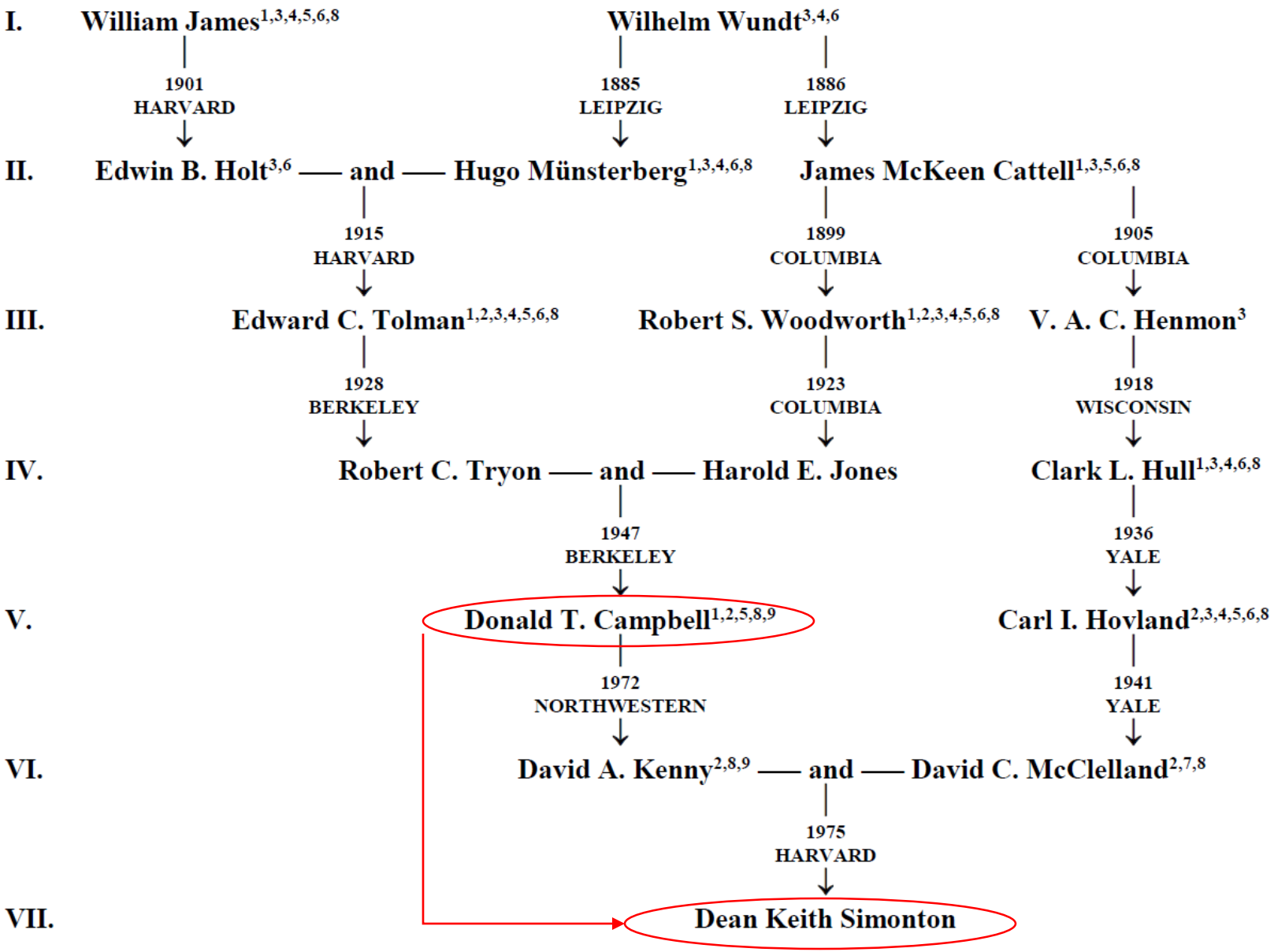
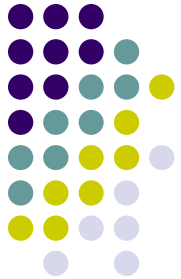
A Genealogy of Direct Doctoral Descent





Creativity as Blind Variation and Selective Retention:

Campbell's BVSR as Philosophy and Psychology

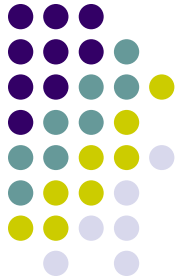
Introduction

- Donald T. Campbell's (1960) "Blind variation and selective retention in creative thought as in other knowledge processes"
  - Stimulated controversy for the next half century
  - Furthermore, this controversy engaged both philosophers and psychologists
    - where proponents and opponents represent both disciplines:
    - The positions on the debate cut across disciplinary lines

Introduction

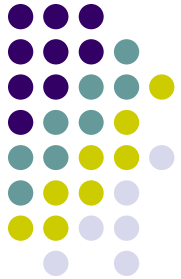
- Hence, here I will examine BVSR as
  - a philosophical proposition, and
  - a psychological hypothesis
- arguing that the two are mutually reinforcing

BVSR as philosophical proposition



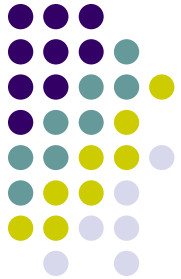
- Though published in *Psychological Review*, the philosophical nature of BVSR was clear
  - First, Campbell quoted at great length Alexander Bain (1855), Paul Souriau (1881), Ernst Mach (1896), and Poincaré (1921)
  - Second, as implied by the title, Campbell was clearly concerned with epistemology – the "knowledge processes"
- Indeed, according to one *PR* editor, this paper could not be published in *PR* today!

BVSR as philosophical proposition



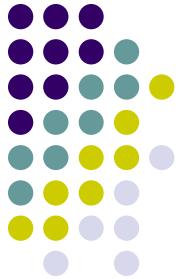
- In addition, rather than develop BVSR's psychological side, Campbell (1974) chose to elaborate the philosophical aspect into his well-known *evolutionary epistemology*
- an elaboration that had explicit connections with the ideas of "conjectures and refutations" in Karl Popper's (1963) philosophy of science developed at almost the same time
- to wit, "blind variation" ≈ "bold conjecture"

BVSR as philosophical proposition



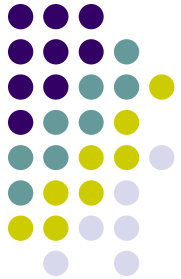
- It was this later version of Campbell's theory that had such a big impact on philosophical thinking both
  - *Pro* (Bradie, 1995; Briskman, 1980/2009; Heyes & Hull, 2001; Kantorovich, 1993; Nickles, 2003; Stein & Lipton, 1989; Wuketits, 2001), and
  - *Con* (Kronfeldner, 2010; Thagard, 1988, 2012)

BVSR as philosophical proposition



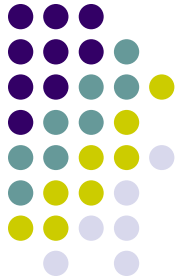
- That said, Campbell's (1960) theory was never really adequate logically because
  - One, he never even loosely defined creativity!
  - Two, his definition of "blindness" was "connotative" rather than "denotative"
- Later, he tried to remedy the latter by introducing alternative terms, such as "unjustified," but without appeasing his critics
- Campbell, in fact, missed a golden opportunity, for if he had provided precise formal definitions, the relation between BVSR and creativity would be shown to be essential rather than hypothetical →

BVSR as philosophical proposition



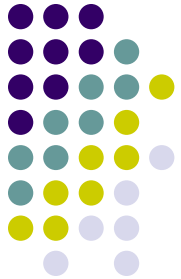
- At the onset of any given problem-solving episode, let a potential solution be defined by the following three *subjective* parameters:
  - *initial* generation probability: p, where $0 \leq p \leq 1$
    - e.g., whether or not an "incubation" period is required
  - *final* utility: u, where $0 \leq u \leq 1$
    - e.g. probability of selection and retention in product
  - *prior* knowledge of u: v, where $0 \leq v \leq 1$
    - e.g., ignorance to educated guess to full expertise (cf. Plato's "justified true belief" in *Theaetetus*)

BVSR as philosophical proposition



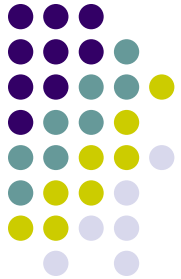
- The *personal* creativity of the potential solution is given by the multiplicative function:
  - $c = (1 - p)u(1 - v)$, again $0 \leq c \leq 1$, where
    - $(1 - p)$ = the idea's subjective *originality*, and
    - $(1 - v)$ = the idea's subjective *surprise*
  - i.e., to be creative is to be original, useful, and surprising, where the multiplicative function ensures that unoriginal, useless, and/or obvious ideas cannot be deemed creative
  - cf. Boden (2004): novel, valuable, and surprising; US Patent Office: new, useful, and nonobvious

BVSR as philosophical proposition



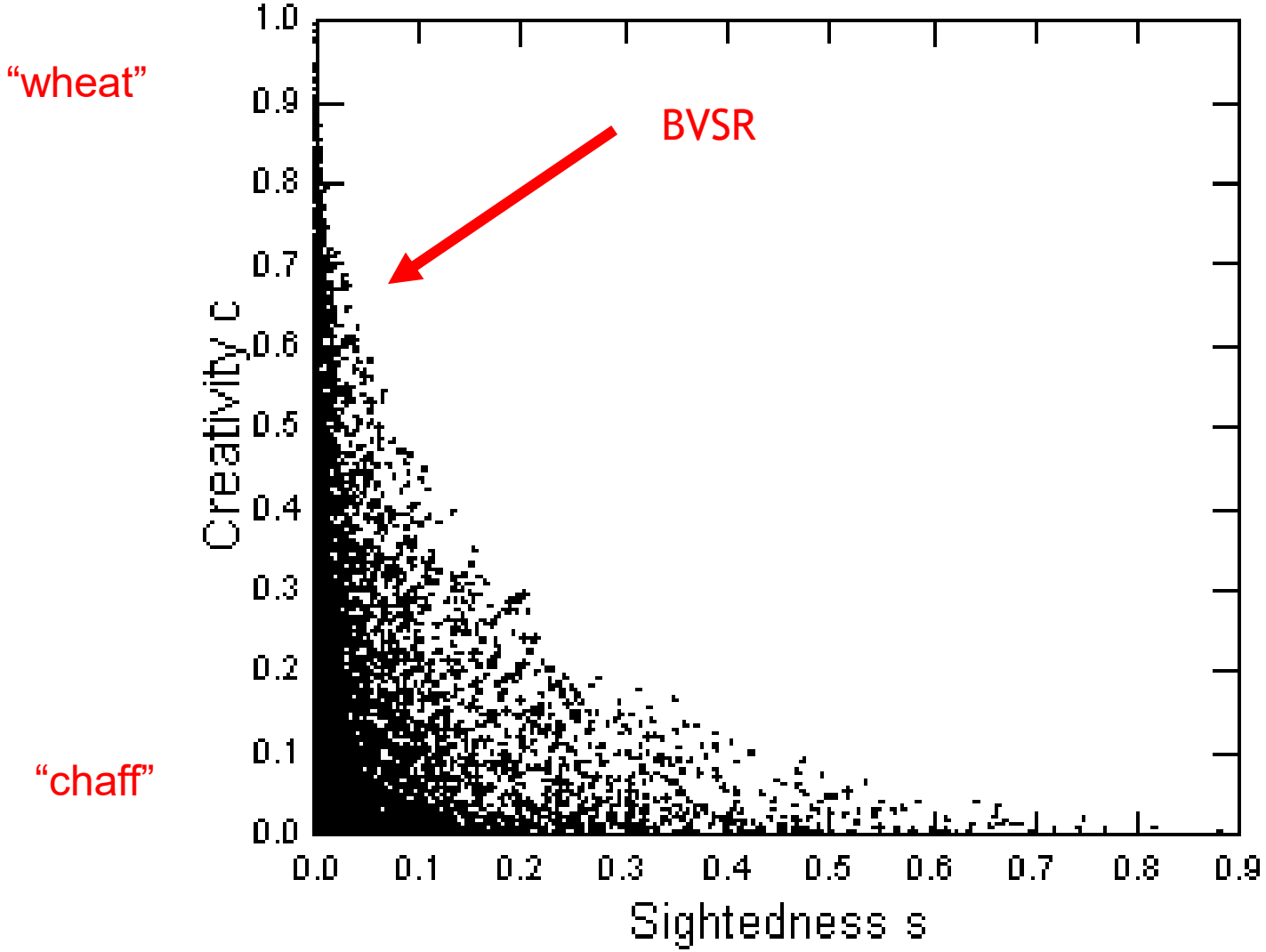
- In contrast, the sightedness *s* of a potential solution is given by: $s = puv$,
  - where $0 \leq s \leq 1$ and $s = 1$ when $p = u = v = 1$
  - This represents pure "positive" expertise: a potential solution has a high initial probability because it has a high utility and that high utility is already well known in advance
    - Using sightedness rather than blindness avoids the unfortunate associations that have accrued to the latter
  - N.B.: This conception of sightedness was initially inspired by Elliot Sober's (1992) formal definition of what would constitute a directed mutation (but here expanded to handle multiple variants and explicitly allow for degrees of sightedness; cf. Simonton, 2010)

BVSR as philosophical proposition

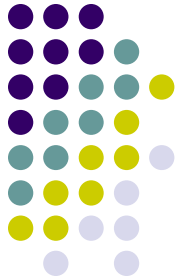


- It then mathematically follows that …
  - *First,* highly sighted ideas cannot be highly creative
    - i.e., as $s \rightarrow 1$, min $c = 0$ and max $c \rightarrow 0$
  - *Second*, highly unsighted ideas can vary from the highly creative to the highly uncreative
    - i.e., as $s \rightarrow 0$, min $c = 0$ but max $c \rightarrow 1$
    - In words, as sightedness decreases, the range in creativity increases
- Illustration from a Monte Carlo simulation …

BVSR as philosophical proposition

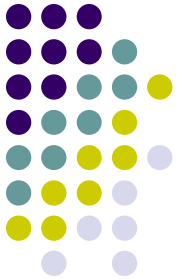


BVSR as philosophical proposition



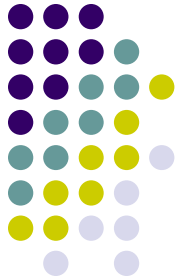
- Consequently, BVSR has an essential relation with creativity
  - In particular, it remains the *only* method available to distinguish between
    - $p \to 0$, $u \to 1$, and $v \to 0$,
      - the highly creative idea, versus
    - $p \to 0$, $u \to 0$, and $v \to 0$,
      - a useless but equally original idea with unknown utility
  - In a nutshell, BVSR is used to assess utilities when we do not already know them
  - We are “blind” to the actual and precise utility

BVSR as philosophical proposition



- Three brief implications regarding:
  - Plato's *Meno's* paradox (cf. Nickles, 2003): "inquiry is either unnecessary or impossible"
  - The "No Free Lunch" theorems (Wolpert & Macready, 1997): "All optimization algorithms perform equally well when averaged over all possible problems" (Simon, 2013, p. 614)
  - BVSR as mere evolutionary analogy: "A remarkable parallel, which I think has never been noticed …" (James, 1880, p. 441; cf. Simonton, 2018)

BVSR as philosophical proposition



- Plato's *Meno* problem
  - Q: How do we know that we know something without knowing it in advance?
  - A: We don't – we can only engage in BVSR to test hypotheses or conjectures against a given utility criterion
  - Indeed, we may even have to use BVSR
    - to identify the best utility criterion or
    - to distinguish solvable from unsolvable problems
  - In fact, as prior knowledge increases (i.e., $v \rightarrow 1$) surprise decreases, so less knowledge is gained

BVSR as philosophical proposition

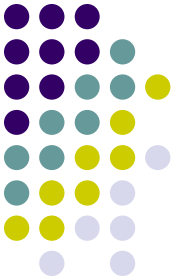
- The “No Free Lunch” Theorems
  - Q: How do we know that BVSR provides the optimal procedure for finding the best solution?
  - A: We know it doesn’t – BVSR provides the *only* universal procedure for finding the most creative idea should any maximally creative idea exist
    - BVSR can even be used to create an algorithm for optimally solving future problems of a similar type
    - Yet when that happens, any solution generated by that algorithm will cease to be creative (as $s \rightarrow 1$, $c \rightarrow 0$)
      - e.g. solving quadratic equations with the quadratic formula

BVSR as philosophical proposition

- BVSR as “remarkable parallel”
  - Q: Given all of the obvious differences between human creativity and biological evolution, how can the analogy be trusted to yield scientific insights?
  - A: BVSR is *not* contingent upon accepting the descriptive value of a conjectured analogy but rather derives directly and logically from the three-criterion definition of personal creativity!
    - Campbell (1960) did not explicitly stipulate the analogy
    - Bain (1855) proposed a proto-BVSR prior to Darwin which the latter overlooked (despite Fanny): e.g. …

“The greatest practical inventions being so much dependent upon chance, the only hope of success is to multiply the chances by multiplying the experiments” (Bain, 1855/1977, p. 597).

BVSR as philosophical proposition

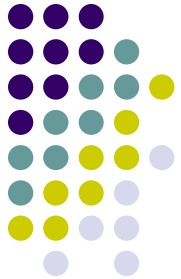


- BVSR as “remarkable parallel”
  - Indeed, that’s why the concept repeatedly reappears under different terms: e.g.,
    - trial and error (also Bain, 1855/1977)
    - illumination and verification (Wallas, 1926)
    - generate and test (various AI algorithms)
    - “spontaneous behavior” plus selection by consequences (Epstein, 1991; Skinner, 1981)
  - All assume that generated potential solutions must be evaluated to isolate actual solutions

BVSR as psychological hypothesis

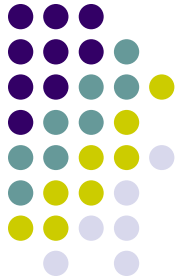
- Although Campbell (1960) made a minimal attempt at grounding BVSR in empirical psychological research, subsequent BVSR advocates in psychology attempted to do so (viz., Damian & Simonton, 2011; Martindale, 1990; Simonton, 1985, 1988, 1999, 2007, 2009, 2010, 2012, 2018; cf. Tsao, Ting, & Johnson, 2019, for more analytical approach)

BVSR as psychological hypothesis



- Yet these later attempts have attracted considerable criticisms as well (e.g., Dasgupta, 2004, 2010, 2011; Ericsson, 1999; Gabora, 2005, 2007, 2010, 2011; Russ, 1999; Schooler & Dougal, 1999; Sternberg, 1998, 1999; Weisberg, 2004, Weisberg & Hass, 2007)

BVSR as psychological hypothesis

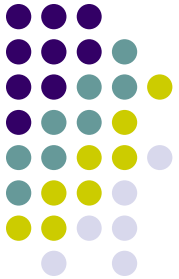


- However, if the previous philosophical analysis has any validity, then the BVSR-creativity connection may not be an entirely empirical question!
- Rather, the BVSR-creativity relation might be partly comparable to a statement like “all bachelors are unmarried men” – albeit far more nuanced because blindness and creativity are not equivalent

BVSR as psychological hypothesis

- In particular, although “all bachelors are unmarried men” is necessarily true (in the English language), and
- the statement that “all highly creative ideas are highly unsighted” is also necessarily true (viz., $c \rightarrow 1$ as $p \rightarrow 0$, $u \rightarrow 1$, and $v \rightarrow 0$, but then $s \rightarrow 0$)
- the statement that “all highly unsighted ideas are highly creative” is necessarily false (e.g., as $u \rightarrow 0$, then both $c \rightarrow 0$ and $s \rightarrow 0$)

BVSR as psychological hypothesis

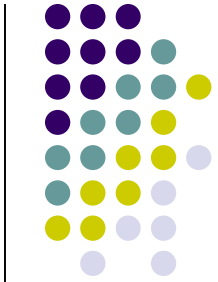


- Indeed, the last statement can be better converted into empirical questions:
  - What proportion of highly unsighted ideas are highly creative?
  - And does that proportion vary across individuals and domains?

BVSR as psychological hypothesis

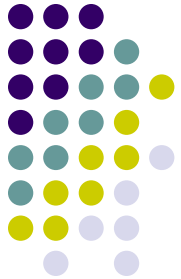
- Nor are those the only empirical questions elicited, for we also can ask:
  - What *cognitive processes* and *behavioral procedures* are most likely to generate ideas where $p \rightarrow 0$, $u \rightarrow 1$, and $v \rightarrow 0$?
  - What *personal characteristics* enable someone to engage in the foregoing cognitive processes and behavioral procedures?
  - What *environmental factors* affect the person's ability to engage in those processes or procedures?

BVSR as psychological hypothesis



- To illustrate, what is the impact (+ or -) of
  - general intelligence?
  - cognitive disinhibition?
  - remote association?
  - divergent thinking?
  - behavioral tinkering?
  - mind wandering?
  - introversion?
  - psychoticism or “positive” schizotypy?
  - domain-specific expertise?
  - multicultural experiences?
  - group composition?
- These are all valid empirical questions!
- Just as much as discovering what determines whether, when, and who men decide to marry

BVSR as psychological hypothesis



- Furthermore, beyond nomothetic analyses BVSR can be used as the basis for idiographic case studies of historic acts of creativity, discovery, and invention: e.g.
  - Creativity: Picasso's *Guernica* sketches (Damian & Simonton, 2011; Simonton, 2007)
  - Discovery: Galileo's telescopic observations (Simonton, 2012)
  - Invention: Edison's patents (Simonton, 2015)
- Making BVSR's operation more concrete

Conclusion

- Hence, the BVSR-creativity connection has both philosophical and psychological significance
- The connection is necessarily true, but requires empirical elaboration
- Ok, grandad?