels

TRADITIONAL MAP ELEMENTS

- Borders
- Mapped area
- Inset (if applicable)
- Title and subtitle
- Legend
- Data source
- Scale
- Orientation

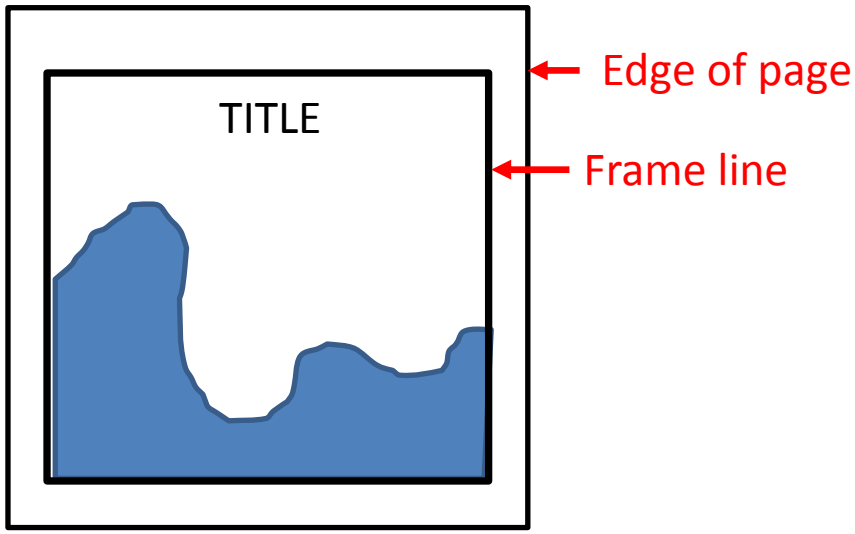
(Slocum et al., 2009)

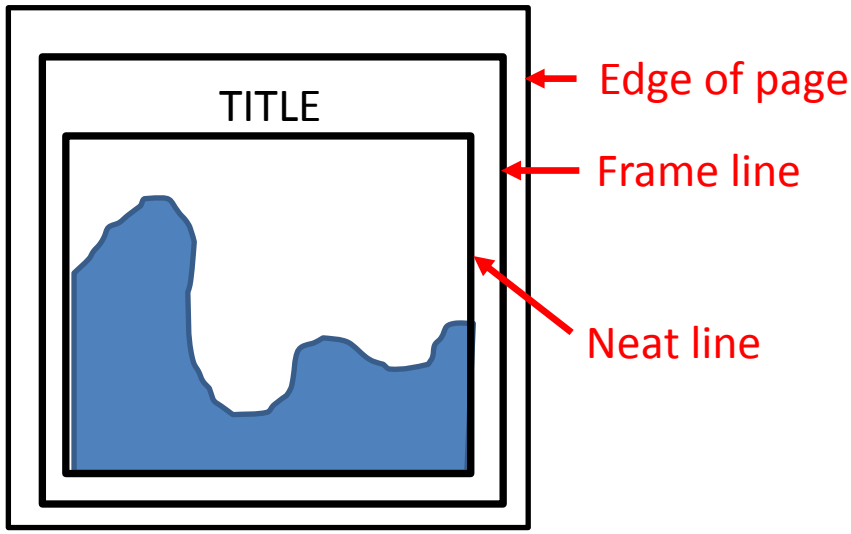
Borders

Frame line and neat line help to organise the map's elements

Similar to a picture frame – focus the user's attention (not distract them)

Avoid **map junk** – maximise data ink ratio. Use clean, crisp borders.

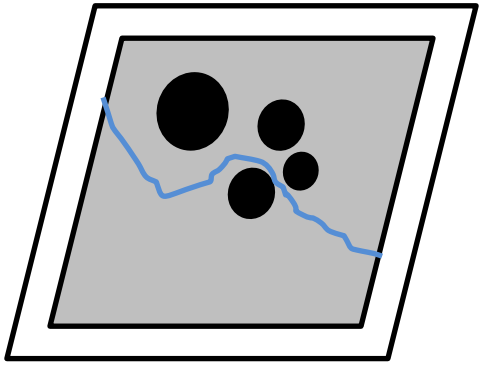




Mapped area

The region of the Earth that is represented.

Size: dependent on various constraints*
Position: Centred (vertical, horizontal)^



Two main components:

1. **Symbology**
   e.g., enumeration units
2. **Base information**
   Provides a geographic frame of reference
   (without it symbols are virtually meaningless)
   e.g., boundaries, transportation routes

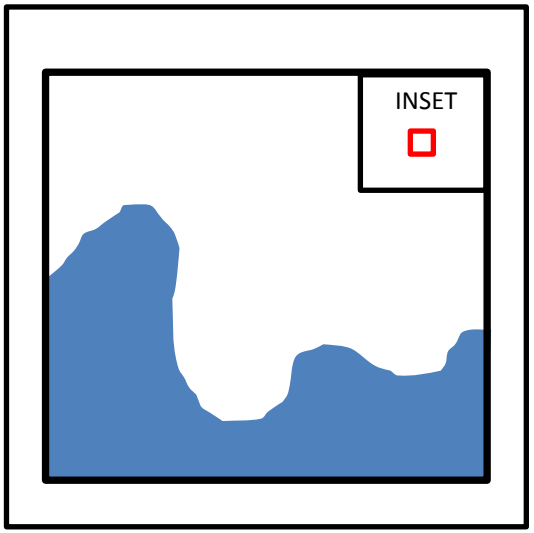
Inset

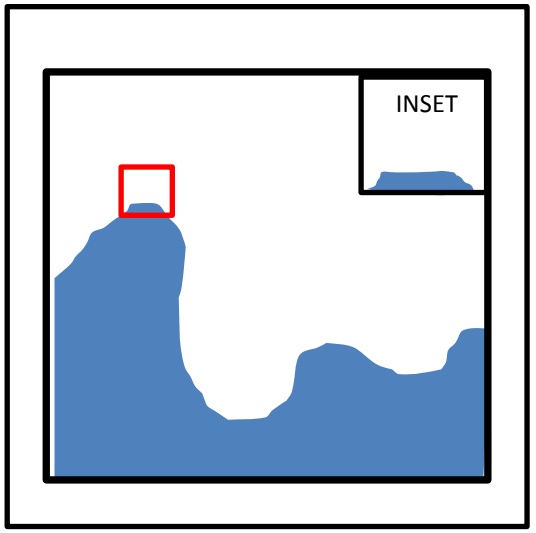
A smaller map within the context of a larger map. Reasons for use:

1. To show the primary **mapped area** in a larger, more recognisable context

2. To **enlarge** important or congested areas

3. To show other topics related to the map (e.g., previous maps from 2014, 2015)





Title and subtitle

Most (if not all) maps require a title

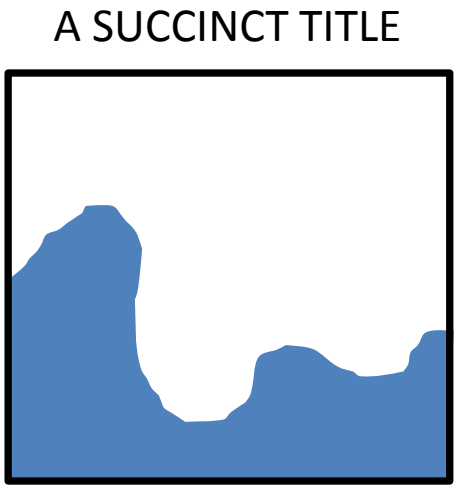
Must succinctly describe the map's theme, while not being too cryptic

Maximise the **mapped area** for the data-ink ratio:
Omit unnecessary words such as 'Map of…'!

Subtitle may be used to elaborate on title

e.g.,

Population density
Melbourne 1883



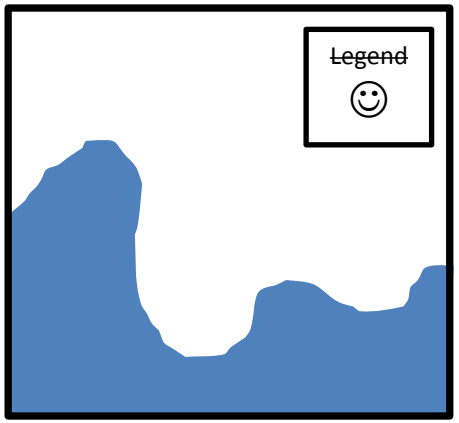
Legend

Defines **all** of the symbols used on the map and that they are identical. Nothing else.

Must be clear and straight forward - avoid a “crypto-graphical mystery”
(Tufte, 1983)

Good design principles apply, e.g., group symbols of the same graphic primitive.

Do **not** add a label: ‘Legend’ or ‘Key’

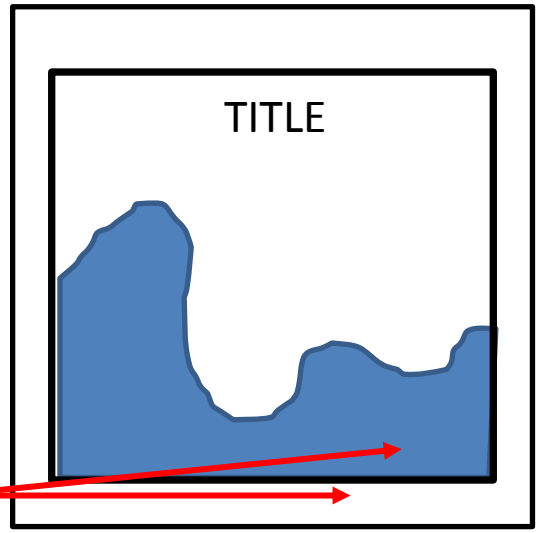


Data source

Allows the map user to understand where the data came from

Use ‘Source:’ and reference all details (date is very important)

Typically:
Included in the mapped area of larger maps, or
Included in the caption of smaller maps

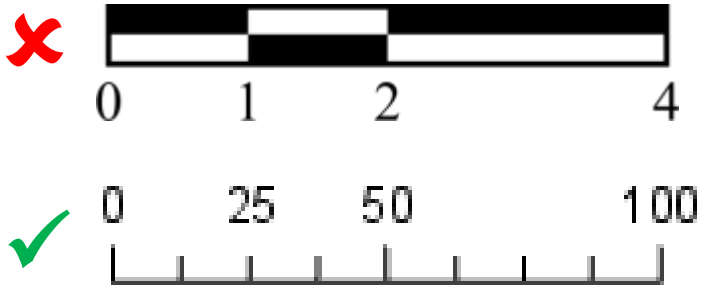


Scale

The amount of reduction that has taken place

The **representative fraction** is the ratio form of a scale
e.g., 1:250,000

Include page size for paper maps
e.g., 1:250,000 at A3



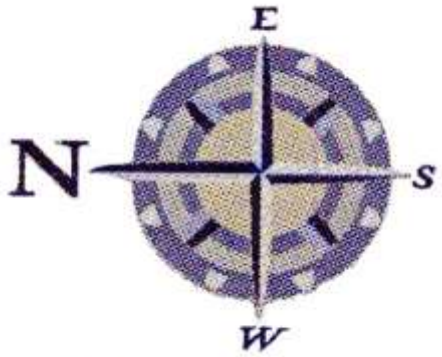
Bar scale allows relative judgements
-Suitable for country or smaller sized areas
-Minimum = 0
-Maximum = rounded (never decimal)
-Needs to be clean and not consume data-ink

Orientation

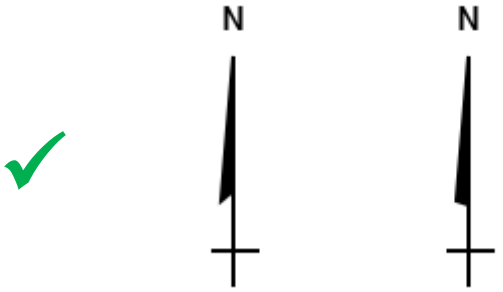
A graticule or north arrow illustrate the direction of 'North' on a map

Type depends on map purpose:
e.g. magnetic north,
true north

Large enough to find and use only, avoid map junk (maximise data-ink!)



Images: ICSM (top), Jonh L. https://3dwarehouse.sketchup.com/ (left) clipart.co (right)



Images: GRASS Wiki http://grasswiki.osgeo.org/

TYPE

Type (or text) refers to the use of words on maps. Typography is the process of formatting type.

Terminology:

RR

- Type family, e.g., Calibri
- Type face, e.g., Courier Light
- Type size, e.g, 12pt (1pt = 1/72”)
- Font: the complete set of characters in a font family
- Serifs: short extensions to letters (no serif = sans serif)
- Letter spacing: distance between letters in a word
- Word spacing: distance between words
- Kerning: distance between adjacent letters
- Leading (line spacing): vertical space between lines

TYPOGRAPHIC GUIDELINES FOR MAPS

Poor use of text spoils the map and impedes reading (Imhof, 1975)

General principles for lettering and design:

1. **Legibility** easily read, discriminated and quickly located
2. **Clear graphic association** to the object to which the text belongs
3. **Minimise disruption** to features and labels (overlapping, concealing)
4. **Assist revealing** spatial extent, connections, importance, differences
5. **Type arrangement** should reflect classification/hierarchy of objects
6. **Selection and arrangement** not unnecessarily even, not clustered

Source: Imhof, E. (1975). Positioning names on maps. *The American Cartographer*, *2*(2), 128-144.

ADDTIONAL GUIDELINES FOR MAPS

- Avoid use of map junk, e.g., decorative type or other elements
- Minimise use of bold styles
- Reserve italics for labelling water features only
- Avoid use of more than two type families (be consistent)
- Choose realistic font sizes (readability vs. maximise data-ink ratio)
- Spell-check
- Critically review, revise and edit
  - Iterative design process

SUMMARY

1. Human vision
2. Data graphics
3. Cartography (representational era, 1950s-60s)

LIMITATIONS OF THE TRADITIONAL MAP METAPHOR

Despite being relatively intuitive and expressive, the map metaphor has four key limitations

- Maps are **static** and poor at representing change and evolution
- Maps are **two-dimensional** and ill-suited to complex three-dimensional phenomena
- Maps are based on **visual stimuli** only and do not take advantage of auditory, haptic etc.
- Maps offer only limited opportunities for **feedback**

Adapted from Worboys and Duckham (2004)

BIG LIMITATIONS OF TRADITIONAL MAP METAPHOR?

Big datasets

Linked data

Displaying ‘necessary’ data

TECHNOLOGIES PROMOTING CHANGE

SOME DRIVERS

- Server technologies
  - Processing
  - Storage
- Devices
  - Various interaction technologies (e.g., display)
- Telecommunications
  - Design (e.g., centralised/decentralised)
  - Bandwidth and speed

SPATIAL DATA INFRASTRUCTURES

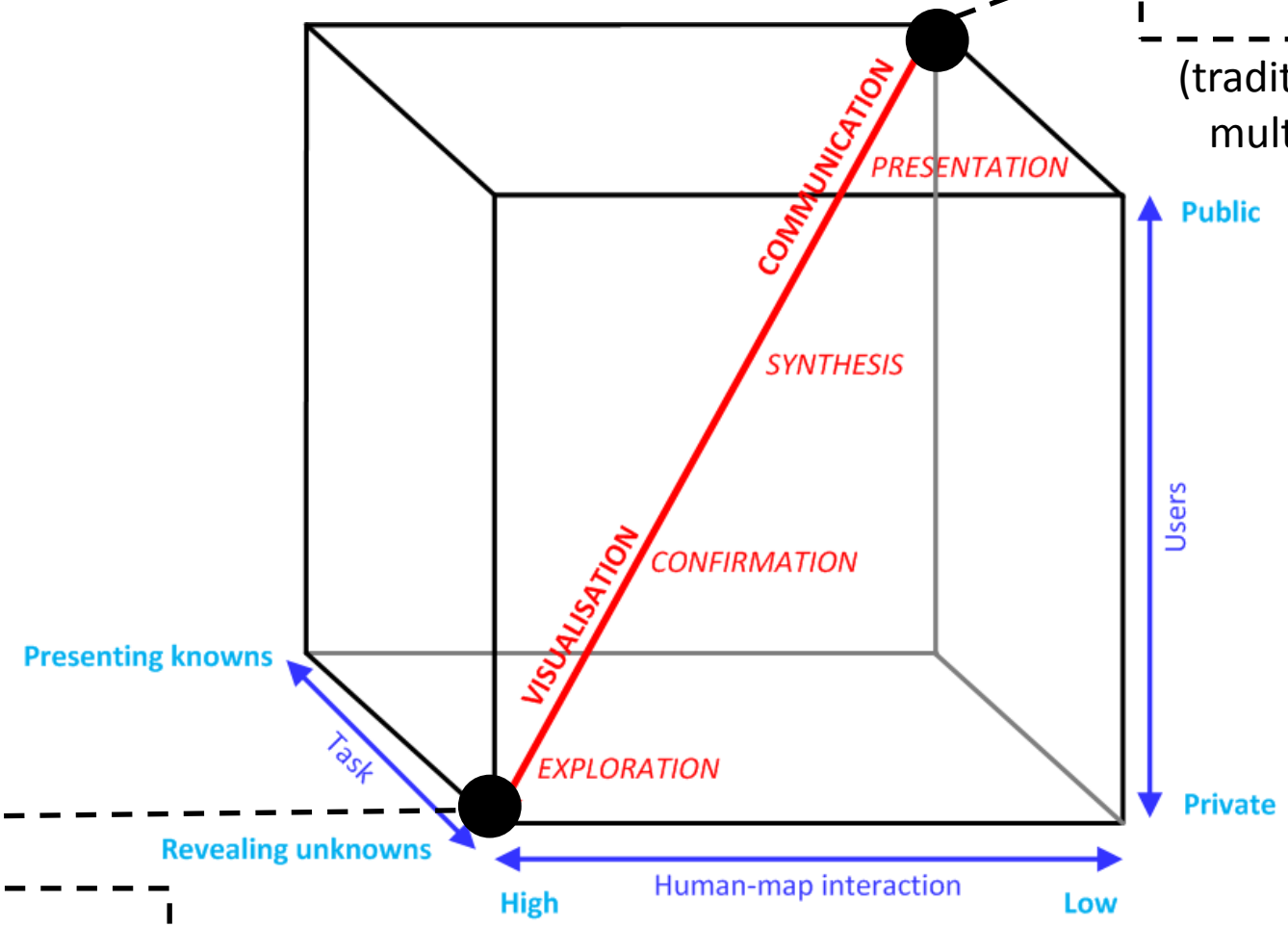
- Interoperability between systems
  - Linking to other data sets or services

LINKED DATA EXAMPLES

- Statistical data associated to the location, e.g., ABS
- Other spatial data (e.g. Data.gov.au: school locations)
- Administrative/government data
- Cultural data related to place
- Connectivity relationships (e.g., network connectedness)
- Dependency relationship (e.g., geometry defines another object)
- Topological relations in 3rd dimension (geometries overlap in the horizontal plane with other relations, e.g., highway flyover)
- Temporal data

More information: http://www.w3.org/2015/spatial/wiki/Linked-data

MAP USE CUBE



Redrawn from MacEachren and Kraak

NEW DEVELOPMENTS IN MAPS

"Cartographic revolution" (Roth, 2013)

…Maps of higher **interactivity** offering greater **feedback**

Image redrawn from Roth (2013)

Compare against the map communication model
(noisy channels)

NEW DEVELOPMENTS IN MAPS

Examples:

- Areal georeferenced video
- Play + pause with temporal navigation
  - Animated CO2 map http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=11719
  - Animated tsunami map http://sos.noaa.gov/Datasets/view-movie.html?video=indian_tsunami_propagation_400

Source: Jenny, B. (2015), http://www.tandfonline.com/doi/full/10.1080/17445647.2016.1157323

NEXT LECTURE

- HCI 1: Interaction design

PRACTICAL

- Presenting Data with Processing (PDP)