Formalization of creativity as search

Based on Wiggins (2006)
Creativity as search


– A conceptual framework for talking about creative systems and their properties
– Views creativity as search (cf. search in AI)
– Looks like an architecture but is not intended to be used as one

– In this tutorial, a simplified version will be presented
Components of the framework

- Universe U contains all possible concepts
- Rules R define the acceptable conceptual space
- Evaluation function E assigns a value to a concept
- Method $T_{R,E}$ for searching U with respect to R and E
Components of the framework

- Universe $U$ contains all possible concepts
  - E.g., all possible sequences of words
- Rules $R$ define the acceptable conceptual space
  - E.g., those sequences that match a given meter
- Evaluation function $E$ assigns a value to a concept
  - E.g., does the text express the desired emotion
- Method $T_{R,E}$ for searching $U$ w.r.t. $R$ and $E$
  - E.g., produce poems using a generative grammar and expressions reflecting the desired emotion
U, R, T, E are system-specific

Recall this problem with four lines connecting the dots.

What was your

• Universe U?

• Rules/acceptable search space R?

• Evaluation function E?

• Traversal (search) method T?
Data science tasks in computational creativity

– Mine, learn, or model:
  – the rules $R$ for acceptable cases from existing examples
  – the evaluation function $E$ from existing examples, or from the user,
  – methods $T$ that leverage existing examples and their properties
  – changes to any of the above from experience and from interaction with others (cf. transformational creativity and social creativity later in the course)
Creativity as Search vs. Boden’s Three Types of Creativity

– Recall Boden’s three types of creativity
  – Combinatorial (combining old ideas to new ones)
  – Exploratory (generating new ideas within rules)
  – Transformational (also changing the rules)
– Wiggins’ model looks like exploratory search
  – A space defined by U, R and E explored by T
– However, Wiggins’ model is generic and allows U, R, E and T to be defined in various ways
  – E.g., T can be based on recombinations of existing ideas (leading to combinatorial creativity)
Wiggins introduces the following additional notation:

– A language L, in which R, E, T are expressed
  – \( R \in L, E \in L, T \in L \)
– An interpreter \( \llbracket \] \) for rules R
  – \( \llbracket R \rrbracket (c) \) evaluates \( c \in U \) using R
– An interpreter \( \llcorner \lrcorner \) for search method T
  – \( \llcorner R, T, E \lrcorner (c_{in}) \) produces \( c_{out} \), concepts to traverse next

– This allows rules R and search method T (and evaluation function E) to be modified during runtime
  → Boden’s \textit{transformational creativity}
Two useful abstractions (1/2)

Three types of creativity  
(Boden 1992)

(Recap from an earlier lecture)

1. **Combinational**: new combinations of familiar ideas
2. **Exploratory**: generation of new ideas by exploration of a space of concepts
3. **Transformational**: involves a transformation of the search space so new kinds of ideas can be generated

Q: How do their inputs differ? (How do the differences in input reflect what is done?)

– These can all be described as search!
Two useful abstractions (2/2)

- Separation of
  - specification (U, R, T, E)
  - operationalization ([[.]], <<.>>)

- Allows one to
  - discuss “what” without going to details
  - change the specification at runtime
    - transformational/meta-creativity