Scientific Creativity in Light of Artistic Spirit:

A Preliminary Literature Review on the Concepts of Intuition and Beauty

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Overview

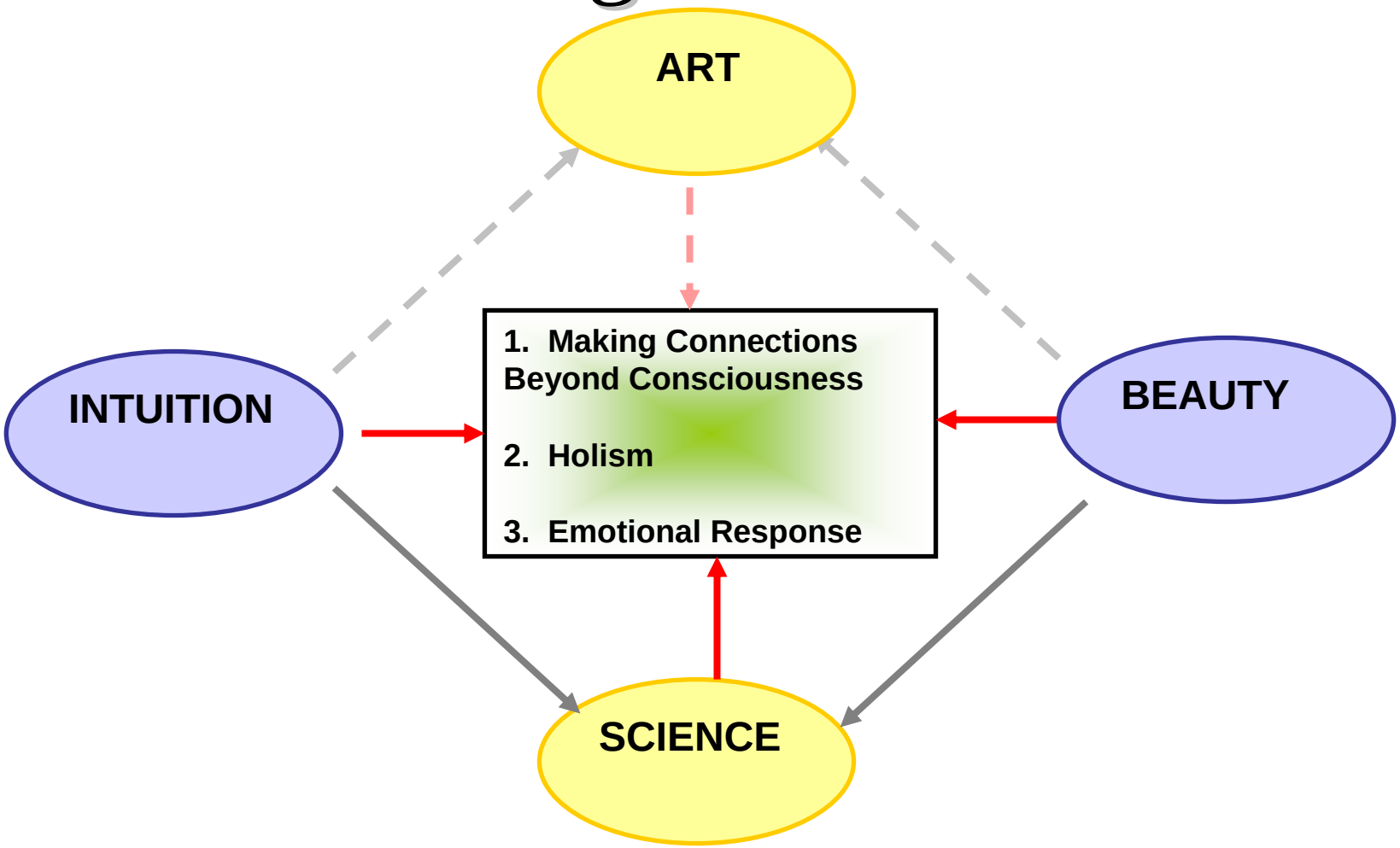
1. Drive behind this topic
2. Inspiring papers
3. Intuition and Beauty
4. Educating for Art + Science:
   Israel Arts and Science Academy
5. Discussion

Drive Behind the Research

CONNECTIONS

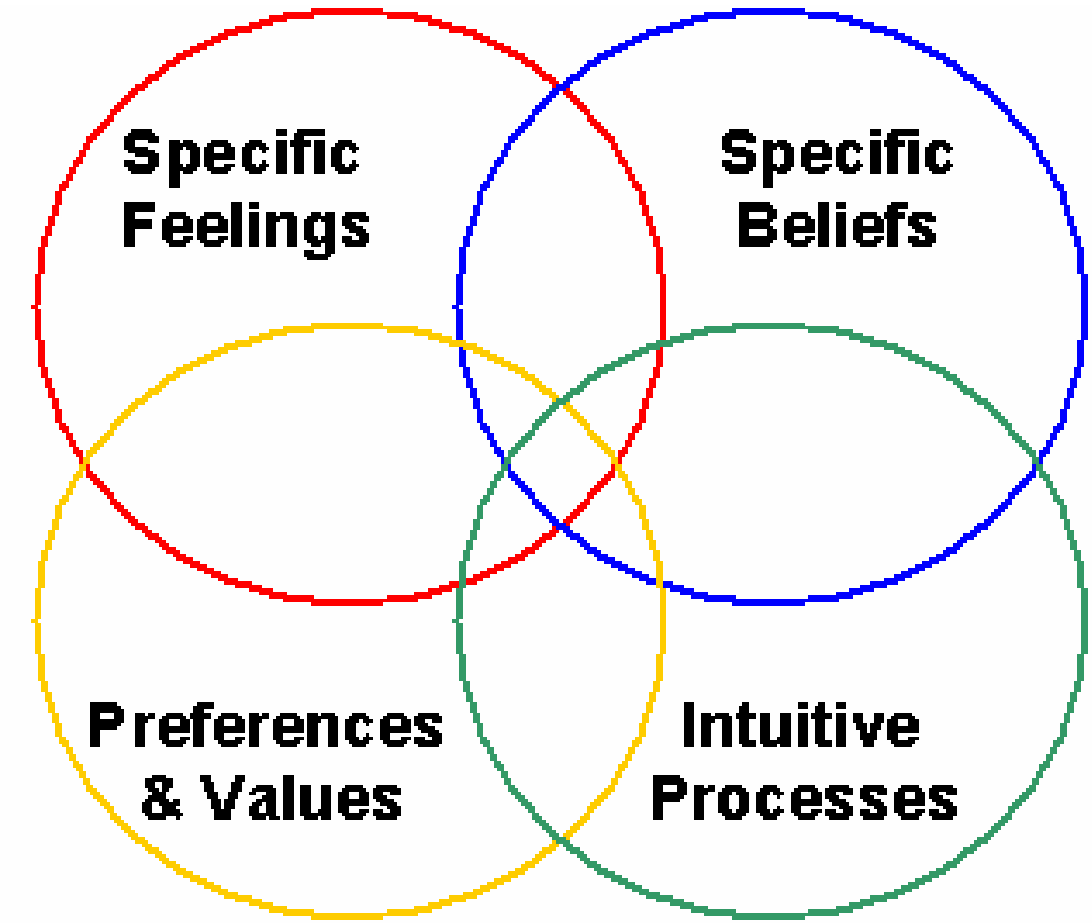
– Life in general and missing links in myself
– Work and travel abroad

Making Connections



Inspiring Studies

Explaining high abilities of Nobel laureates (Shavinina, 2004)



Harmony and Beauty in Medical Research (*Root-Bernstein*, 1987)

- History shows those who made biggest breakthroughs in medicine and science were also talented in:
  - Music
  - The Arts
  - Poetry
  - Literature
- Arts contribute to personality. These are the scientists that make a difference.

Intuition & Beauty

3 shared themes from the literature:

1. Making connections beyond consciousness
2. Holism
3. Emotional Response

Connecting Science and Art: INTUITION

"As between science and art, the priority developmentally seems to rest with art, this being the more immediate and intuitive ground from which the rationalistic and generalizing scientific meanings subsequently develop."

(Phenix quoted in Innamorato, 1998, p. 5)

Reflection

Is art the more immediate and intuitive ground from which rationalistic and generalizing scientific meanings develop?

"[The pioneer scientist] must have a vivid intuitive imagination, for new ideas are not generated by deduction, but by an artistically creative imagination."

Max Planck (quoted in Shavinina & Seeratan, 2004, p. 90)

Physicist and founder of Quantum Theory

Connecting Science and Art: BEAUTY

"The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful."

Henri Poincaré (Thinkexist, 2006)

Mathematician, theoretical physicist, philosopher of science

Reflection

What is the purpose of science? To make useful discoveries? To study the beauty in nature?

Consider:

a) patterns in nature
b) fractal art

Reflection: Patterns in Nature

Sunflower Leaves

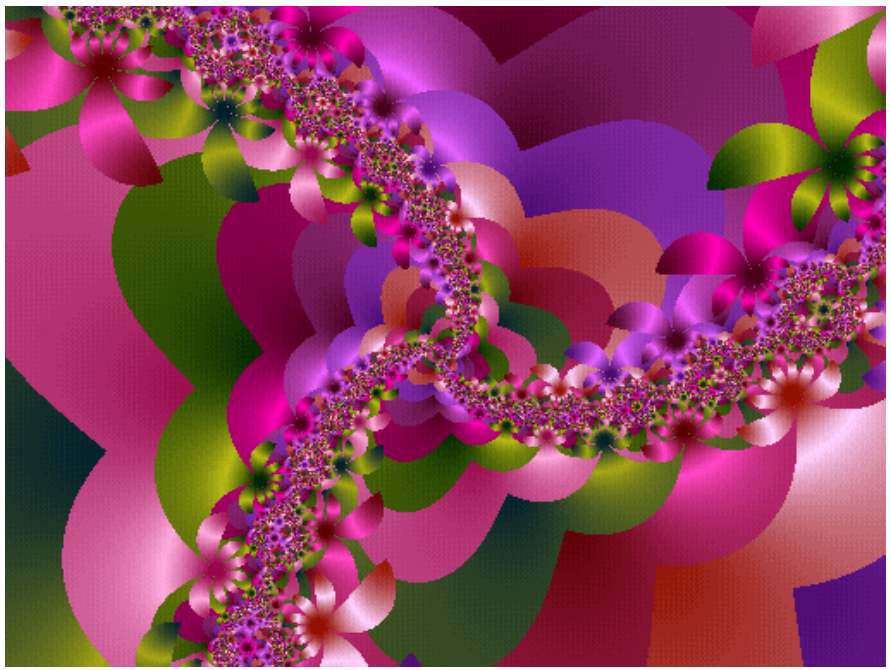
Knott, 2007

Cauliflower

Knott, 2007

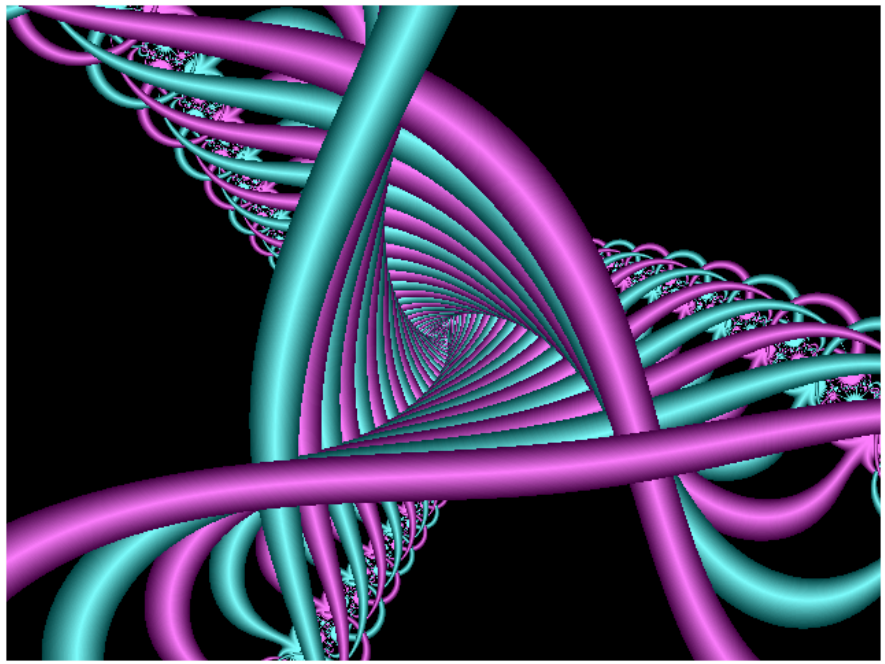
Reflection: Fractal Art

Fractal Garden



Carlson, 2004

Fractal Stalk



Carlson, 2004

Educating for Art + Science: Implications for Intuition and Beauty?

"If we are to truly educate our children, we must develop both the scientist and the artist within them."

(Girod, Rau, & Schepige, 2003)

Israel Arts and Science Academy

Schusterman Campus, Jerusalem

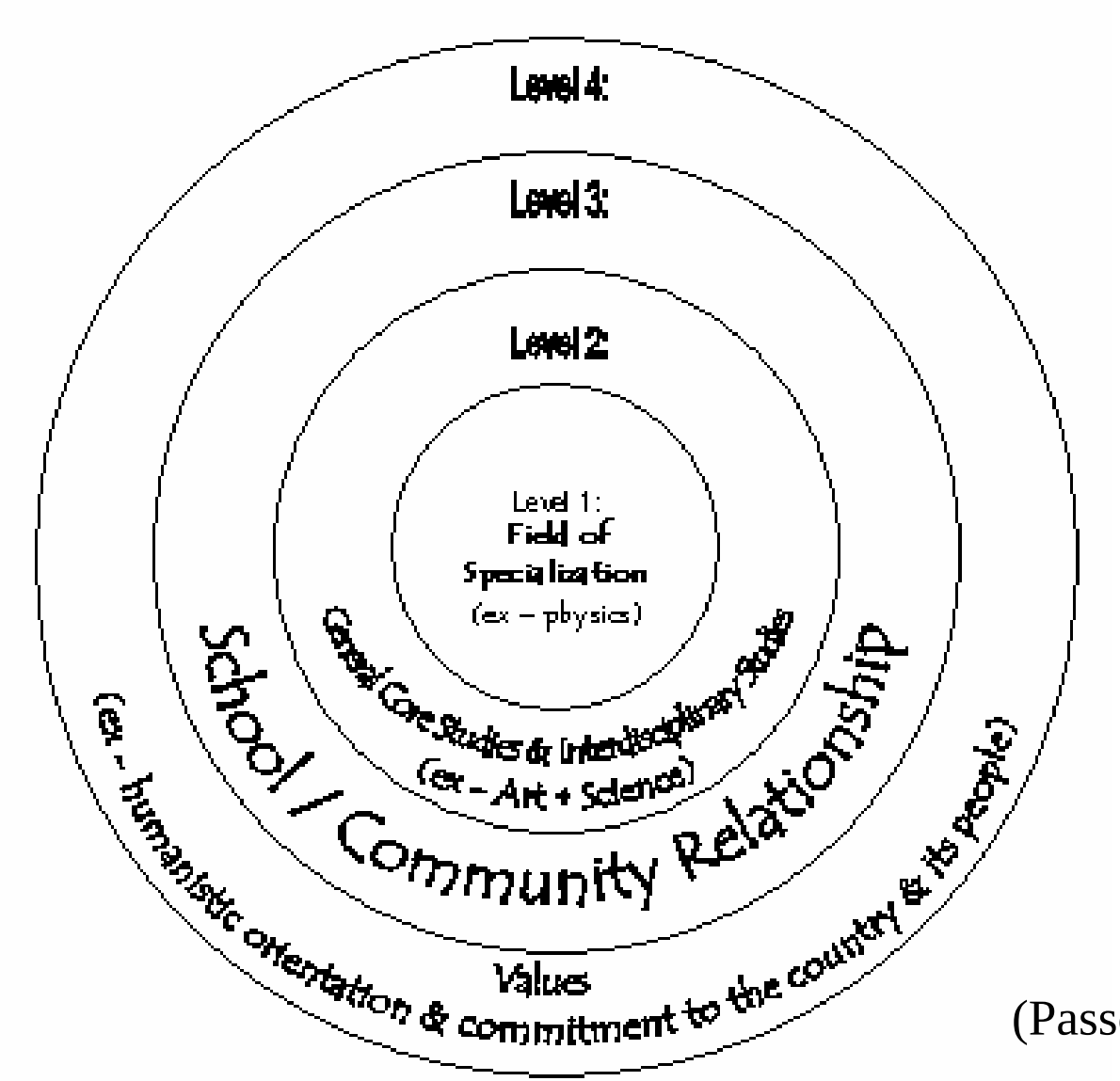
(IASA, n.d.)

About IASA

- National, residential senior high school
- Incorporates:
  a. **Creativity** through **Arts**,
  b. **Discipline** through **Sciences**, and
  c. **Values/ethics** through **Community Work**
- For outstanding students in:
  a. the sciences (chemistry, biology, physics),
  b. computer science,
  c. math, or
  d. the arts (music, sculpture, visual art).

(Erez, 2001)

Philosophy



(Passow, 1992)

Interplay of Art and Science

- Living together
- Investigating each other's topics of interest
- Gildor Project Week

(IASA, n.d.)

Discussion

Self-Reflection Questions

1. What is your personal experience with intuitive processes or feelings of beauty in doing your own research?

2. Is research itself more of an art or a science? To what extent do we allow intuition and feelings of beauty into our practice of research?

Questions for Education

3. If the arts are indeed relevant, might it be important for scientists to be trained in the arts or simply educated to appreciate the arts?
4. Are there implications for arts-integrated curriculum with the sciences?
5. Can intuition and feelings of beauty be taught? How can they be ignited?

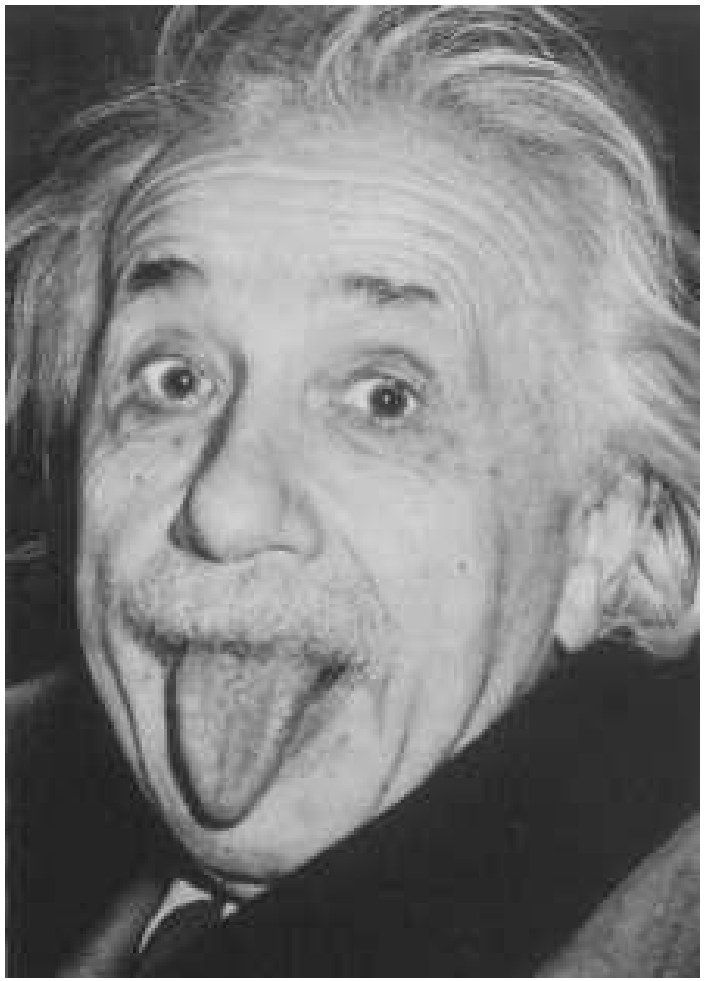
Final Question

What might be some important research questions and studies to further investigate scientific creativity in light of an artistic spirit?

"After a certain high level of technical skill is achieved, science and art tend to coalesce in esthetics, plasticity, and form. The greatest scientists are always artists as well."

Albert Einstein (Thinkexist, 2006)

Theoretical physicist known for Theory of Relativity



References*

Carlson, P. (2004). *The Paul Carlson fractal museum.* Retrieved May 24, 2007 from http://acsweb.fmarion.edu/math/museum/

Erez, R. (2001). The interrelationships among science, art, and values: Significance for advancing holistic…. *Journal of Secondary Gifted Education, 13*(1), 6-11.

Girod, M., Rau, C., & Schepige, A. (2003). Appreciating the beauty of science ideas: Teaching for aesthetic understanding. *Science Education, 87*(4), 574-587.

Kentucky Community and Technical College System (n.d.). *Fractal Art exhibited at Hopkinsville.* Retrieved May 24, 2007 http://www.kctcs.edu/newspublications/exchange/index.cfm?eei_id=10

Knott, R. (2007). *Fibonacci numbers and nature.* Retrieved May 24, 2007 from http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html#leaf

Innamorato, G. (1998). Creativity in the development of scientific giftedness: Educational implications. *Roeper Review, 21*(1), 54-59.

Israel Arts & Science Academy (n.d.). *The society for excellence through education.* Retrieved November 1, 2006 from http://www.see.org.il/eng/

Passow, A. H. (1992). A residential high school for gifted in arts and science. *Gifted Child Today, 15*(1), 2-7.

Root-Bernstein, R. S. (1987). Harmony and beauty in medical research. *Journal of Molecular Cellular Cardiology, 19,* 1043-1051.

Shavinina, L. V. (2004). Explaining high abilities of Nobel laureates. *High Ability Studies, 15*(2), 245-254.

Shavinina, L. V., & Seeratan, K. L. (2004). Extracognitive phenomena in the intellectual functioning of gifted, creative, and talented individuals. In L. V. Shavinina & M. Ferrari (Eds.), *Beyond knowledge: Extracognitive aspects of developing high ability* (pp. 73-102). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Thinkexist (2006). *Einstein quotes*. Retrieved May 10, 2007 from http://thinkexist.com/quotation/after_a_certain_high_level_of_technical_skill_is/222037.html

these references are only from the powerpoint presentation. Additional references can be found on the literature review posted on www.learndev.org/BtSM2007.html under "Papers Submitted"