



# Introduction to Research in Computing

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Workshop on research

CIIC 8996

February 23, 2011

10:30am to 12:00, S229



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# Present yourself

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- ◆ Name
- ◆ Short bio
  - Where are you from
  - Degree/degrees
  - Area of research
- ◆ What do you expect from CIIC 8996



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# Objective

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- ◆ Students will understand the fundamental concepts and competencies required for computing research.
- ◆ Students will understand the scope of their own individual research project.



# Genius?



- ◆ “You don't have to be a genius to do well in graduate school. You must be reasonably intelligent, but after a certain point, I think other traits become more important in determining success.”

“Everything I wanted to know about C.S. graduate school at the beginning but didn't learn until later.” by Ronald T. Azuma, v. 1.08, 2003



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# Which traits?

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- ◆ Traits
  - Mental toughness
  - Self-reliance
  - Desire to excel
  - Commitment to scholarship
- ◆ The successful graduate student is one who possesses both the intellectual abilities and the necessary personal characteristics.



# Traits



- ◆ "In sum, graduate work takes initiative, independence, perseverance, acceptance of responsibility, and a general freedom from emotional conflict and anxiety. The benefits of going to graduate school, especially a top-ranked school, are enormous, but they demand a high price in sweat and anxiety...Succeeding in graduate school requires years of single-minded dedication, much energy, individual initiative, and responsible independent study. We wish you well!" (Fretz and Stang, 1980).

# Traits

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# Do you have those traits?

- ◆ Yes
  - Great! You are going to finish in no time.





# Do you have those traits?

- ◆ Yes
  - Great! You are going to finish in no time.
- ◆ No
  - Did you truly believe those who said yes?





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# Essential Features in Research

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- ◆ Read scientific literature
- ◆ Work independently
- ◆ Use of careful and reproducible techniques
- ◆ Oral communication
- ◆ Written communication
- ◆ Meaningful and focused research question
  - Strive to produce a significant finding
- ◆ State of the art environment
- ◆ Professional meetings



# Two aspects

## ◆ Technical

- Understanding scientific method
- In depth knowledge on the topic
  - Understanding of the issues
- State of the art
- Lab skills

## ◆ Soft skills

- Time management abilities
  - Courses vs research
- Good communication skills
  - Oral
  - Written
- Problem solving
- Working under pressure

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# How do you know things?

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- ◆ You know
  - The world is round.
  - It is cold on the dark side of the moon.
  - Vitamin C prevents colds.
- ◆ How do you know things?
  - At some point everybody knew that the world was “flat”.

# Example



# Example



**Maguery worm: are two varieties of edible caterpillars that infest maguery and Agave tequilana plants. ....**

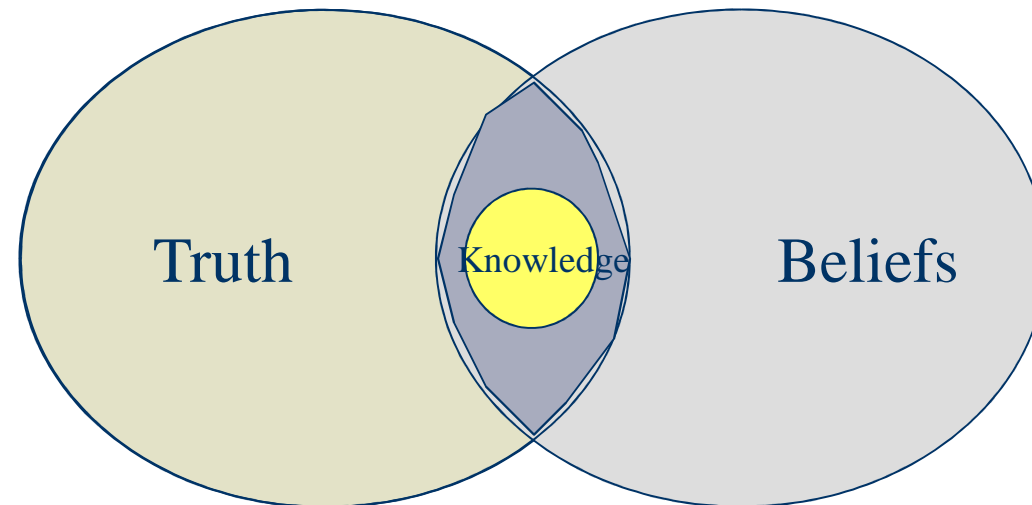
**They are also considered delicious deep fried or braised, seasoned with a spicy sauce and served in a tortilla.**

# Questions

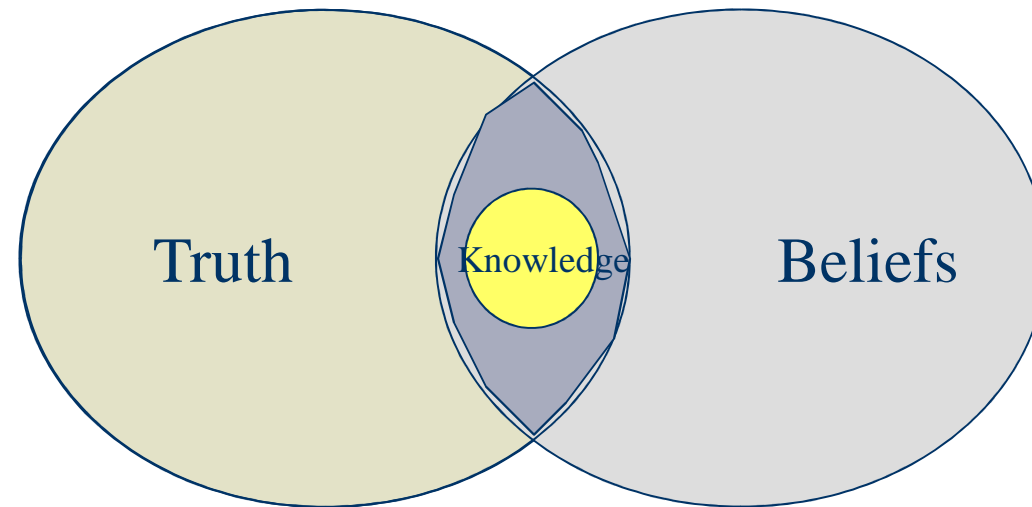
- ◆ Are worms “really” good or bad to eat?
  - How do you know what is really true?
- ◆ Looking for reality
  - Tricky business
  - **Epistemology** or **theory of knowledge** is the branch of philosophy that studies the nature, methods, limitations, and validity of knowledge and belief.



# Preposition



# Proposition



Knowledge = justified true belief

A good reason

See Edmund  
Gettier for  
another definition

# The four canons of science

- ◆ Determinism
  - The universe is orderly
  - All events have meaningful, systematic causes
- ◆ Empiricism
  - The best way to find out how the world works is to make observations.
- ◆ Parsimony
  - Facing with two competing theories that do an equally good job of handling a set of empirical observations, we should prefer the simpler one.
- ◆ Testability
  - Theories can be tested.
    - Confirmable or disconfirmable using current available research techniques.



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# Knowing about the world

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- ◆ Authority
- ◆ Intuition
- ◆ Logic
- ◆ Observation

How would you know if eating worms is good for you?



# How do we find out?

## ◆ Scientific Discovery

### ■ Law

- Universal statement of the nature of things that allows reliable predictions of future events

### ■ Theories

- General statement about the relation of two or more variables

### ■ Hypotheses

- Predictions about specific events that are derived from one or more theories.

# Hypotheses

- ◆ A prediction, stemming from a theory, stated in a way that allows it to be tested.
  - Help to test the validity of theories
  - Question
    - What is the best way to study for a test?
      - ◆ Cramming the night before the exam
      - ◆ Study over several nights
  - How are questions answered?
    - Research



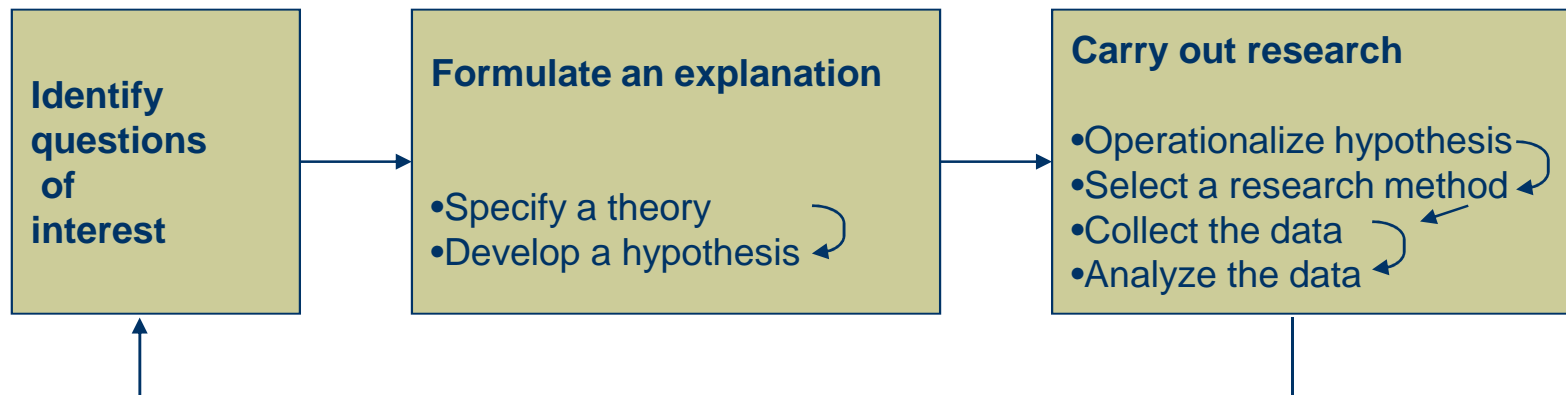


# Research

- ◆ Systematic inquiry aimed at the discovery of new knowledge.
  - Operationalization
    - The process of translating a hypothesis into specific testable procedures that can be measured and observed.

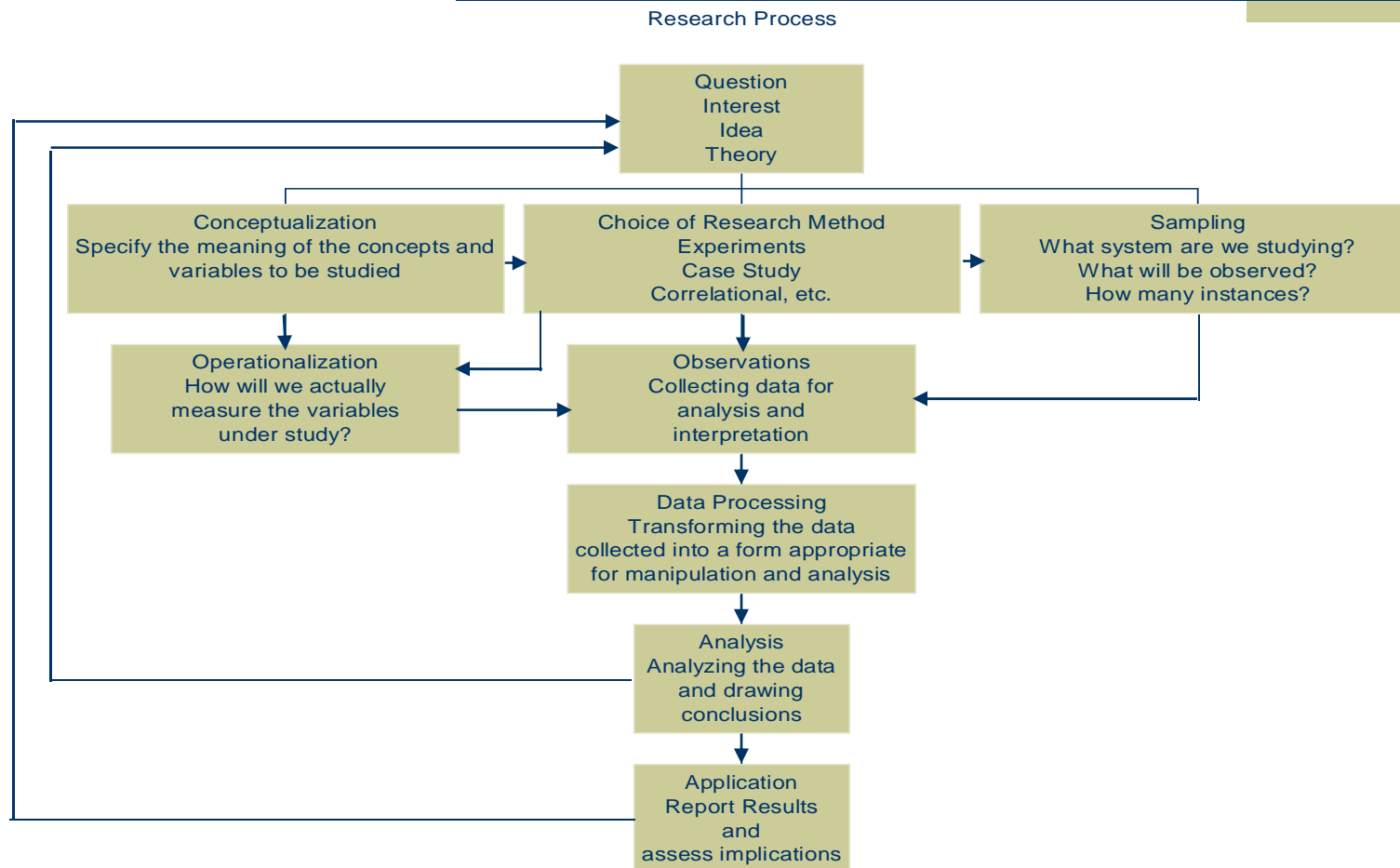
# Scientific Method

- ◆ The approach used to systematically acquire knowledge and understanding about the phenomena of interest





# The Research Process



From E. Babble

# Conceptualization

- ◆ A **concept** is an abstract idea or a mental symbol, typically associated with a corresponding representation in and language or symbology, that denotes all of the objects in a given category or class of entities, interactions, phenomena, or relationships between them.
- ◆ Conceptualization – the process of coming to an agreement of the meaning of a term
- ◆ Creating a conceptual order
  - Cognitive map

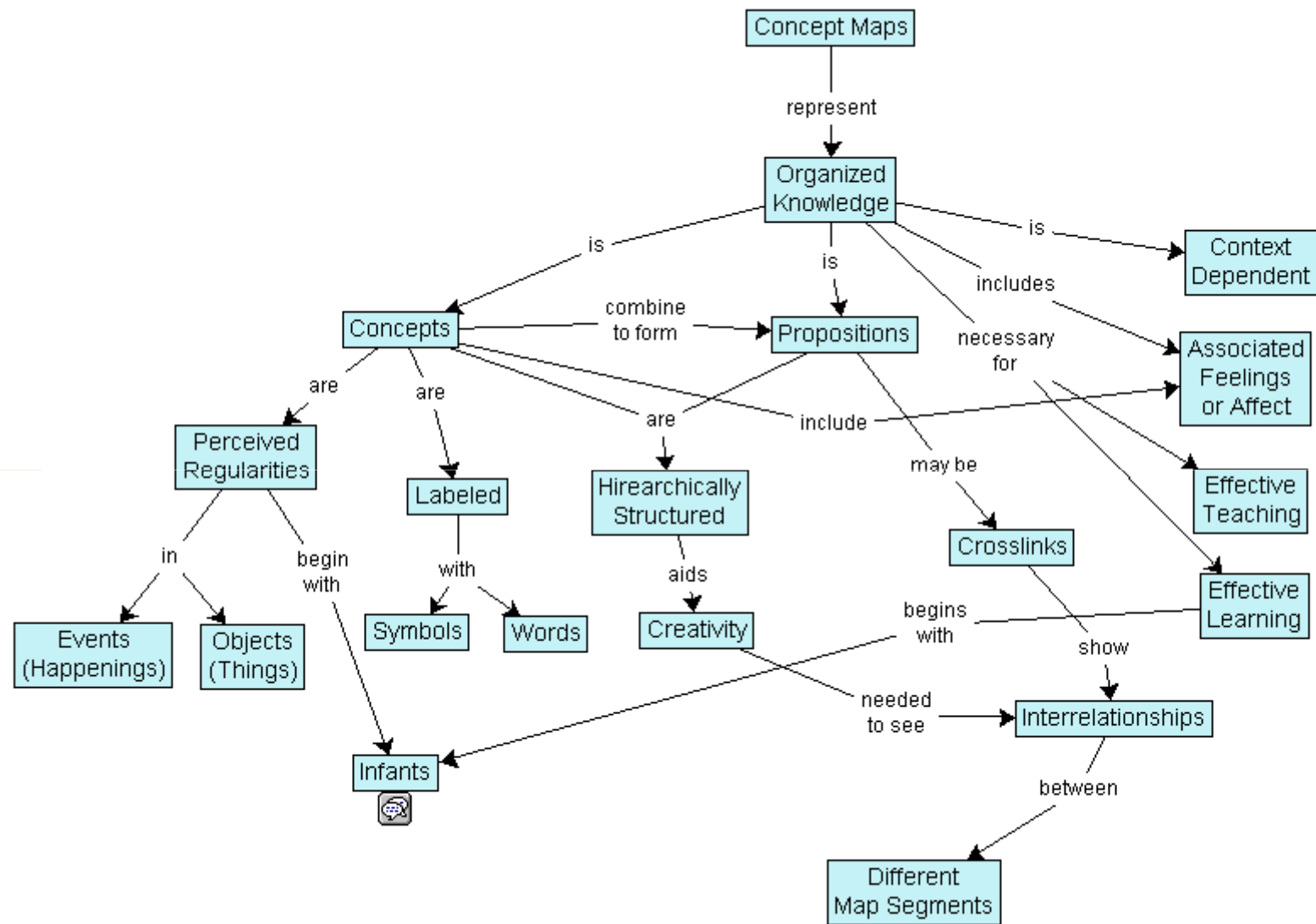


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# Cognitive Map

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- ◆ Cognitive maps are a method we use to structure and store spatial knowledge, allowing the "mind's eye" to visualize images in order to reduce cognitive load, and enhance recall and learning of information.
  - Cognitive maps can be represented and assessed on paper through a concept map, or any variety of spatial representation.





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# Exercise

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- ◆ In a piece of paper
- ◆ Write the title of your research
- ◆ Write the question of interest associated to your research
- ◆ Draw a concept map or visual map of the concepts associated to your research work



# References



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Questions?



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