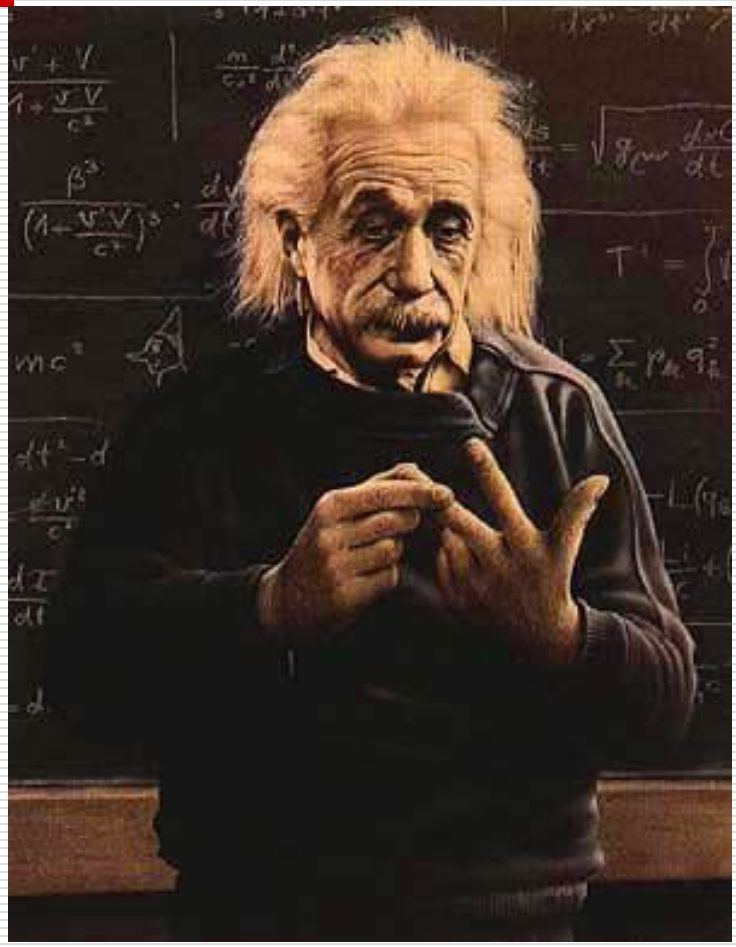


Little-c creativity, Big-C Creativity

Formal Definitions and Implications

What is creativity?

The Problem:

- Can research on creativity be productive without consensus on what it entails?
- In particular, what is a “creative idea”?
- Can we really study creative talent or its development without knowing what counts as a creative idea?
- After all, the product, person, and process perspectives on creativity all depend on what counts as a creative idea

Past reviews and discussions

- Plucker, Beghetto, & Dow (2004)
- Runco & Jaeger (2012)
- Simonton (2012)
- Piffer (2012)

Four critical questions:

- What are the assessment criteria?
- How are the assessments scaled?
- How are the assessments integrated?
- Who makes the assessments?

What are the assessment criteria?

- Two-criterion definitions
  - Some variation on
    - novel or original, and
    - useful, adaptive, or functional
- But I would argue that "novelty" conflates "originality" with "surprise"
- If we split the concept into two, then we get a three-criterion definition: originality, utility, and surprise

What are the assessment criteria?

- Three-criterion definitions
  - US Patent Office:
    - new, useful, and nonobvious
  - Boden (2004):
    - novel, valuable, and surprising
  - Amabile (1996):
    - novel
    - appropriate, useful, correct, or valuable
    - heuristic rather than algorithmic

How are the assessments scaled?

- Qualitative? Yes/No?
- Quantitative? Numbers?
  - Ordinal? Ranks?
  - Interval? Continuous?
  - Ratio? Zero point?
  - Proportion or probability? 0-1?
    - My preference for latter

How are the assessments integrated?

- Additive?
- Multiplicative?
  - Why the latter > former
    - The reinvented wheel?
    - The bank safe made out of soap bubbles?

Who makes the assessments?

- The individual?
  - "little-c creativity"
  - "P-creative" (Boden, 2004)
- The field?
  - "Big-Creativity"
  - "H-creative" (Boden, 2004)
- Hence, need for individual- and field-level definitions

Individual-level definition

- Given k ideas x_1, x_2, x_3, … x_i, … x_k, how do we gauge their creativity?
- Three parameters:
  - *personal probability* p_i,
    - where $0 \leq p_i \leq 1$
  - *personal utility* u_i,
    - where $0 \leq u_i \leq 1$
  - *personal obviousness* v_i,
    - where $0 \leq v_i \leq 1$

Individual-level definition

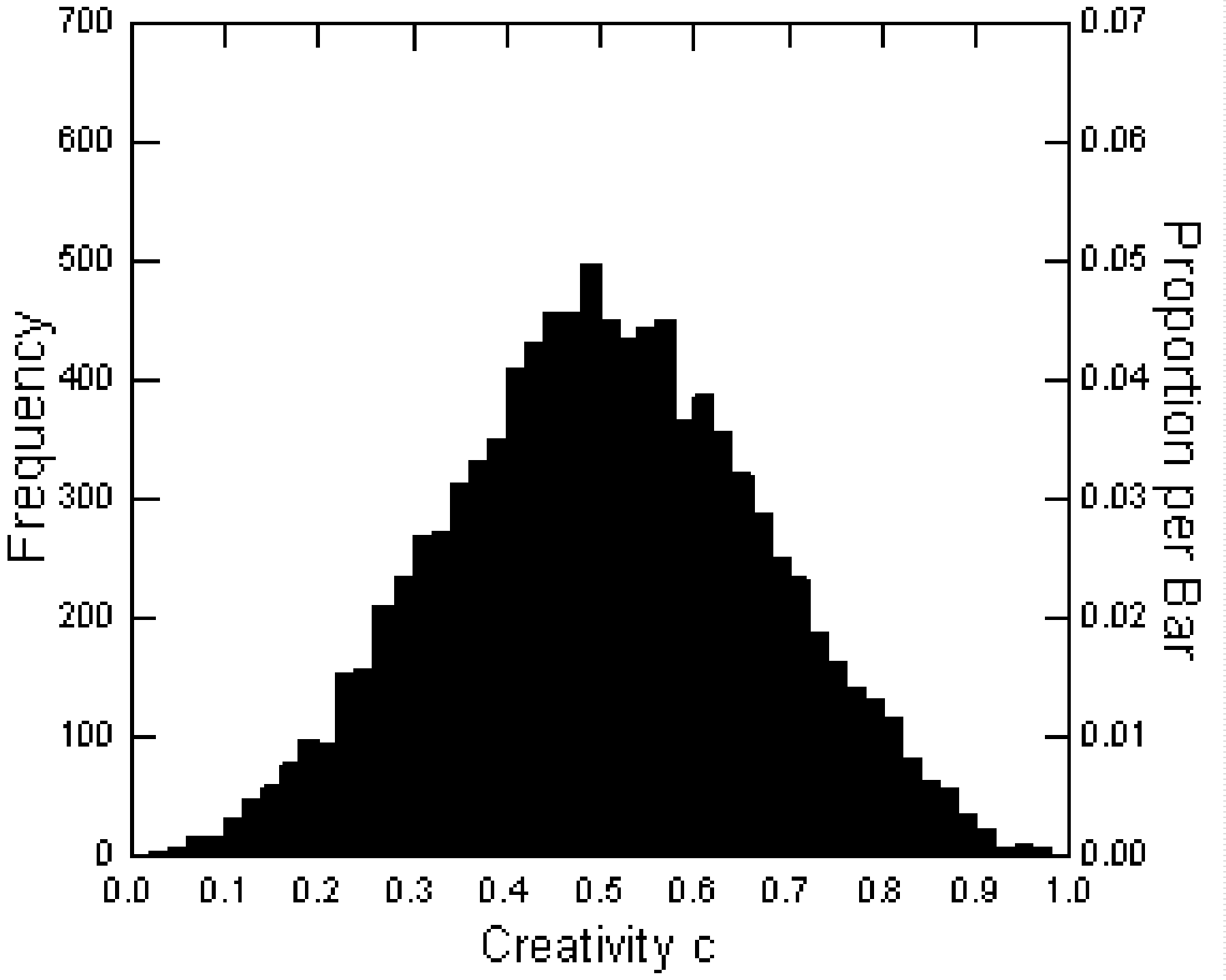
- N.B.: $p_i = 0$ only when idea x_i is not initially available to the individual without entering an "incubation period"
- An serendipitous priming stimulus initiates the "spreading activation" that eventually yields $p_i > 0$
- Hence, a eureka or aha! experience

Individual-level definition

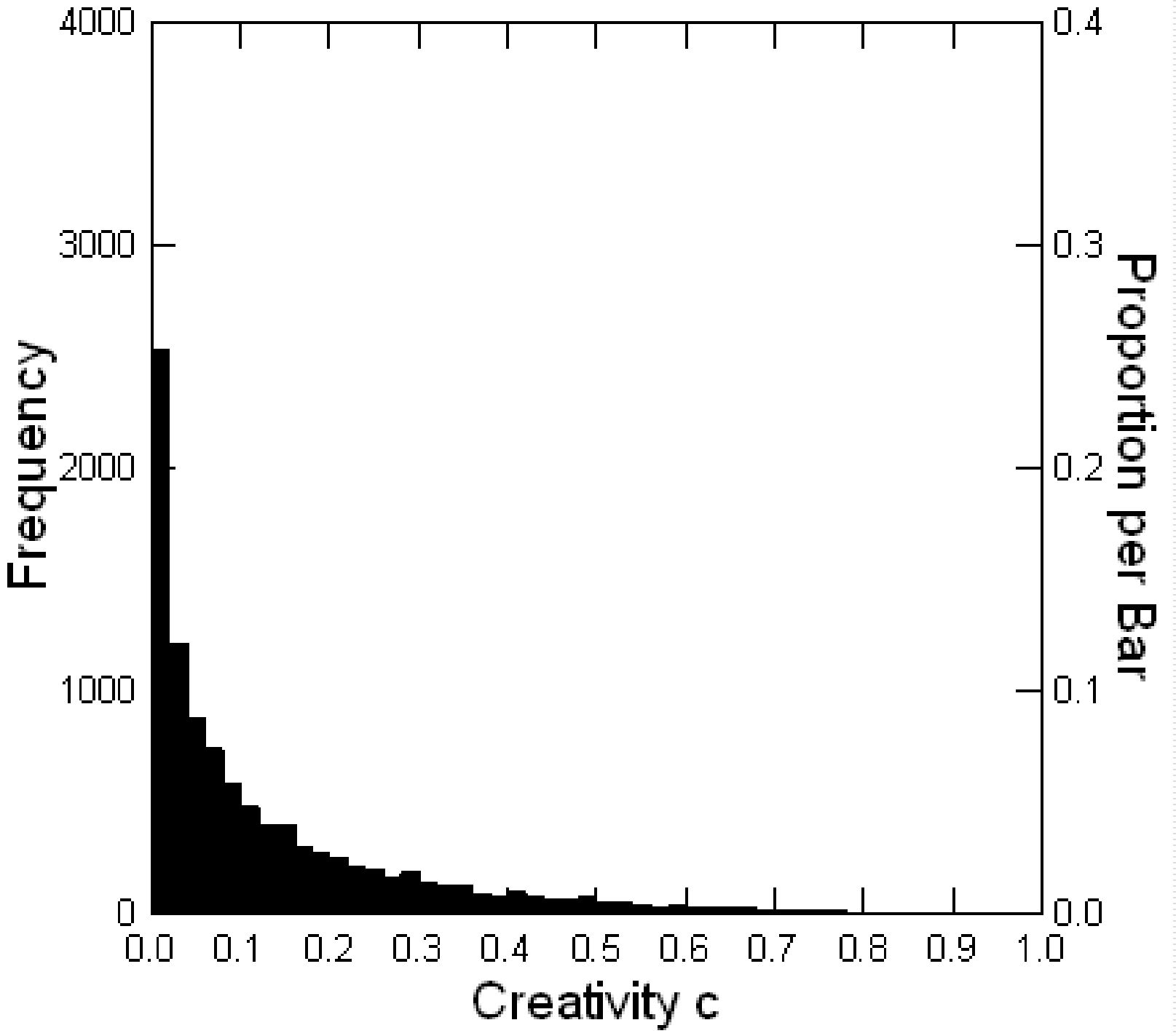
- Derived parameters
  - *personal originality* $(1 - p_i)$,
    - where $0 \leq (1 - p_i) \leq 1$
  - *personal surprisingness* $(1 - v_i)$,
    - where $0 \leq (1 - v_i) \leq 1$
- Therefore, *personal creativity*
  - $c_i = (1 - p_i)u_i(1 - v_i)$,
    - where $0 \leq c_i \leq 1$
  - literally "little-c" creativity

Individual-level definition

- Two significant implications
  - First – Whereas in the
    - Additive model personal creativity has normal distribution, in the
    - Multiplicative model personal creativity has skewed distribution … as in …


700
600
500
400
300
200
100
0
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Frequency
Proportion per Bar
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Creativity c

versus


4000
3000
2000
1000
0
Frequency
0.4
0.3
0.2
0.1
0.0
Proportion per Bar
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Creativity c

Individual-level definition

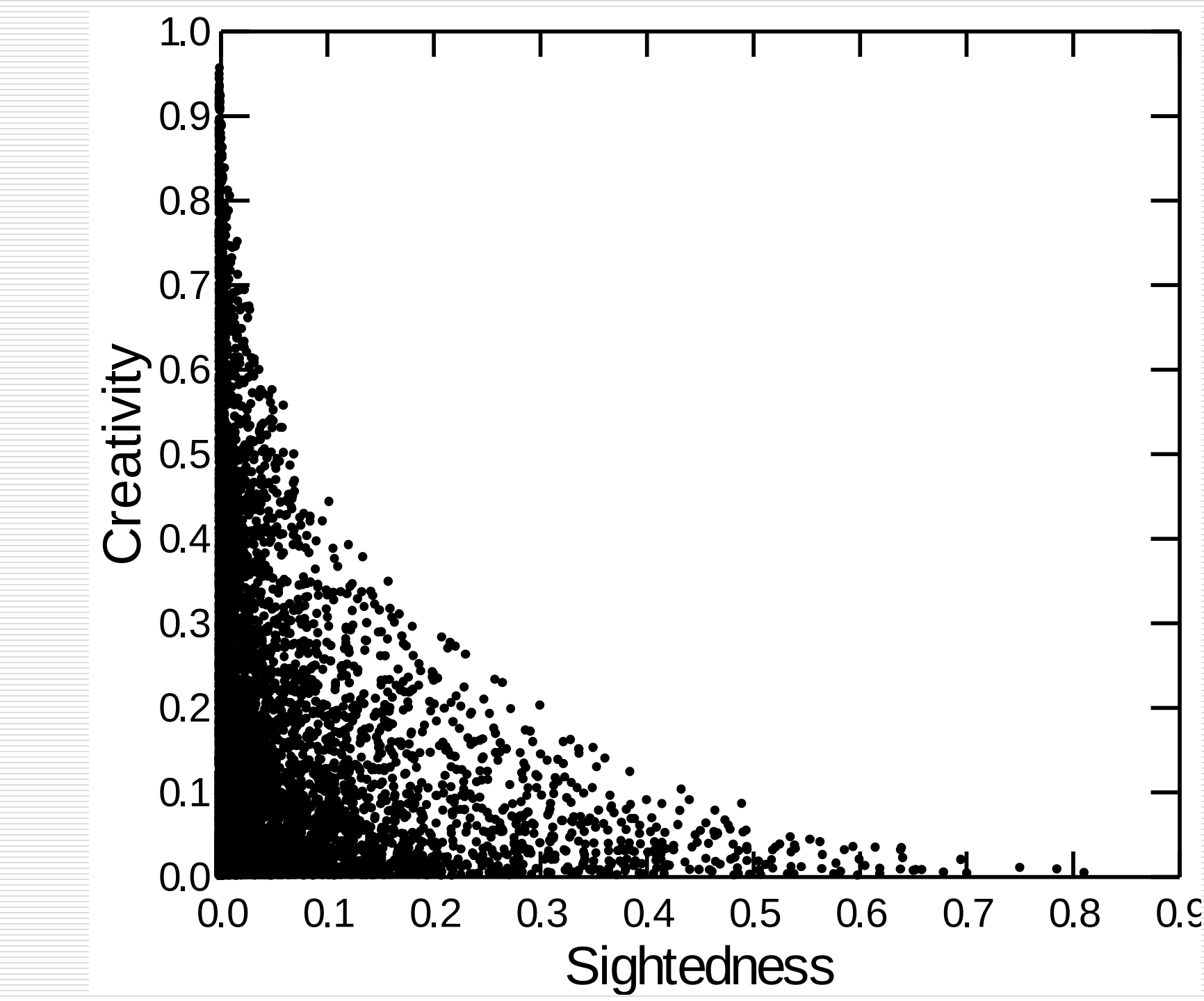
- Two significant implications
  - Second –
    - The necessity for BVSR creativity,
    - i.e., blind variation and selective retention (Campbell, 1960; Simonton, 1985-2013)
    - That is, ideas that are highly sighted cannot be creative whereas highly blind ideas can vary greatly in creativity, requiring a selection-retention procedure to winnow out the wheat from the chaff
    - To demonstrate …

Individual-level definition

- Two significant implications
  - Second –
    - The sightedness of x_i is given by
      - $s_i = p_i u_i v_i$, where $0 \leq s_i \leq 1$
      - i.e., an idea is highly sighted to the degree that it is highly probable, highly useful, and highly probable because it is already known to be highly useful
      - The sightedness of the entire set of k ideas is given by $S = 1/n \, \Sigma \, s_i$, where $0 \leq S \leq 1$

Individual-level definition

- Two significant implications
  - Second –
    - Hence, it follows that
      - the *blindness* of x_i is given by $b_i = 1 - s_i$
      - and the *blindness* of the entire set of k ideas is given by $B = 1 - S$.
    - Concentrating on single ideas, note that
      - as $b_i \rightarrow 0$, $c_i \rightarrow 0$; but that
      - as $b_i \rightarrow 1$, then max-$c_i \rightarrow 1$ but $\sigma_c^2 \rightarrow 1$
      - viz. the following scatter plot …


1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Creativity
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Sightedness

Now time to switch to

Big-C Creativity

Field-level definition

- Csikszentmihályi's (1990) systems perspective
  - Domain "the parameters of the cultural symbol system" (p. 190)
  - Field "individuals who know the domain's grammar of rules and are more or less loosely organized to act as gatekeepers to it" (p. 201)
    - Field size = *n* (including the individual),
      - where $250 \leq n \leq 600$ (Wray, 2010)

Field-level definition

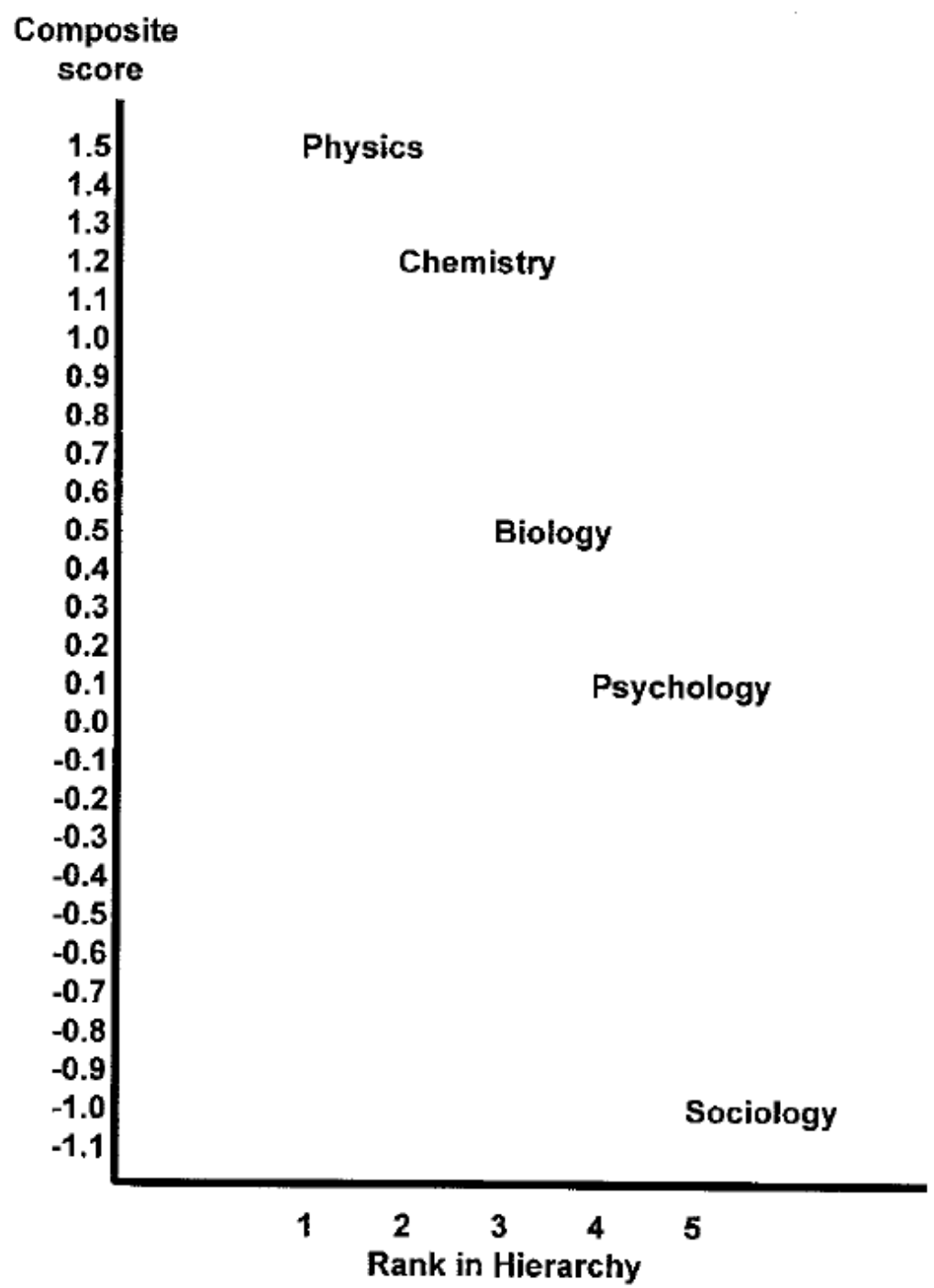
- If M_j identifies the jth field member:
  - $P_i = 1/n \Sigma p_{ji}$, = *consensual probability*
  - $U_i = 1/n \Sigma u_{ji}$, = *consensual utility*
  - $V_i = 1/n \Sigma v_{ji}$, = *consensual obviousness*; and
  - $C_i = 1/n \Sigma c_{ji}$, = *consensual creativity*,
    - or literally its "Big-C" creativity
- where all values are positive decimals ranging from 0 to 1

Field-level definition

- Yet given that the consensual parameters are averages we must define the following variances:
  - $\sigma^2(p) = 1/n \Sigma (p_{ji} - P_i)^2$,
  - $\sigma^2(u) = 1/n \Sigma (u_{ji} - U_i)^2$,
  - $\sigma^2(v) = 1/n \Sigma (v_{ji} - V_i)^2$, and
  - $\sigma^2(c) = 1/n \Sigma (c_{ji} - C_i)^2$
  - where all variances range from 0 to 1

Field-level definition

- Hence, crucial distinction among
  - High-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx 0$,
  - Medium-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx .5$, and
  - Low-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx 1$
- To illustrate, in the sciences …


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

Field-level definition

- Hence, crucial distinction between
  - High-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx 0$,
  - Medium-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx .5$, and
  - Low-consensus fields where
    - $\sigma^2(p) \approx \sigma^2(u) \approx \sigma^2(v) \approx \sigma^2(c) \approx 1$
- These variances are absolutely critical in calibrating the relation between little-c and Big-C creativity!

Individual-field creativity comparisons

- Assume idea x_i was created by individual M_1
- Hence, the contrast is between c_{1i} and C_i
- Although the latter includes the former, any part-whole bias shrinks as n increases or as $\sigma^2(c)$ decreases

Individual-field creativity comparisons

- Creativity evaluations in high- versus low-consensus fields
  - High-consensus fields
    - $P_i \approx p_{1i}$, $U_i \approx u_{1i}$, $V_i \approx v_{1i}$, and $C_i \approx c_{1i}$
    - "neglected genius" extremely rare

Individual-field creativity comparisons

- Creativity evaluations in high- versus low-consensus fields
  - Low-consensus fields
    - *Case 1*: $C_i > c_{1i}$ ("attributed talents")
    - *Case 2*: $C_i < c_{1i}$ ("neglected geniuses")
    - *Case 3*: $C_i \approx c_{1i}$
      - Individual M_1 "typical" of field
      - $C_i \approx c_{1i}$ does *not* imply that $P_i \approx p_{1i}$, $U_i \approx u_{1i}$, and $V_i \approx v_{1i}$ except when $C_i \approx c_{1i} \approx 1$

Individual-field creativity comparisons

- Personal versus consensual creativity measurement in low-consensus fields
  - As $\sigma^2(c) \rightarrow 1$, then a large proportion of the field would arrive at the value $c_{ji} = 0$ ($j \neq 1$)
  - Moreover, increased difficulty of calibrating the transition from "little-c" to "Big-C" creativity
  - e.g., the CAQ (Carson, Peterson, & Higgins, 2005):

H. Scientific Discovery

__0. I do not have training or recognized ability in this field (Skip to Theater

__1. I often think about ways that scientific problems could be solved.

__2. I have won a prize at a science fair or other local competition.

__3. I have received a scholarship based on my work in science or medicine.

__4. I have been author or coauthor of a study published in a scientific journal.

*__5. I have won a national prize in the field of science or medicine.

*__6. I have received a grant to pursue my work in science or medicine.

__7. My work has been cited by other scientists in national publications.

E. Creative Writing

__0. I do not have training or recognized talent in this area (Skip to Humor).

__1. I have written an original short work (poem or short story).

__2. My work has won an award or prize.

__3. I have written an original long work (epic, novel, or play).

__4. I have sold my work to a publisher.

__5. My work has been printed and sold publicly.

__6. My work has been reviewed in local publications.

*__7. My work has been reviewed in national publications.

Two Implications

- First –
  - Big-C creativity is not just a simple quantitative extension of little-c creativity, but represents a distinct set of field assessments that may or may not dovetail with those operating at the individual level

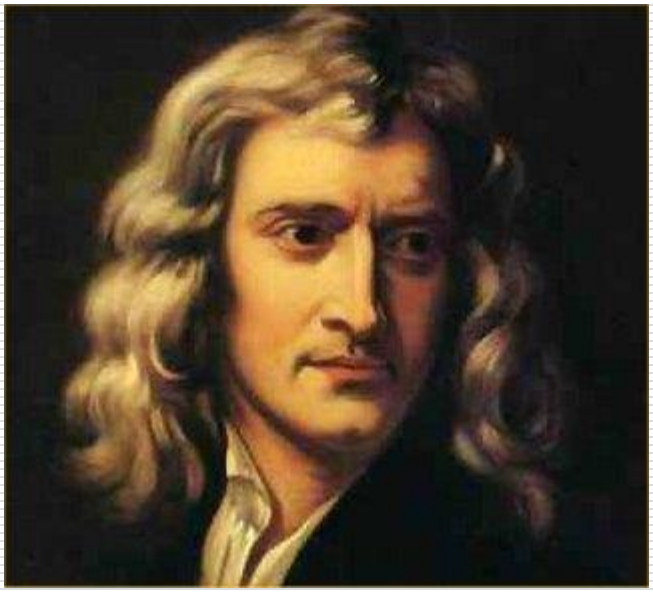
Extremely High Consensus

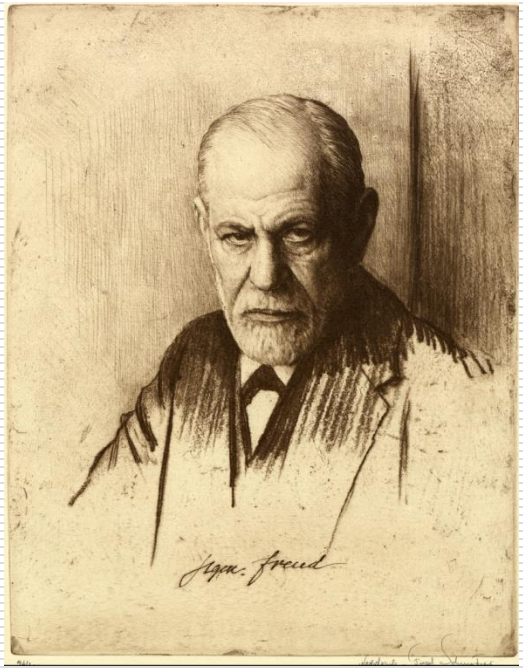
Moderate Consensus

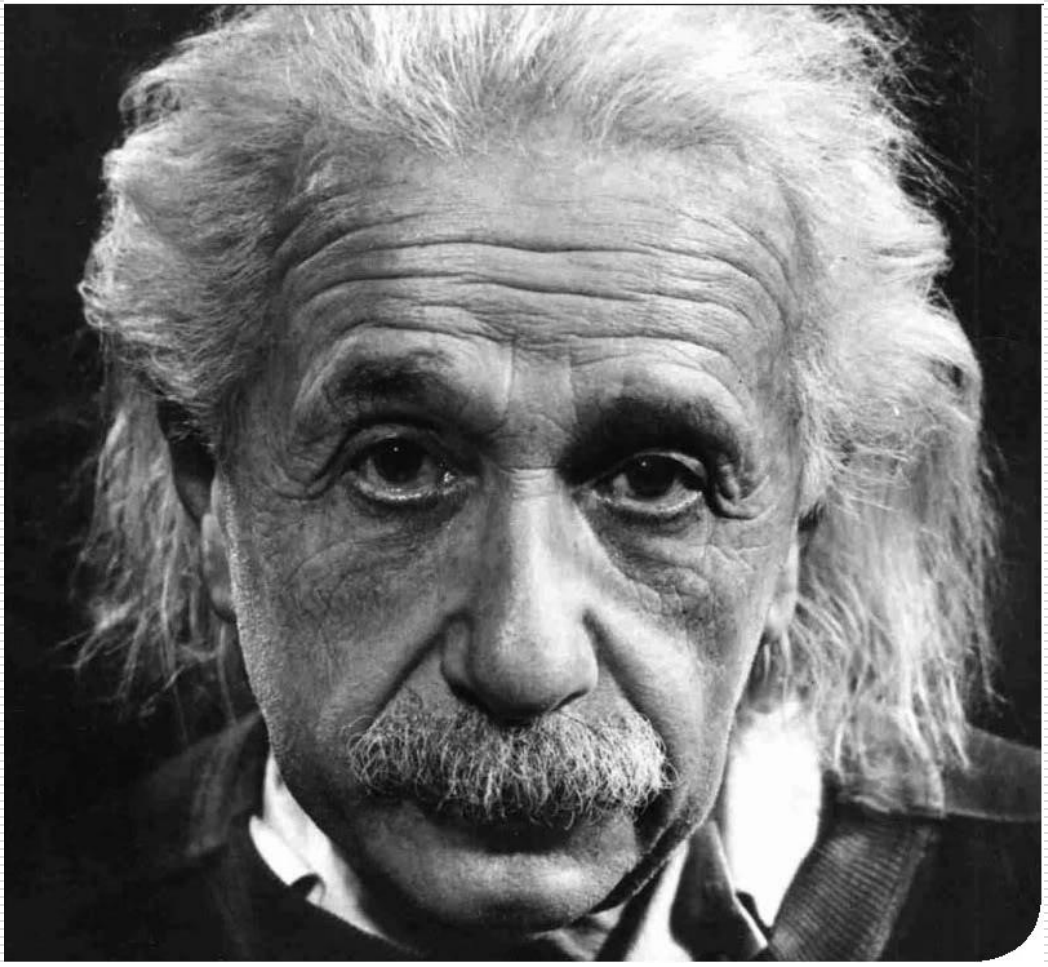
Extremely Low Consensus

Two Implications

- Second –
  - Creative talent and its development must differ for
    - high-consensus versus low-consensus fields, and
    - little-c versus Big-C creativity
- Or stated more visually …




Sigm. Freud



ALBERT EINSTEIN

vs

Robert Einstein