

FIELDS ARRANGED BY PURITY

→
MORE PURE

SOCIOLOGY IS
JUST APPLIED
PSYCHOLOGY

PSYCHOLOGY IS
JUST APPLIED
BIOLOGY.

BIOLOGY IS
JUST APPLIED
CHEMISTRY

WHICH IS JUST
APPLIED PHYSICS.
IT'S NICE TO
BE ON TOP.

OH, HEY, I DIDN'T
SEE YOU GUYS ALL
THE WAY OVER THERE.



SOCIOLOGISTS

PSYCHOLOGISTS

BIOLOGISTS

CHEMISTS

PHYSICISTS

MATHEMATICIANS

Hierarchies of Creative Domains:

Disciplinary Constraints on Blind
Variation and Selective Retention

Fundamental Question

- Is creativity “one or many”?
- If the former, then what is the single unifying process or procedure?
- If the latter, how do the various forms of creativity differ?
 - Does creativity vary willy-nilly?
 - Or, is there some method in the madness?

Integrative Solution

- Two independent intellectual traditions
 - Creativity contingent on disciplinary hierarchies
 - Creativity contingent on blind-variation and selective-retention (BVSR)
- Argument:
 - Disciplinary hierarchy largely defined by the degree that creativity is contingent on BVSR

Disciplinary Hierarchies

- Dichotomous distinctions
 - Plato (ca. 360 BCE): mathematics versus visual arts
 - Kant (1790): fine arts versus science
 - Kuhn (1972): paradigmatic versus pre-paradigmatic sciences
- Ordinal differentiations
 - Comte (1839-1842): astronomy, physics, chemistry, biology, sociology

Disciplinary Hierarchies

- Dichotomous distinctions
 - Plato (ca. 360 BCE): mathematics versus visual arts
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 - Kuhn (1972): paradigmatic versus pre-paradigmatic sciences
- Ordinal differentiations
 - Comte (1839-1842)
 - Bliss (1935):

FUNDAMENTAL SCIENCES,
and main classes of; the histories implied
Science in general.

A. Abstract sciences (formal).

1. Logic.
2. Mathematics.

B. Natural sciences.

- I. Physical sciences.
 3. Physics.

4. Chemistry.

Bb. Natural history.

II. Biological sciences.

5. Biology.

C. Psychological sciences.

6. Psychology.

III. Anthropological Sciences.

Cb. History of Humanity.

IV. Social sciences.

7. Sociology.

D. Arts, Knowledge of.

8. Philology.

BVSR Creativity

- Anticipators
 - Bain (1855); cf. Darwin (1859)
 - James (1880); cf. Darwin (1871)
 - Mach (1896)
 - Poincaré (1921)

BVSR Creativity

- Originators
 - Philosophical: Popper (1959, 1963, 1979)
 - Psychological: Campbell (1960, 1974)

BVSR Creativity

- Proponents
 - Philosophical: e.g., Briskman (1981/2009), Kantorovich (1993); Nickles (2003)
 - Psychological: e.g., Cziko (1998); Martindale (1990); Simonton (1988-2010); Staw (1990)

BVSR Creativity

- Opponents
 - Philosophical: e.g. Kronfeldner (2010); Thagard (1988)
 - Psychological: e.g. Dasgupta (2004); Gabora (2005, 2010); Sternberg (1998, 1999)

BVSR Creativity

- Misconceptions regarding blind variation
 - Blindness does not mean random; blindness can be systematic rather than stochastic
 - Blindness does not negate volition, but only imposes a disjoint between will and outcome
 - Blindness is not a qualitative property, but rather is a quantitative attribute defined by a bipolar blindness-sightedness dimension
- Above misconceptions all based on a false presumption of a Darwinian analogy

BVSR Creativity

- Unfortunately, Campbell's (1960) original formulation was too imprecise to carry the weight of BVSR theory
- Therefore, it is necessary to propose a formal (mathematical) definition
- The definition begins with a set of k hypothetical ideational variants that define the search space for a given problem (e.g., trial solutions)

Set of k Hypothetical Variants

Variant	Probability	Utility	Expectation
X_1	p_1	u_1	q_1
X_2	p_2	u_2	q_2
X_3	p_3	u_3	q_3
...
X_i	p_i	u_i	q_i
...
X_k	p_k	u_k	q_k

where $q_i = P(X_i | u_i)$

Yielding ...

Variant Typology

Type	p_i	u_i	q_i	Generation	Status	Designation
1	> 0	> 0	> 0	possible	true positive	sighted inclusion
2	> 0	> 0	$= 0$	possible	true positive	blind inclusion
3	> 0	$= 0$	$= 0$	possible	false positive	blind inclusion
4	$= 0$	> 0	> 0	impossible	false negative	blind exclusion
5	$= 0$	> 0	$= 0$	impossible	false negative	blind exclusion
6	$= 0$	$= 0$	$= 0$	impossible	true negative	sighted exclusion

N.B.: Variants with $u_i = 0$ but $q_i > 0$ expectations are ruled out of court

Blind-Sighted Continuum

- Blind-sighted measure of p - q coupling:
 $0 \leq C_{pq} \leq 1$:
- $C_{pq} = 0 \rightarrow$ perfect blindness
 - e.g., systematic scans; combinatorial searches; aleatoric creativity; genetic algorithms

Blind-Sighted Continuum

- Blind-sighted measure of p - q coupling:
 $0 \leq C_{pq} \leq 1$:
- $C_{pq} = 0 \rightarrow$ perfect blindness
- $C_{pq} = 1 \rightarrow$ perfect sightedness
 - e.g., domain-specific algorithmic methods that guarantee (routine) solutions

Blind-Sighted Continuum

- Blind-sighted measure of p - q coupling:
 $0 \leq C_{pq} \leq 1$:
- $C_{pq} = 0 \rightarrow$ perfect blindness
- $C_{pq} = 1 \rightarrow$ perfect sightedness
- $0 \ll C_{pq} \ll 1 \rightarrow$ intermediate blindness-sightedness
 - e.g., domain-general heuristic methods, such as means-end analysis, analogy, hill-climbing (steepest ascent), and trial and error (generate and test)

Empirical Integration

- Domains
- Creators
- Domain-Creator Correspondence

Domains

- Empirical research establishes the following hierarchy for six core scientific domains (Simonton, 2002, 2004; see also Fanelli, 2010; Prpić, 2008):

**Composite
score**

1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
-1.1

Physics

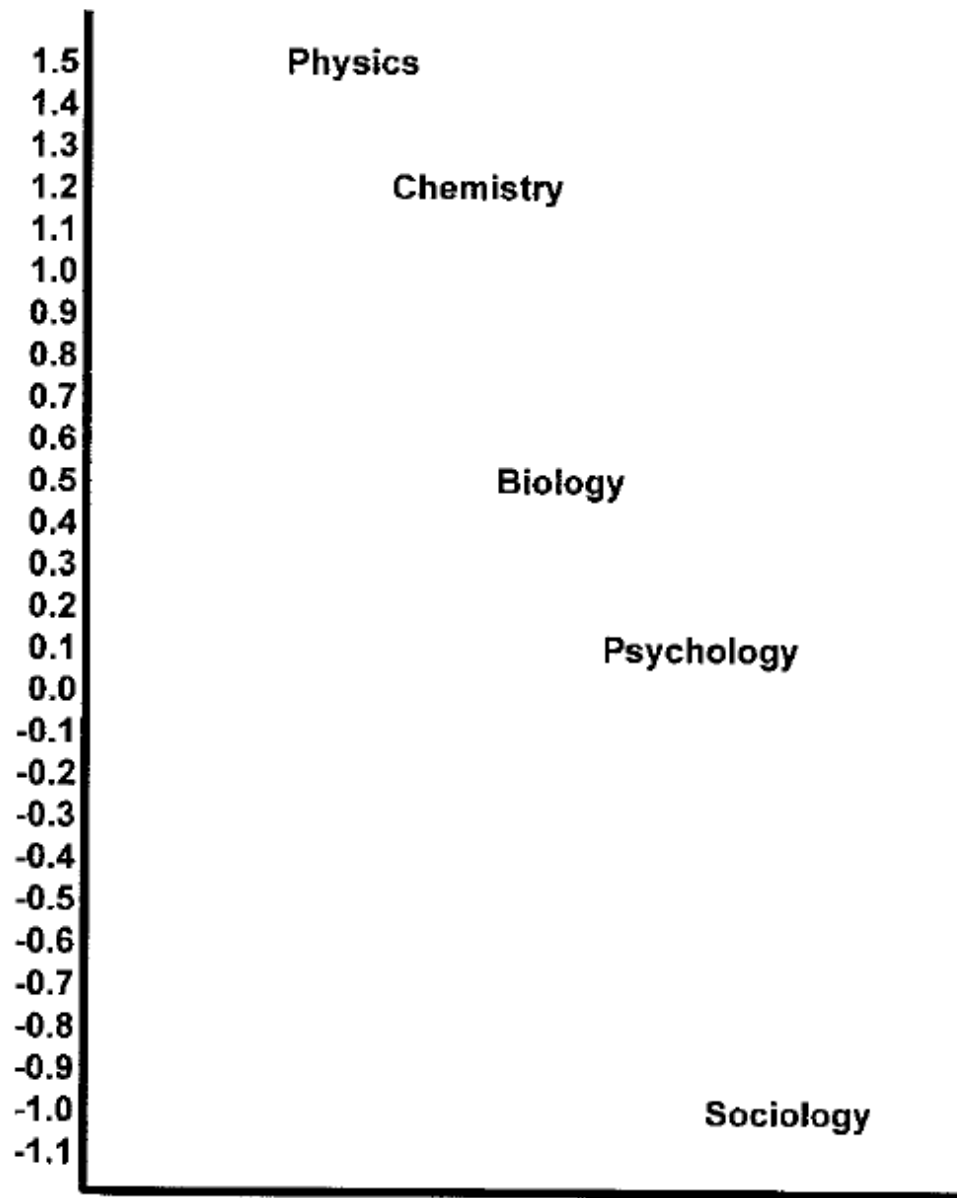
Chemistry

Biology

Psychology

Sociology

1 2 3 4 5
Rank in Hierarchy



Placement Criteria:

↓ Positive versus Negative ↓

- Citation concentration
- Citation immediacy
- Early impact rate
- Peer evaluation consensus
- Obsolescence rate
- Anticipation frequency
- Graph prominence
- Rated disciplinary hardness
- Lecture disfluency
- Theories-to-laws ratio
- Consultation rate
- Confirmatory hypothesis tests
- Objectivity in the scientist rather than in the research process
- Age at receipt of Nobel prize

Extrapolations and Interpolations

- Extrapolation to encompass the arts and humanities, with the humanities falling between the sciences and the arts: e.g.,
 - Obsolescence rate:
 - psychology/sociology > history > English
 - Lecture disfluency:
 - psychology/sociology < political science < art history < English (cf. philosophy)

Extrapolations and Interpolations

- Interpolation within creative domains:
 - Paradigmatic sciences in normal versus revolutionary stages (e.g., classical versus quantum physics)
 - Non-paradigmatic sciences with contrasting theoretical/methodological orientations (e.g., the natural-science versus human-science psychologies)
 - Formal versus expressive arts (i.e., Apollonian versus Dionysian; Classical versus Romantic; etc.)

Two Working Hypotheses

- *First*, the extended and differentiated hierarchy represents an underlying bipolar dimension expressing whether creativity in the domain tends to be
 - more logical, factual, objective, precise, formal, and consensual
 - versus
 - more irrational, imaginative, subjective, ambiguous, expressive, and individualistic

Two Working Hypotheses

- *Second*, the former bipolar dimension determines the extent to which domain creativity is dependent on BVSR, that is,
 - for disciplines high in the hierarchy, dependence is low (i.e., the modal problem-solving episode has $\sim .5 < C_{pq} < 1$), whereas
 - for disciplines low in the hierarchy, dependence is high (i.e., the modal problem-solving episode has $0 < C_{pq} < \sim .5$)

Creators

- BVSR in part depends on specific
 - Dispositional traits:
 - cognitive processes
 - openness to experience
 - psychopathology
 - Developmental experiences:
 - home environment
 - birth order
 - education and training
 - mentors and role models
 - sociocultural *Zeitgeist*

Domain-Creator Correspondence

- Thus, the more a domain depends on BVSR, the higher the concentration of creators in that domain who have the corresponding dispositional traits and developmental experiences
- In particular ...

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DISPOSITION

*more constrained, predictable,
logical, conscious, deliberate,
simple, non-versatile*

← Cognitive processes →

*more unconstrained,
unpredictable, illogical,
intuitive, involuntary,
complex, versatile*

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DISPOSITION

more restricted, focused attention, fewer interests, serendipity rare

← Openness to experience →

more unrestricted, defocused attention, many diverse interests, serendipity common

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DISPOSITION

*lower incidence rate, less severe
symptoms*

← Psychopathology →

*higher incidence rate, more
severe symptoms*

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DEVELOPMENT

*more conventional, stable,
homogeneous*

← Home environment →

*more unconventional, unstable,
heterogeneous*

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DEVELOPMENT

more likely firstborn

← Birth order →

more likely later born

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DEVELOPMENT

*superior grades, more
formal training, less
likely marginal*

← Education and training →

*inferior grades, less formal
training, more likely
marginal*

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DEVELOPMENT

fewer, more homogeneous

← Mentors and role models →

*more numerous,
heterogeneous*

Low Dependence on BVSR ← CREATIVITY → *High Dependence on BVSR*

DOMAIN

Scientific

Artistic

Paradigmatic

Non-paradigmatic

Formal,
classical

Expressive,
romantic

Normal

Revolutionary

DEVELOPMENT

← Sociocultural *Zeitgeist* →

*more politically stable,
culturally uniform*

*more politically unstable,
culturally diverse*

Confessions

- Despite empirical support, this is a speculative sketch only
- Two primary limitations
 - First, the connection between BVSR and both domain and creator attributes needs to be more precisely articulated
 - e.g., birth order vis-a-vis latent inhibition
 - Second, differences among disciplines most likely multidimensional
 - e.g., pure versus applied domains

Confessions

- Nonetheless, I maintain that the current sketch provides a promising framework for future research on creativity
- In particular, we should be able to establish that ...

CREATORS AND DOMAINS VARY ACCORDING TO RELATIVE BVSR DEPENDENCE

← MORE BVSR

LESS BVSR →

