Tools of research

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Tools of R

Every professional needs specialized tools:

Carpenter - hammer and saw

Surgeon - scalpel and forceps

Researcher - means by which data can be collected

(specific / general)

General tools of R

Do not confuse the tool with the methodology!

R tools: mechanism / strategy for collecting or interpreting data

R methodology: general approach in carrying out the project (dictates the selection of tools)

General tools of R

Recognise the confusion

"Library R" - place for locating data to be analyzed in the R process

"Statistical R" - ways to summarize and analyze data

Characteristics

1. The library and its resources

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2. The computer and its software

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3. Techniques of measurement

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4. Statistics

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4. Statistics
5. The human mind

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2. The computer and its software
3. Techniques of measurement
4. Statistics
5. The human mind
6. Facility with language

1. The library and its resources as a tool of research

Initially - literary mausoleum (repository)

20th century - explosion of information →

- impossibility to hold all worlds info

- ease and speed of access to info (priority)

Evolution of the library
Quiet past
(present in the Victor Babes University)

Hard catalog → stacks

Vol. of cross indexed references → periodicals

nuggets of info written down on index cards

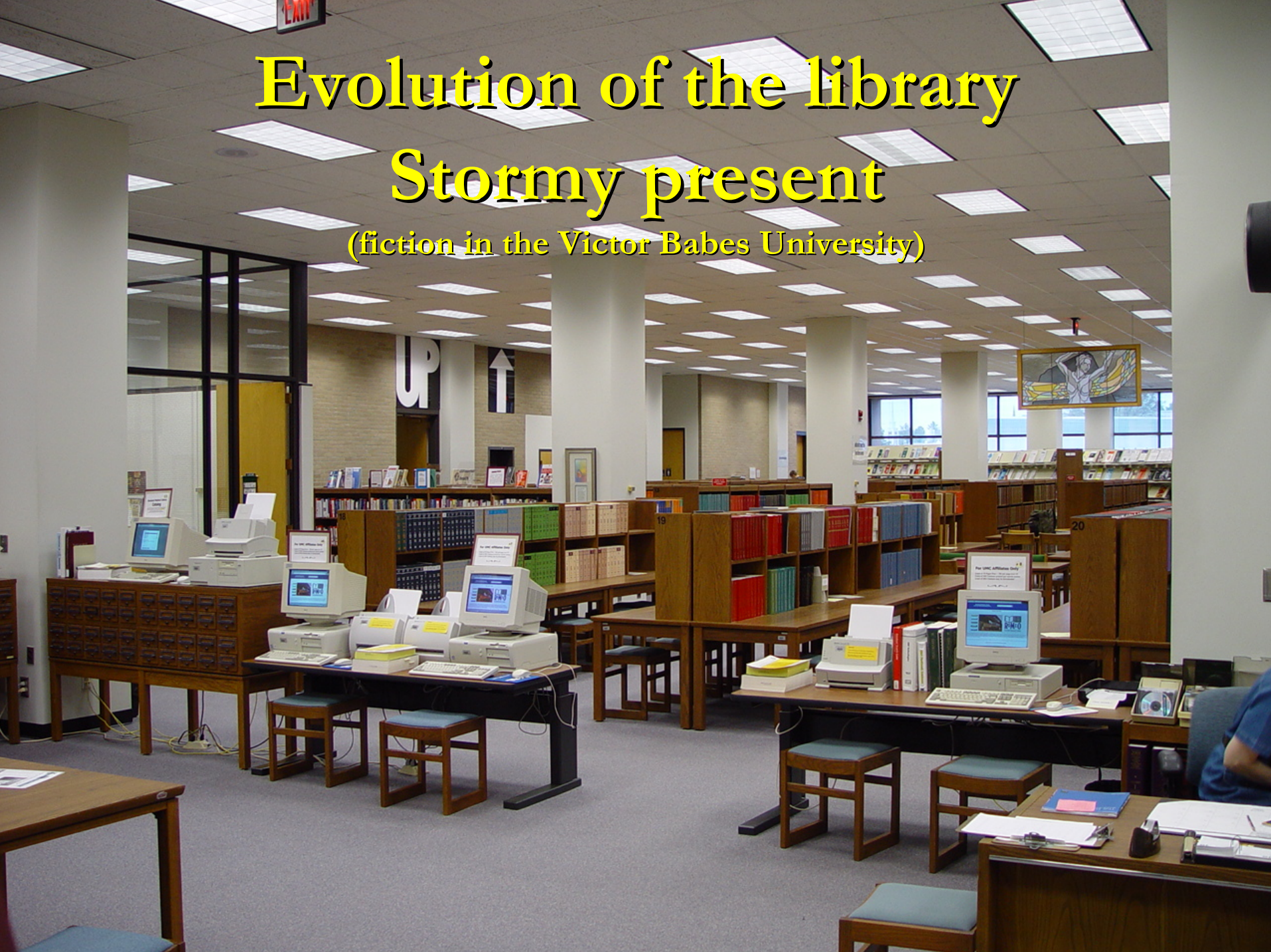
Laborious, time consuming process

Evolution of the library
Stormy present
(fiction in the Victor Babes University)

Change in organization

Hard catalog →

rows of computer terminals


Evolution of the library
Stormy present
(fiction in the Victor Babes University)

Evolution of the library
Stormy present
(fiction in the Victor Babes University)

Change of conventional view of knowledge

- separate disciplines ("boxes" - anatomy, etc.)

- in the structure of the university = departments

But modern research does not work under the concept of

divisions, cells of knowledge - less discipline specific

How to access knowledge quickly and efficiently

A. Library catalogs

B. Indexes and abstracts

C. The reference librarian

D. Browsing the library shelves

How to access knowledge quickly and efficiently

A. Library catalogs

- replaced with an electronic database
- card catalog:

1. books by a person precede books about a person
2. collected works precede individual works
3. if a word is common for a (a) person, (b) place, or (c) thing, cards will be arranged in that order
4. saints, popes, kings are arranged in that order

How to access knowledge quickly and efficiently

B. Indexes and abstracts

= the "heart" of the library for the researcher

- paper and electronic versions
- CD-ROM - 300.000 pages of text
- floppy disk - 700 pages
- invaluable for a literature review

CD-ROM

How to access knowledge quickly and efficiently

C. The reference librarian

- persons that help you to find the information you need in the computer catalog, CD-ROM indexes, other electronic resources

- why these persons?

- library resources change quickly

How to access knowledge quickly and efficiently

D. Browsing the library shelves

- physically or electronically
- many information is found not in the targeted material, but nearby

How to access knowledge quickly and efficiently

THE BEST WAY TO LEARN

ABOUT THE LIBRAY

IS TO USE IT!

How to access knowledge quickly and efficiently

GO IN

AND

EXPLORE!

2. The computer and its software

2. The computer and its software

Computers are a commonplace

- they are not human brains!
- are not miracle workers

Computers as a research assistant

- literature review
- study implementation, data gathering
- analysis, interpretation etc.

Take advantage of the Internet

World Wide Web

- access to the www requires a web browser
- full multimedia resource
- search feature

Take advantage of the Internet

File Transfer Protocol

- ability to share files and databases with someone at a different location
- the user must know the name of the file + the FTP address location + password
- retrieving or sending large files

Take advantage of the Internet

Electronic Mail (e-mail)

- single message mail / bulk mail
- delivered in seconds, no matter where in the world
- cost is negligible
- short messages, attachments, cc, forward etc.

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3. Measurement as a tool of research

- Research needs **objectivity**
- A way to remain objective: to identify a systematic way of **measuring** a phenomenon

3. Measurement as a tool of research

Definition of measurement:

The process of associating numbers with physical quantities and phenomena

Encyclopaedia Britannica

3. Measurement as a tool of research

Definition of measurement

limiting data of a phenomenon (substantial or insubstantial) so that those data may be interpreted and compared to an acceptable qualitative and quantitative standard

3. Measurement as a tool of research

Measurement is limiting the data - we set a limit that restrains the data (a meter, a kilogram)

of any phenomenon - substantial or insubstantial - nothing exists that the researcher cannot measure

- basis in the physical world or

- concepts, opinions etc. - the degree students learned, extent to which people "value" physical exercise vs. smoking

3. Measurement as a tool of research

so that those data may be interpreted - when researcher gains an insight into disparate data = interpretation = data are transformed into units of discovery

and compared to a qualitative or quantitative standard - a researcher must have a point of orientation, a standard (norms, conformity to expected statistical distribution etc.)

3. Measurement as a tool of research

Measurement is ultimately a comparison = a thing or a concept measured against a point of limitation

- length of an object ↔ ruler, measuring tape
- data examined statistically - statistic norms
- religious beliefs ↔ sacred writings, its creed
- philosophical ideas ↔ writings of Platon, Marx

Scales of measurement

Non-interval scales

- Nominal
- Ordinal

Interval scales

c. Interval

d. Ratio

Stevens, 1946

Scales of measurement

a. Nominal - assigning names

statistics: - *percentage*

- *chi-square test*

b. Ordinal - we use an ordinal scale of measurement

- we compare data as being greater/higher

- the scale allows to rank-order the data

statistics: - *median*

- *percentile rank*

Scales of measurement

c. Interval - has equal units of measurement
- zero point established arbitrary

statistics: - means, standard deviation

Place an X on the scale below at the point where you would rate the availability of your professor for courses

Scales of measurement

d. Ratio - equal units of measurement
- absolute zero point

statistics: - geometric mean, percentage variation

Question for you!

Can be the "availability" scale a ratio scale?

Validity and reliability of measurement

Validity = the extent to which the instr. measures what it is supposed to measure

- insubstantial phenomena: what does "always available" mean?

Reliability = the consistency with which a measuring instr. yields a certain result when the entity being measured has not changed

- today's "70" is tomorrow's "90" - is this reliable?

4. Statistics as a tool of research

- Statistical values are never the end, nor the final answer of R
- The final question in R is *What do this data indicate?*
- Statistics give *information*, not the *meaning* of the data
- Statistics will summarize the body of data, but cannot capture the nuances of the data.

4. Statistics as a tool of research

One cannot draw large savings

out of an account into which

little has been deposited.

Functions of statistics

Descriptive: general nature of the data

- variability among data, interrelation of characteristics

Inferential: help making decisions about the data

- differences are large enough to be attributed to experiment not other influences

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These functions **summarize data** and create entities that have no counterpart in reality: arithmetic mean

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If statistics offer an unreality, why use them?

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These functions *summarize data* and create entities that have no counterpart in reality: arithmetic mean

If statistics offer an unreality, why use them?

Because statistics *help the human mind comprehend disparate data as an organized whole.*

5. The human mind as a tool of research

Most important tool

A. deductive logic

1. the earth is flat

2. a flat surface has boundaries, that means edges

3. if a ship travels across a flat surface, it comes eventually to the edge of it and falls off

5. The human mind as a tool of research

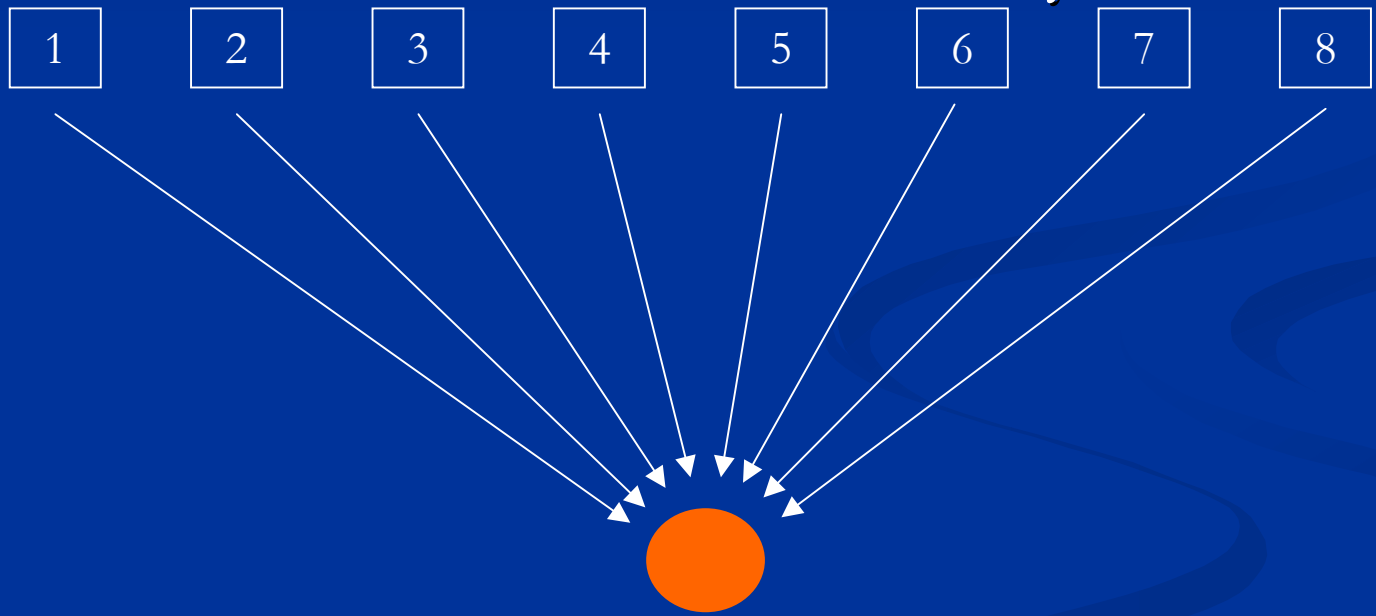
B. inductive reasoning

1. begins with an observation

2. we use specific instances to draw conclusions about entire classes of objects/events

5. The human mind as a tool of research

Separate and individual facts observed by the researcher



They lead to a single conclusion

5. The human mind as a tool of research

Example of inductive reasoning:

Silverman, Masland, Saunders and Swab (1970)

How long can a person have "flat ECG" and still recover?

They observed 2650 cases: in all cases over 24 hours not a single recovery occurred.

Conclusion: it is unlikely that a recovery takes place in patients who exhibit flat ECG of 24 hours or more in duration.

THE LINE FROM *EACH* CASE LED TO THAT *ONE* CONCLUSION

5. The human mind as a tool of research

C. Scientific method (*scientia* is Latin for knowledge)

a. identifying a problem

b. stating a hypothesis

c. gathering data relevant to the hypothesis

d. analyzing and interpreting the data to see whether it supports the hypothesis and solve the problem

5. The human mind as a tool of research

D. Critical thinking = evaluation the information or arguments in terms of accuracy and worth *(Beyer, 1985)*

a. *verbal reasoning*: understanding the persuasive techniques found in oral and written language

b. *argument analysis*: discriminating between reasons that do or do not support a particular conclusion

c. *decision making*: identifying and evaluating several alternatives and selecting the best

6. Facility with language as a tool of research

Language - one of humankind's greatest achievments

It facilitates our thinking in several ways *(Ormrod, 1999)*

1. reduce the world's complexity
2. facilitate generalization
3. allow abstraction
4. enhance the power of thought

Value of knowing 2 or more languages

A most all significant R is reported in English

Doctoral programs should require competency in at least English

The importance of writing

All research must eventually be presented as a written document - accessible to scientists

Conventionally clear thinking *precedes* clear writing

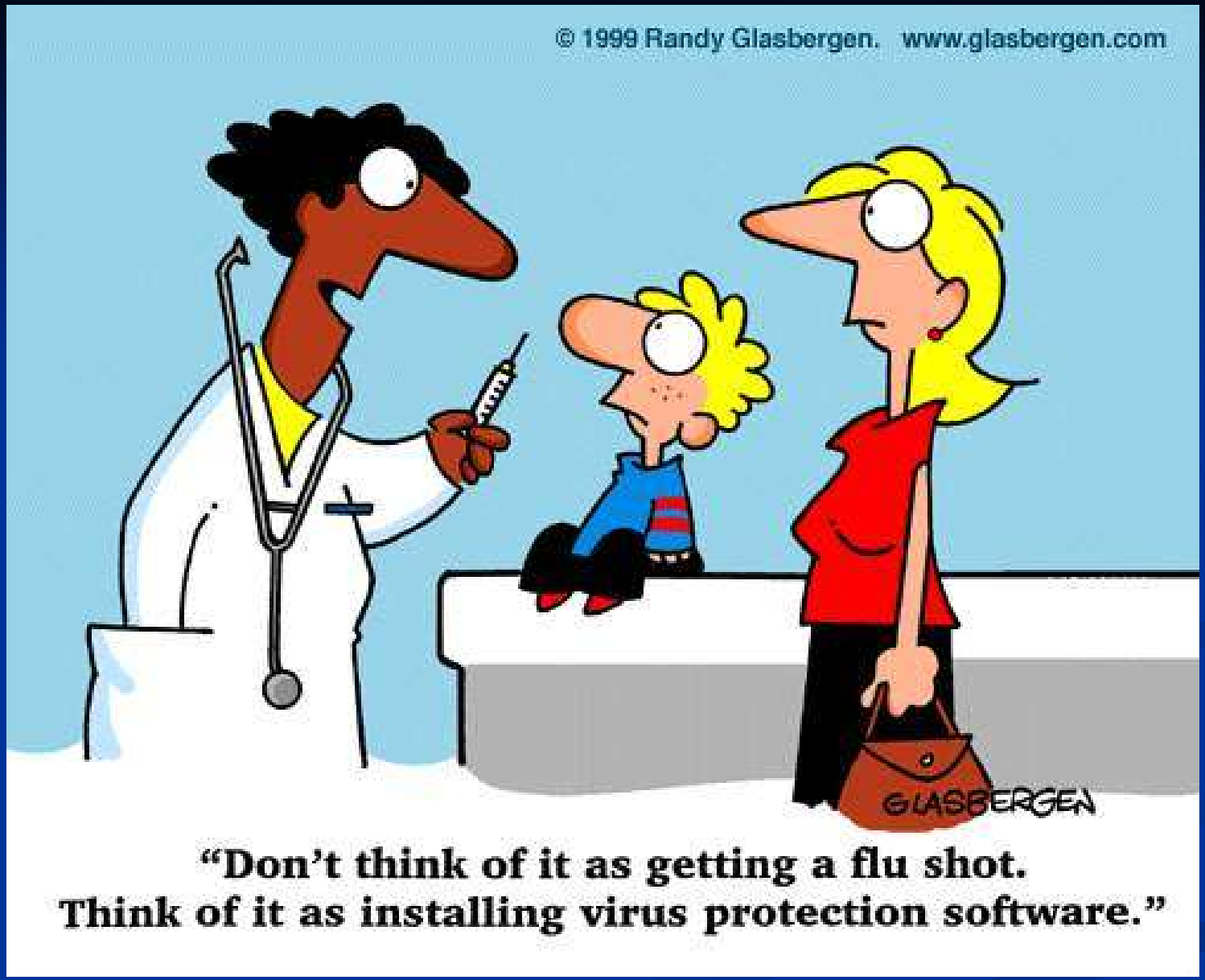
Actually writing is a productive form of thinking:

- you identify things you do and do not know about your topic
- you clarify/organize your thoughts to communicate
- you find gaps and logical flaws in your thinking

The importance of writing

Therefore: writing about a topic enhances our understanding of that topic *(Benton 1997, Kellogg 1994)*

If you wait until all your thoughts are clear before you start writing, you may never begin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"Don't think of it as getting a flu shot.
Think of it as installing virus protection software."

Thank you!