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- Indeed, according to one *PR* editor, this paper could not be published in *PR* today!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*)
The *personal* creativity of the potential solution is given by the multiplicative function:

\[ c = (1 - p)u(1 - v), \text{ again } 0 \leq c \leq 1, \text{ where} \]

- \( (1 - p) = \) 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

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

“wheat”

“chaff”
Consequently, BVSR has an essential relation with creativity

In particular, it remains the *only* method available to distinguish between

- $p \to 0, u \to 1, \text{ and } v \to 0$,
  - the highly creative idea, versus
- $p \to 0, u \to 0, \text{ and } v \to 0$,
  - 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., $v \to 1$) 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 $s \to 1$, $c \to 0$).
      - 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

BVSR as psychological hypothesis

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
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?
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 \( p \to 0 \), \( u \to 1 \), and \( v \to 0 \)?
- 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?