

Interdisciplinary Research - Necessary or Sufficient, or...?

**Jeremy Horne, Ph.D., President-emeritus, Southwest Area Division,
American Association for the Advancement of Science (AAAS) and
CEO of the Inventor Assistance League, USA**

jeremy@inventions.org

Before the co-located conferences sponsored by the

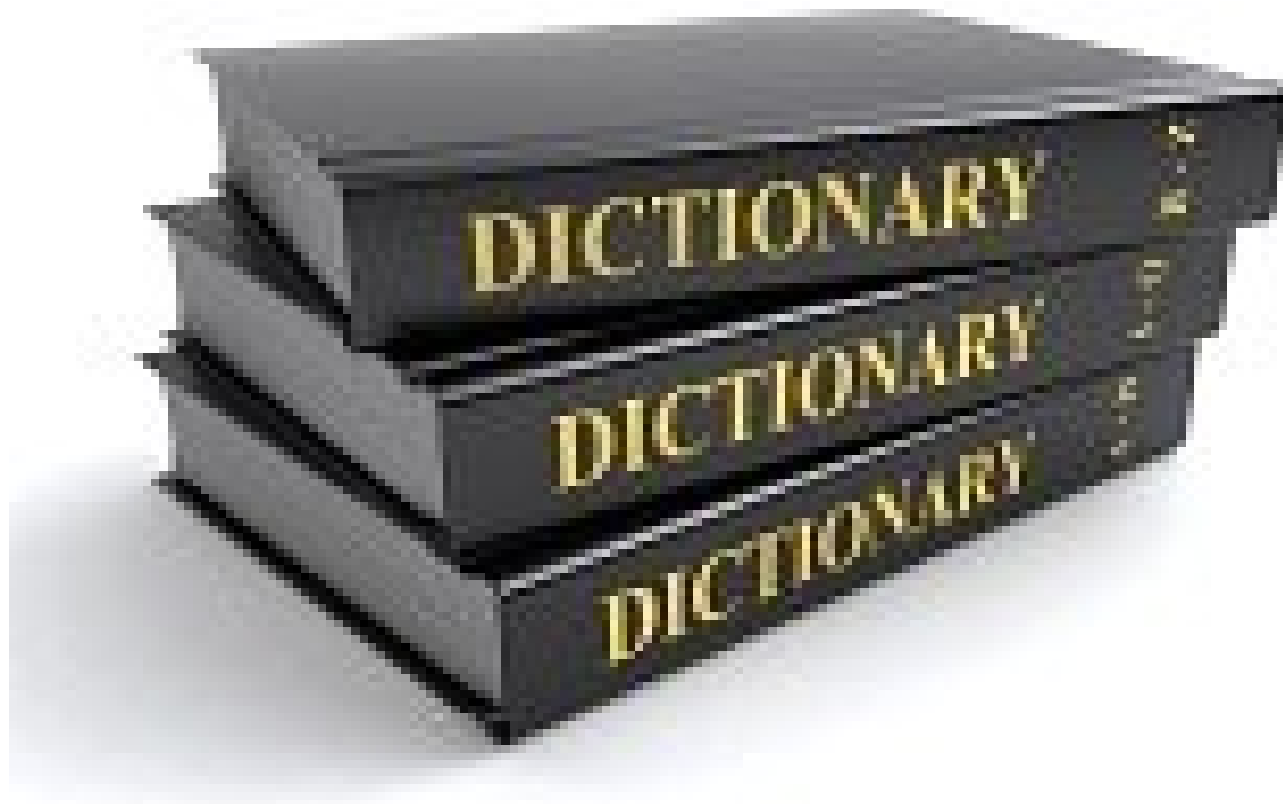


Orlando, Florida, USA ~ July 12 – 15, 2015

Problem

Disciplinary research is a NECESSARY condition for Science advancement but it is not a SUFFICIENT one for real problem solving and technological innovation.” This is because it will be oriented to disciplinary academic who do thing that “Disciplinary research is a NECESSARY condition for Science advancement” and inter-disciplinary research might not be. Even in the case of people thinking this way (which depends on what they understand by Science) I would like to tell them, that even they are right, this does not solve real live problems or lead to technological innovations, i.e. even if “Disciplinary research is a NECESSARY condition for Science advancement, it is not a SUFFICIENT one for real problem solving and technological innovation.” This affirmation is so evident for me that I really do not know why disciplinarians do not see it.

Some terms



Begging the question

WHAT is a DISCIPLINE?



Characteristics of DISCIPLINE

- Focus
- Maturity
- Skill
- Knowledge
- Area of expertise

....but at least two major problems remain -

BOUNDARY

COMMUNICATION

How is a discipline created?

- Narcissism
- Superfluous novelty
- Knowledge quality

“Scientific methods” is a figurative calling card for deeper philosophical values about why we should be curious in the first place and assessment of knowledge quality.

“Advancement” and “innovation”

Discipline as ego

If you fractionalize a specialty area, you ultimately and logically reach an individual's idea of what constitutes that area, or discipline.



How

Jargon vs. explanatory words and words that are shorthand.

- **Jargon – Knowledge is power in the hands of the presenter.**
- **Explanatory words – Knowledge is power in the hands of everyone.**

INTER-disciplinary

Those concerned with INTERDISCIPLINARY presentations communicate their content to the general public with natural, or everyday language. That is, the content concerns material common to more than one discipline.

Language	Translation
Chinese	问好 nei* ho/lei ho (Cantonese) nǐ hǎo (Mandarin)
Dutch	hallo (informal) goedendag (formal)
English	hi/hey (informal) hello (formal)
French	salut (informal) bonjour (formal, daytime) bonsoir (formal, evening)
German	hallo (informal) Guten Tag (formal, daytime) Guten Abend (formal, evening)
Hebrew	shalom hi (informal)
Italian	ciào (informal) buongiorno (formal, daytime) buona sera (formal, evening)
Japanese	おはよう (ございます) ohayoou (gozaimasu)
Korean	안녕하세요 ahn nyeong ha se yo (formal) 안녕 ahn nyeong (informal)
Portugese	oi, boas, olá or alô
Russian	Privet! (informal) zdravstvuyte (formal)

Common to all:

HELLO

Three areas of discussion

- Dialectics
- Nature of Language (Ayer)
- Boundary
- Granularity
- Science in terms of Technology and vice versa

THEN, we can discuss sufficient and necessary.

DIALECTICS

THE most fundamental law

**Something is apprehended
in terms of what it is not.**

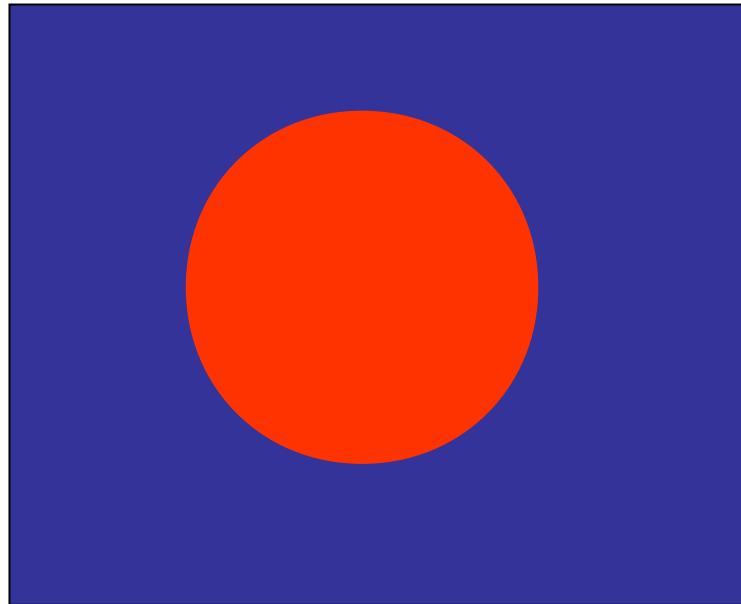
Dialectics – Part I

Square with a circle inside it – what do you see?



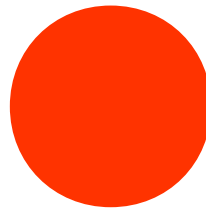
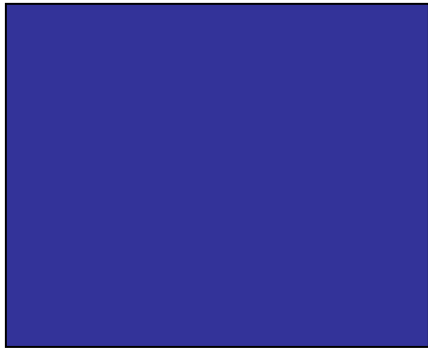
Dialectics - Part II

Now, what do you see?



Dialectics - III

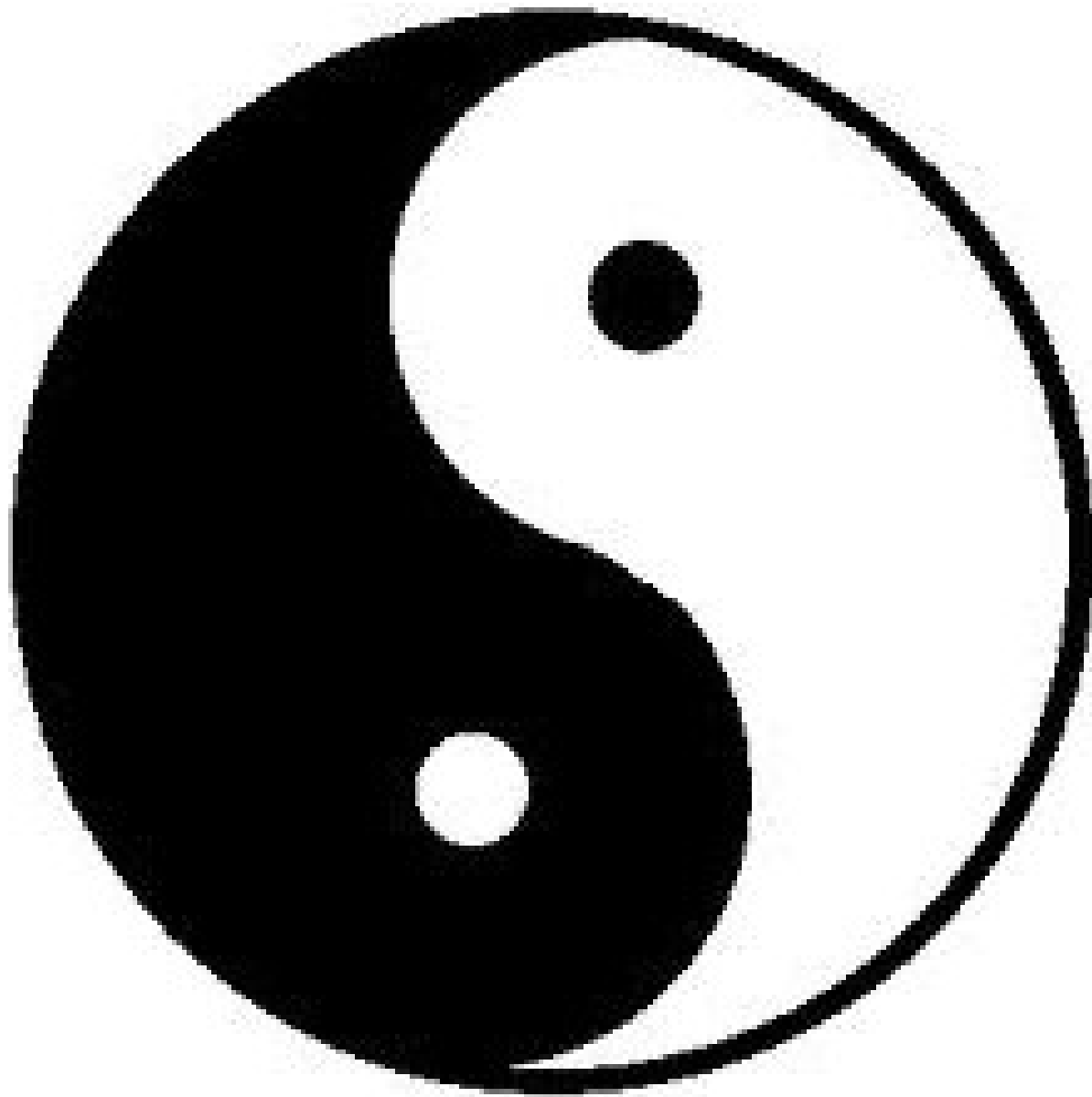
You apprehend something in terms of what it is not. Whatever is not red you see blue, and whatever is not blue you see red (aside from the background, of course 😊).



What is dialectics?

- **One apprehends something in terms of what it is not.**
- **It is a process. One does not apprehend this thing or that thing, but one as being not the other and conversely - dynamically.**

Dialectics is inherently binary at its simplest level.



A process expresses the parts, and the parts, in turn, give process its existential status.

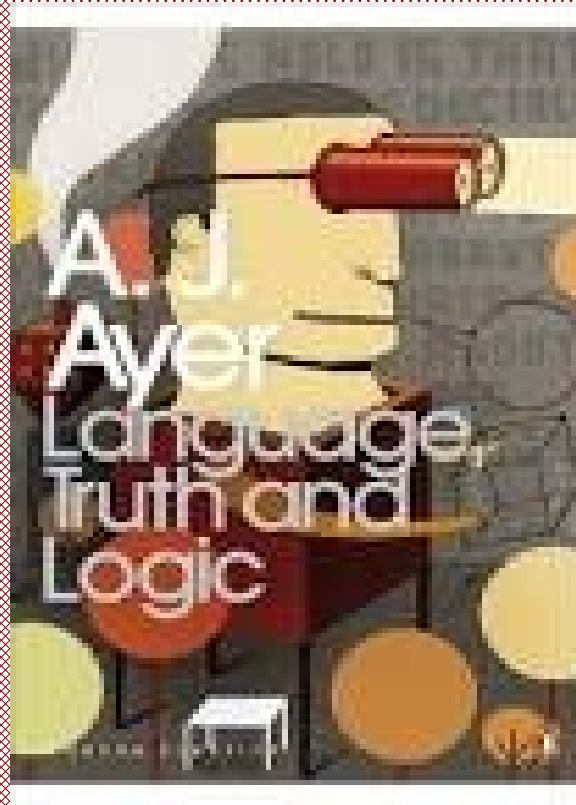
Something exists in terms of what it is not!!!!

This *most fundamental law* helps us to understand such apparent paradoxes as “particle wave duality”. A wave may be regarded as process. The “particle” is evidence of it, similar to induction. Without the particle, we would not know about the wave. This is similar to Kant’s appearance and reality [*Critique of Pure Reason*] and Plato’s forms.

NATURE OF LANGUAGE

Why have a discipline?

Knowledge through naming and reference.



[cf: All over the internet - e.g.,

https://docs.google.com/viewer?url=http://www.fphil.uniba.sk/fileadmin/user_upload/editors/kfdf/sylabus/sabela/texty/Ayer.pdf]

Let's say we wanted to talk about...

Specialty Language and Its Value

- Examples:
- Software manuals
- Specialty papers
- Jargon, in general

What is a PLATYPUS?

“The platypus is a semiaquatic mammal endemic to eastern Australia, including Tasmania. Together with the four species of echidna, it is one of the five extant species of monotremes, the only **mammals** that lay **eggs** instead of giving **birth**.”
[Wikipedia]



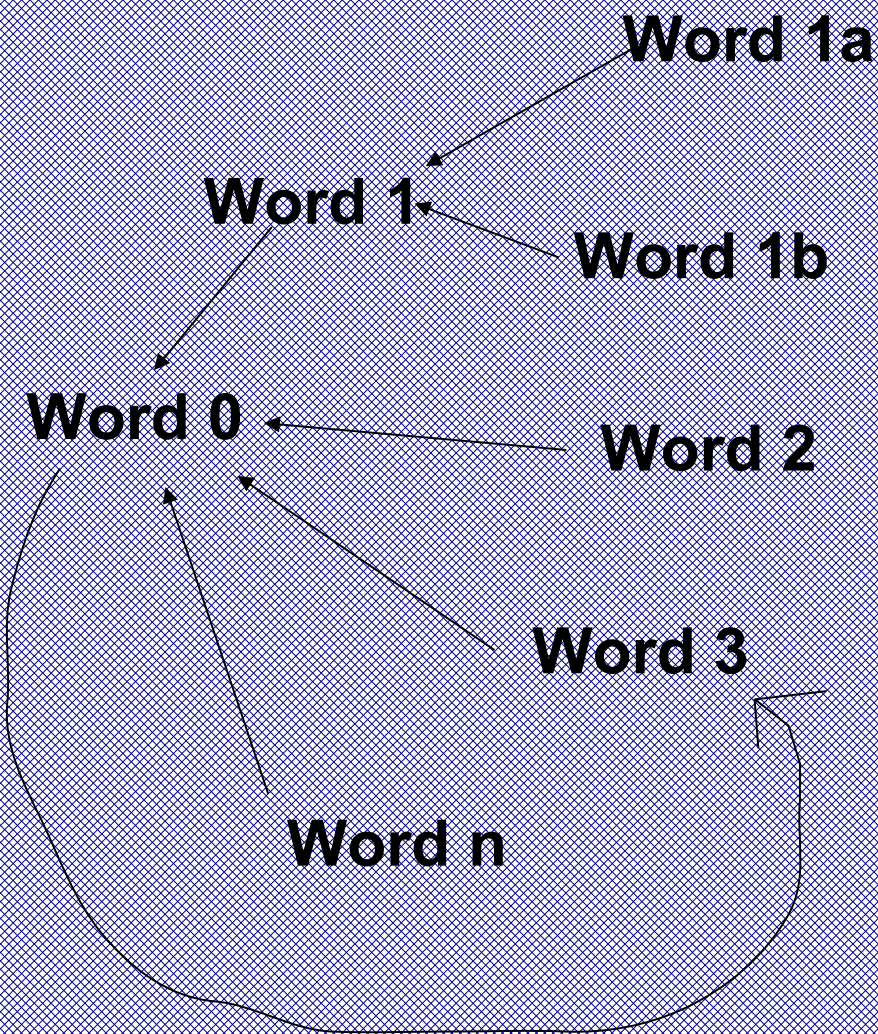
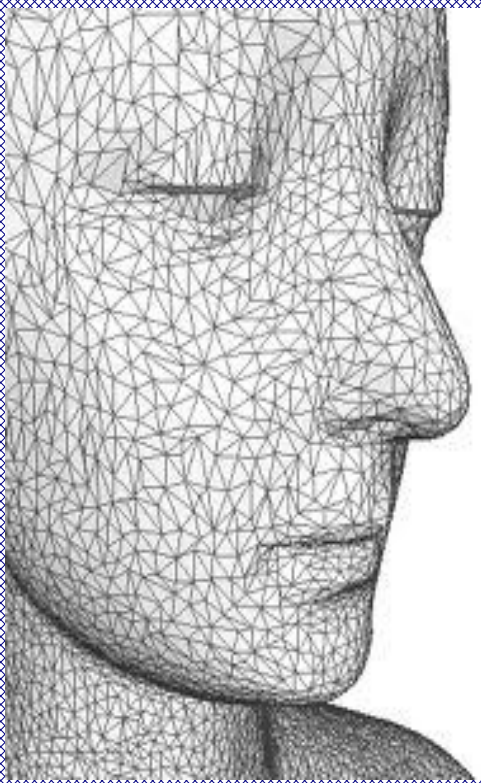
Start with words probably most familiar to general public.

Which is easier and faster?

- Using the definition every time we speak of this mammal
- or
- Using the shorthand designator, “platypus”?

A dictionary for a language is a word net.

A dictionary for a language is a word net.



Recursive

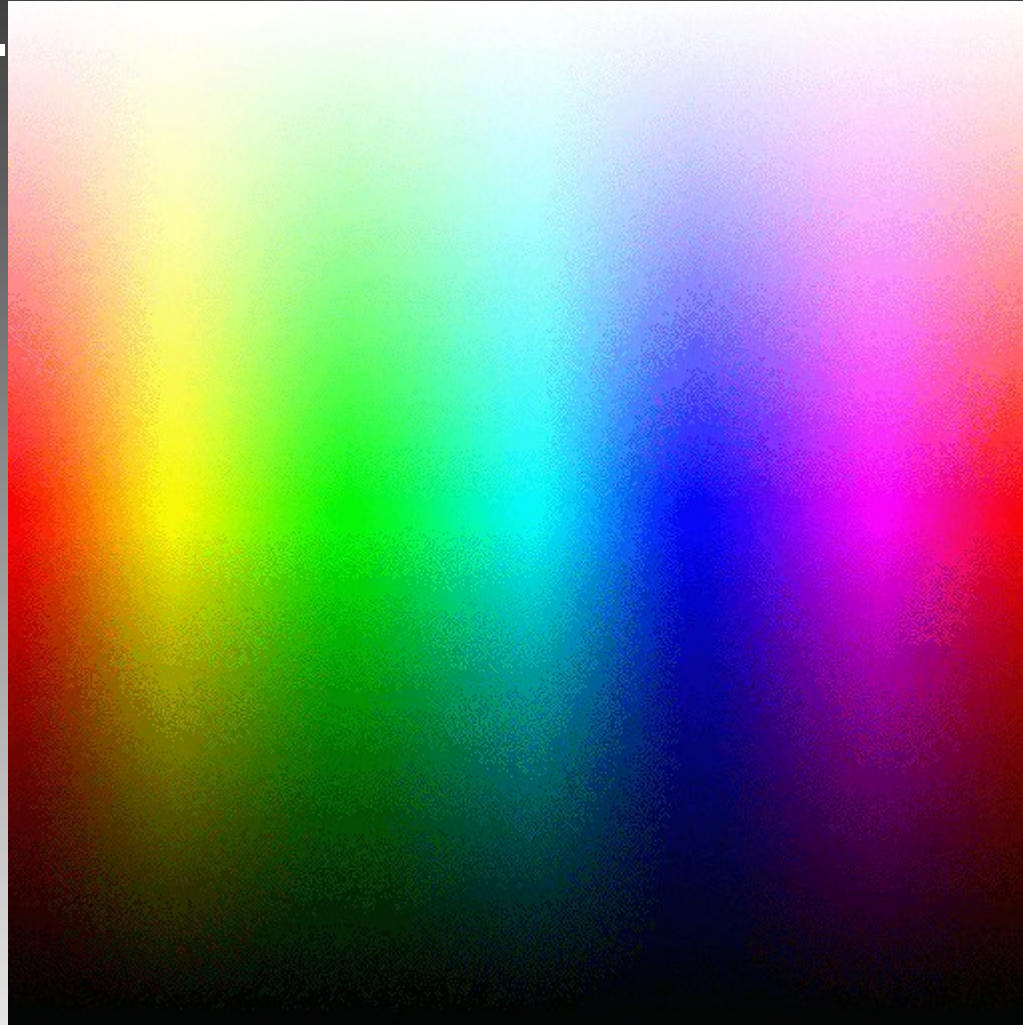
Not to be answered but to be considered by the one using words to communicate:

- **Tautological? (Do the words add anything new?)**
- **Does the language drive the thought, or vice versa?**
- **Whorf – Popularly thought that he said words drive thought.**

BOUNDARY

Boundary

Where is...



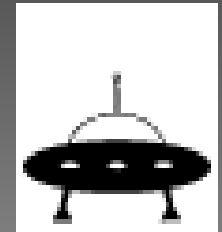
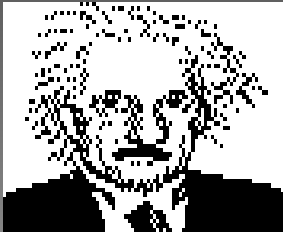
Boundary Issues

How does one determine what a discipline is?

- Do words control content? Jargon vs. explanatory words and words that are shorthand
- Complexity of explanation proportional to specialization
- All are defined in terms of context
- Set theoretical aspects

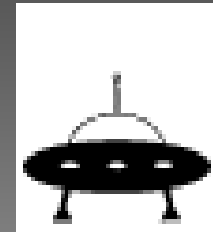
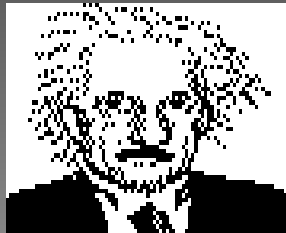
Are there boundaries?

... and who sets them? How?



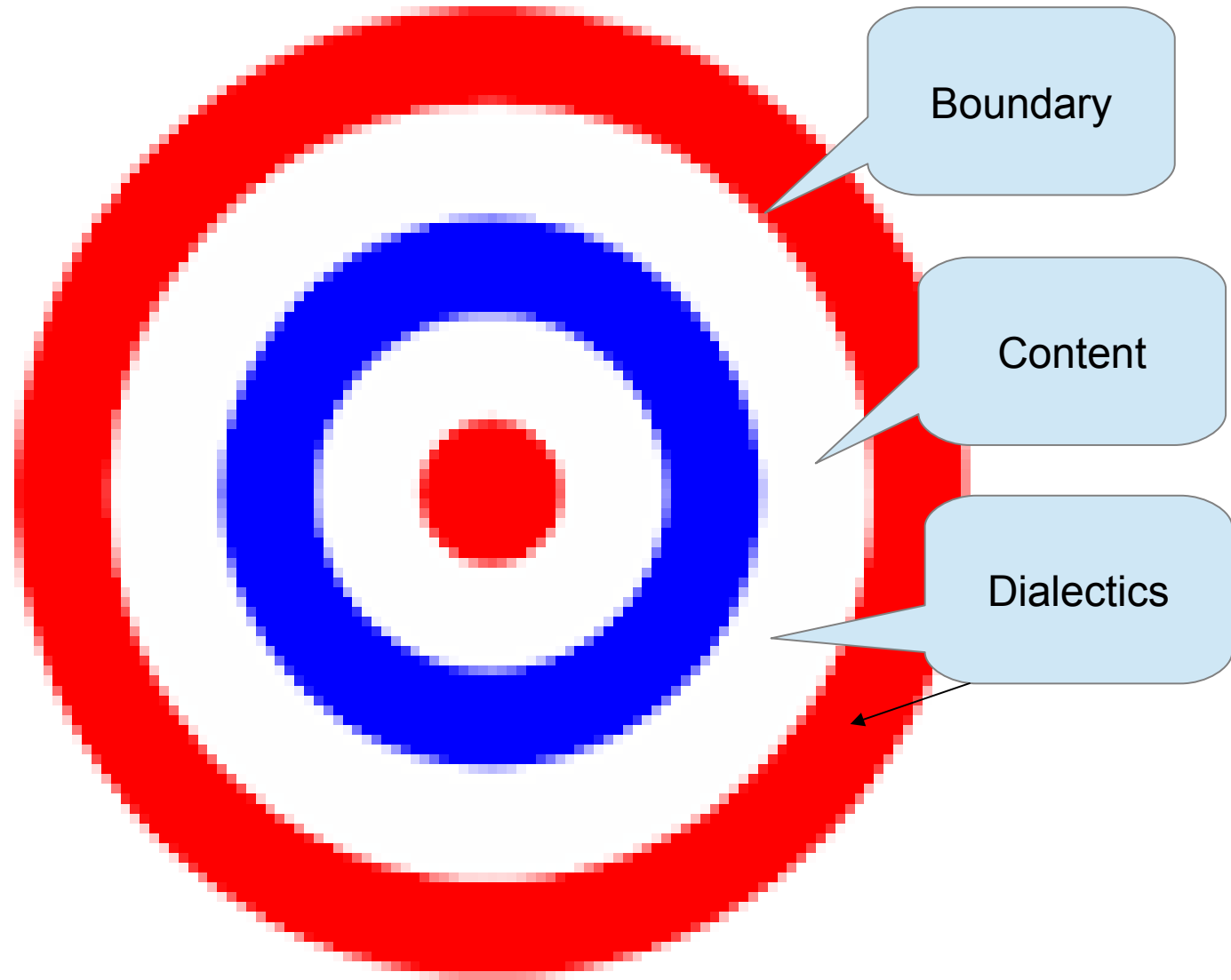
Are there boundaries?

... and who sets them? How?



GRANULARITY

Granularity of Discipline



Granularity Issue

Further details do add new knowledge; the one adding that detail and doing the specialized disciplinary work may ultimately turn out to be an interdisciplinarian. For example, the natural philosopher Newton was versant in physics, but now we have the minute specialty areas in which scientists can't even communicate with each other - each being a granule in the greater field of physics.

The end of discipline

Does information entropy result from the continued fractionalization of a discipline, analogous to the heat death of the universe?



SUFFICIENT AND NECESSARY

Sufficient and Necessary -

First, we have “sufficient”

$p \supset q$

If p , then q

" q if p "

" q is implied by p "

p is a sufficient condition for a consequent q . p is stronger than q . p GUARANTEES q .

Truth is tied to the consequent. What will allow q to occur?

human \supset mammal “human” is sufficient to have mammal, but not necessary, as there can be other beings that are mammals.

Is this the case?

If I have DISCIPLINARY (D) research then I will have REAL
PROBLEM SOLVING (P)

Sufficient and Necessary - Second, we have “necessary”

$p \subset q$

If q , then p , every time

" p if q "

" p is implied by q "

q is a necessary condition - state of affairs - coming from p .
 p is weaker than q . p GUARANTEES q .

Truth is tied to the consequent. What will allow q to occur?

mammal \subset human “mammal” is a necessity from having human,

Is this the case?

Returning to the nub of the problem

It is said that disciplinary research is necessary for science, but not sufficient for technological innovation.

But is it even sufficient for science?

Depends

We have discovered that any we apprehend exists because of what it is not, language is a web, boundaries are subjective, the content is contextual regarding it being interdisciplinary (Newton example), and science exists because of technology and vice versa. Interdisciplinary – because of dialectics, inability to establish boundary, and the web of language - is automatically part and parcel of what is being presented but to what degree? That depends upon granularity.

The Nature of Science and Technology

- Form - Substance
- Inductive - deductive
- Theory - Application
- Education – Training

- One is defined in terms of the other – dialectics.

Qualifications

- Real problem solving – what of problem (solutions to theoretical problems can lead to technological solutions, as well)
- Technological innovation (how defined?)
- Science
- Technology
- Granularity of “discipline”

You looked puzzled or are about ready to break out into laughter, throw rotten whatever or think there might actually be some philosophy to be had.

This critter? – He's my brother – nothing to do with the previous, but, he's quite the feller, don't you think? Add him into this discussion, too, if you'd like. It IS, after all, an interdisciplinary discussion.

