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A Multi-Disciplinary Analogy: From Jazz To The Social Sciences

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Abstract:

Analogies are utilized in many disciplines to assist in the explanation and understanding of observations, phenomena, and theories. Along with helping students with their lessons, interdisciplinary analogies can also be used to provide insight into the concerns of apparently unrelated fields of study. Is it possible that an interdisciplinary analogy could provide a remedy to some of the concerns within the social sciences? At times, some social scientists may feel isolated and limited to working only within their own academic silos. Such disconnection of practitioners may produce a slowing of progress, a lack of innovation both in research and in practice. The authors are proposing an interdisciplinary analogy of jazz, astrophysics, biology, and the social sciences to highlight the true interconnectedness of all disciplines within the social sciences, which are stitched together by strong bonds of common theory and methodology along with the significant research and application efforts of thousands of social scientists. With this analogy, the authors wish to break down academic silos and fuel efforts in taking the next steps toward innovation within the social sciences.

Keywords: social sciences, jazz, interdisciplinary analogy

Introduction:

Is it possible that an interdisciplinary analogy could provide a remedy to some of the concerns within the social sciences? At times, some social scientists feel isolated and limited to working only within their own academic silos. Such disconnection of practitioners could produce a slowing of progress, a lack of innovation both in research and in practice. The authors are proposing an interdisciplinary analogy (from jazz to the social sciences) to highlight the true interconnectedness of all the disciplines and subdisciplines within the social sciences, and thus, fuel efforts in taking the next steps toward innovation within the social sciences, and possibly going further connecting the social sciences to other disciplines.

Materials and Methods:

Analogies are utilized in many disciplines to assist in the explanation and understanding of observations, phenomena, and theories. Without the use of analogies, Einstein's theory of general relativity, for example, is extremely difficult to comprehend. However, an analogy provided by a good storyteller can make even the murkiest theory seem familiar to a young student (see Stephon Alexander's modern version of Einstein's rocket ship analogy for general relativity, 2017, page 126). Along with helping students with their lessons, interdisciplinary analogies have also been used to provide insight into the concerns of apparently unrelated fields of study (Alexander, 2017).

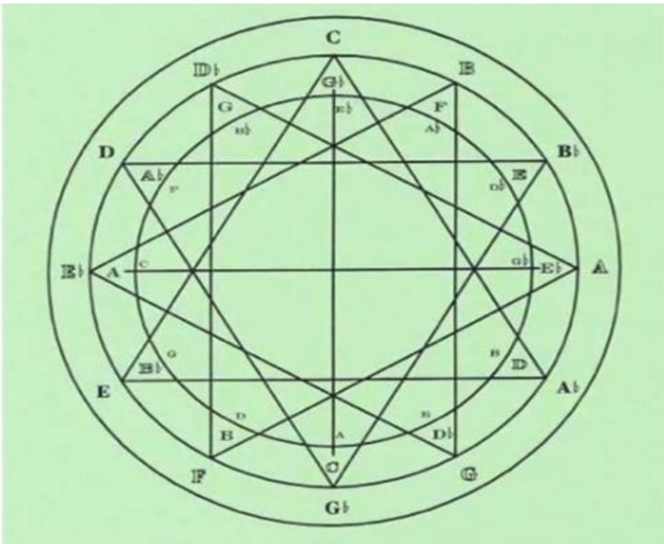
Discussion:

Jazz is unique in western music. When symphonic violinists are given a piece of music, they play the music as it is written on the page. When a jazz musician is given a piece of music, the piece is changed through embellishment and improvisation. Change is built into every level of jazz performance. The length of the notes of on the page can be altered as the jazz musician sees fit, slight note changes can occur within the melody as the musician finds a new idea, and once the musician has played through the melody once or twice, the melody can be discarded completely. What replaces the melody is a spontaneously created new melody based on the remnants of the song – this spontaneous compositional process is improvisation. Improvisation yields small rough ideas spun in a predictably repeating structure, absorbed by the musicians, and expanded as the music progresses. Working within the structure of the song allows for the jazz musician to create new ideas, new commentary, and new vision for the work.

It is improvisational jazz's freedom to explore the structure of music and the authority to push a musical piece to its limits that astrophysicist Stephon Alexander points to when discussing his creative solutions in his research of the cosmos (Alexander, 2017 and TEDTalentSearch, 2012). Alexander provided an in depth look at the connection between jazz and physics in his 2017 book: *The Jazz of Physics: The Secret Link between Music and the Structure of the Universe*. More specifically, in his book, Alexander detailed his lifelong exploration of the structure of jazz, and explained how experimenting with improvisational jazz allowed him to think in new ways about the problems of astrophysics. Alexander utilized a complex analogy of the symmetrical geometry of jazz to illustrate and investigate the cosmological mechanisms of general relativity and to produce a new theory of cyclical expansion-contraction of the universe (Alexander, 2017).

Stephon Alexander saw this connection of jazz and physics while first viewing a diagram made by jazz musician John Coltrane (TEDTalentSearch, 2012). Coltrane's original hand-drawn diagram, known as the Giant Steps Diagram, can be found on page 5 in Alexander's book (2017; and in Hein, 2018 and Lateef, 1981). Though John Coltrane considered his diagram to be a puzzle for his fellow jazz musicians to solve (TEDTalentSearch, 2012), Coltrane used his Giant Steps Diagram to explain his cutting edge jazz that moved beyond the near-steps chord progression rules of the Circle of Fifths within western music (Open Culture, 2017). Alexander simplified Coltrane's diagram into his own diagram (Figure 1) to highlight jazz's mathematical (geometric) and musical symmetric structure.

Figure 1: Stephon Alexander's chord change diagram based on chromatic steps.



(Image source: TEDTalentSearch, 2012)

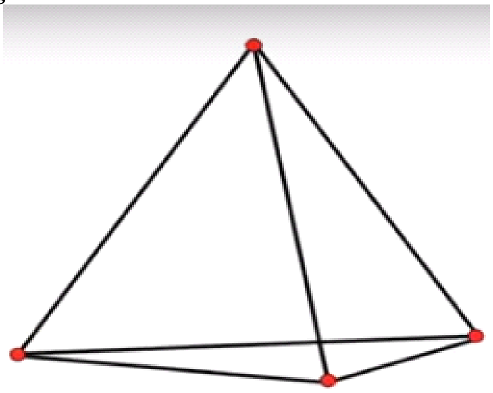
At the top of Alexander's diagram (Figure 1) in the outermost circle is the musical note "C" (the common starting point in western music), and counter-clockwise around the circle are the half-steps up the piano keyboard with "G flat" at the bottom and completing the twelvefold cycle by continuing to move counter-clockwise around the circle and returning to the musical note "C" at the top.

Mathematical (geometric) and musical symmetry are illustrated by the vertical line drawn through the center of the diagram, which shows 6 musical half-steps on each side of the diagram. A horizontal line was drawn to show symmetry along the horizontal axis of the diagram. Mathematical (geometric) and musical symmetry is also illustrated in the inner circle with the musical note “G flat” at the top (the opposite of the outer circle) and once again moving counter-clockwise around the circle one half-step at a time to “C” at the bottom and back up to “G flat” at the top.

More eye catching than the circles are the triangles of Alexander’s diagram (Figure 1). The points of the triangles represent the individual chords of western music, while the triangles represent the chord progressions found in Coltrane’s celebrated jazz composition, “Giant Steps” (John Coltrane, 2015 and Vox, 2018), originally recorded in 1959 (Porter, 2000). The symmetrical arrangement of the triangles across the circles once again emphasizes the mathematical and musical symmetry of the structure of jazz (TEDTalentSearch, 2012).

Utilizing the free form thinking of improvisational jazz, Alexander saw within his diagram something more than the mathematical (geometric) and musical symmetric structure of jazz compositions. He realized that if the four triangles representing the musical chord progressions in his diagram were expanded into the third dimension by connecting the edges of the triangles, the four triangles would become a tetrahedron, also known as a triangular pyramid (Figure 2) (TEDTalentSearch, 2012).

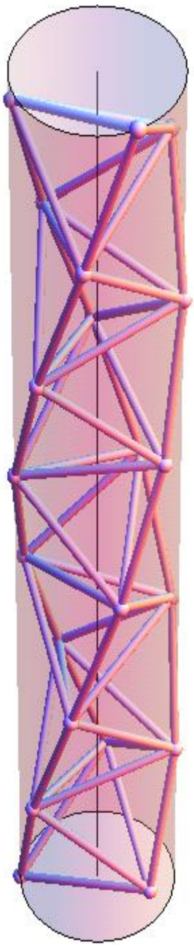
Figure 2: Alexander’s tetrahedron structure.



(Image source: TEDTalentSearch, 2012)

Alexander could imagine that if this tetrahedron structure was then expanded further into the third dimension by stacking multiple tetrahedrons face-to-face, a twisting tetra-helix structure would form along the central axis of a right circular cylinder (TEDTalentSearch, 2012). Figure 3 illustrates the twisting tetra-helix structure, which occurs frequently in nature, specifically biology; for example: the single twisting tetra-helix of RNA, the double twisting tetra-helix of DNA, and the triple twisting tetra-helix of collagen proteins (Rettner, 2017 and Lodish et al, 2016).

Figure 3: Twisting tetra-helix structure with a central axis of a right circular cylinder.



(Image source: Hayes, 2013)

With the tetra-helix structure in mind, Alexander was able to develop an analogy for the complex concepts of theoretical physics that he had spent years working on. Alexander's analogy:

Just as within jazz as illustrated by Coltrane's and his own geometrically symmetrical diagram, and just as with the triangular building blocks that produce the double helix of DNA, the small symmetric structures within quantum physics when expanded significantly into the third dimension have become the unimaginably large structures of the cosmos (Alexander, 2017).

Very simply stated, the extremely small "atoms of space-time" of quantum gravity have produced the extremely large-scale, self-organized, patterned network of galaxies and stars (Alexander, 2017 and TEDTalentSearch, 2012) as described by quantum field theory (Hosoya and Morikawa, 1989), string theory (Freivogel and Susskind, 2004), and casual set theory (Harper, Robin et al, 2017). Alexander remains confident that the same symmetrical geometry that occurs in his music diagram and tetra-helix biological structures is reflected in the geometric principles of Einstein's theory of general relativity and the structure of the cosmos (Alexander, 2017 and TEDTalentSearch, *2012*). With his jazz analogy encouraging free thinking and an emphasis on geometrical symmetry, Alexander and his colleagues continue to work their equations and discuss the implications of quantum physics and cosmology (Alexander and Sims, 2018 and Alexander, Stephon et al., 2014, 2014, 2016, and 2017).

Stephon Alexander urged his readers in *The Jazz of Physics: The Secret Link Between Music and the Structure of the Universe* to go further in their work by stating, "Although it is important for both jazz musicians and physicists to strive for technical and theoretical mastery in their respective disciplines, innovation demands that they go beyond the skill sets they have mastered."

He goes on to state, "For students to keep up [with modern knowledge, technology and global interconnectedness], for the researcher to discover new truths and for the professor to lend guidance and insight, it may take a combination of ideas from ancient and modern-day philosophy, as well as creativity and improvisation with a bold willingness to make mistakes" (Alexander, 2017, page 84).

Following Alexander's lead and applying his words to the social sciences, we can state that mastery is not the end of the journey for social scientists. It is the jumping off point for innovation without fear of going down a bunny trail or making an unrecoverable error. Students, researchers, practitioners, and professors alike need to look to the historical theories and modern methods, and then go beyond their own skill sets by creatively seeking out the skills and knowledge of other social science disciplines.

Utilizing improvisational thinking plus the symmetrical geometries of jazz, theoretical physics, and biology, social scientists can look at Alexander's diagram (Figure 1) and imagine new interdisciplinary connections. In fact, Alexander's diagram may vaguely remind the reader of Da Vinci's Vitruvian Man.

This imagery along with Alexander's analogy allows us to build our own social science interdisciplinary analogy:

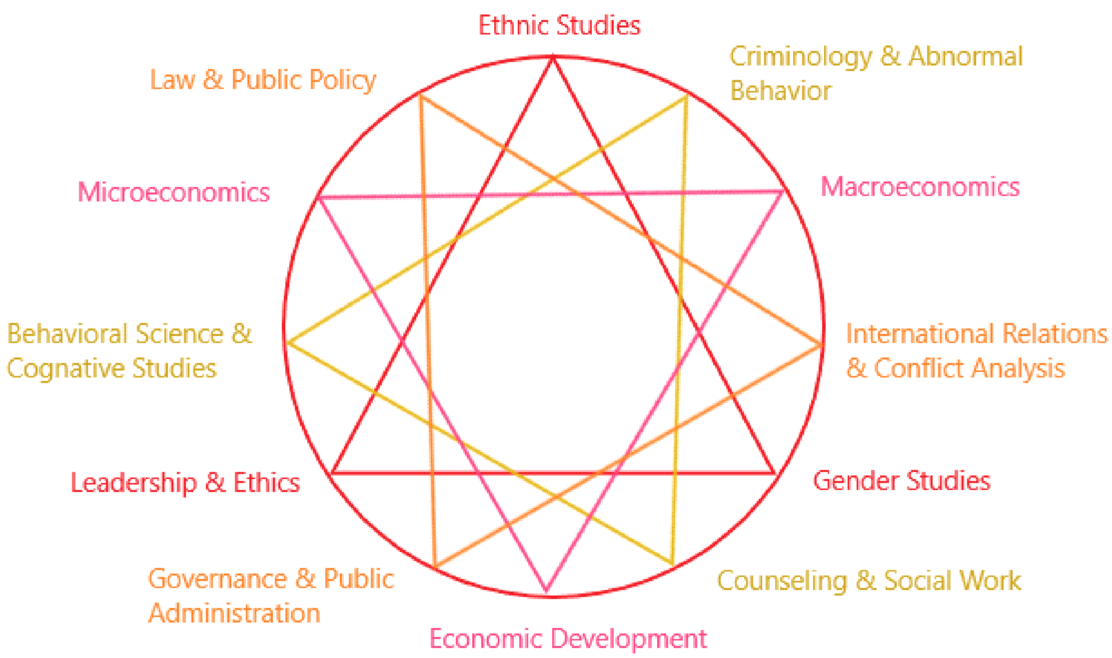
Just as within jazz, the double helix of DNA, and astrophysics, the small structures within the social sciences (the various disciplines and sub-disciplines) when expanded significantly through interdisciplinary connections represent the unimaginably large structure of society.

Social scientists can imagine our own tetra-helix structure just as Alexander did. We can build the DNA of the social sciences. To complete Alexander's diagram (Figure 1) for the social sciences, 12 social science disciplines/sub-disciplines are needed to complete the twelvefold cycle.

- Sociology
  - Ethnic Studies
  - Gender Studies
  - Leadership & Ethics
- Political Science
  - Law & Public Policy
  - Governance & Public Administration
  - International Relations & Conflict Analysis
- Economics
  - Microeconomics
  - Microeconomics
  - Economic Development
- Psychology
  - Counseling & Social Work
  - Behavioral Science & Cognitive Studies
  - Criminology & Abnormal Behaviors

Each of four disciplines with three sub-disciplines represents a triangle on Alexander's diagram (Figure 4).

Figure 4: A twelvefold cycle of the social sciences.



Placed together, the four triangles then form a tetrahedron, and if the tetrahedron are stacked one on top of another, a single twisted tetra-helix of social science is formed (Figure 5).

Figure 5: A single tetra-helix of the social sciences.

Utilizing the social science disciplines/sub-disciplines listed below, we can form a second twelvefold cycle of social science (Figure 6) and a second single twisted tetra-helix (Figure 7).

- Anthropology & History
  - Cultural & Regional Studies
  - Archeology & Heritage Preservation
  - Linguistics & Communication Studies
- Human Geography
  - Urban & Rural Studies
  - Environmental Studies
  - Demography & Population Studies
- Philosophy
  - Metaphysics & Religious Studies
  - Esthetics & Moral Philosophy
  - Epistemology & Philosophy of Science

- Education
  - Early Childhood Education
  - K-12 Education
  - Special Education

Figure 6: A second twelvefold cycle of the social sciences.

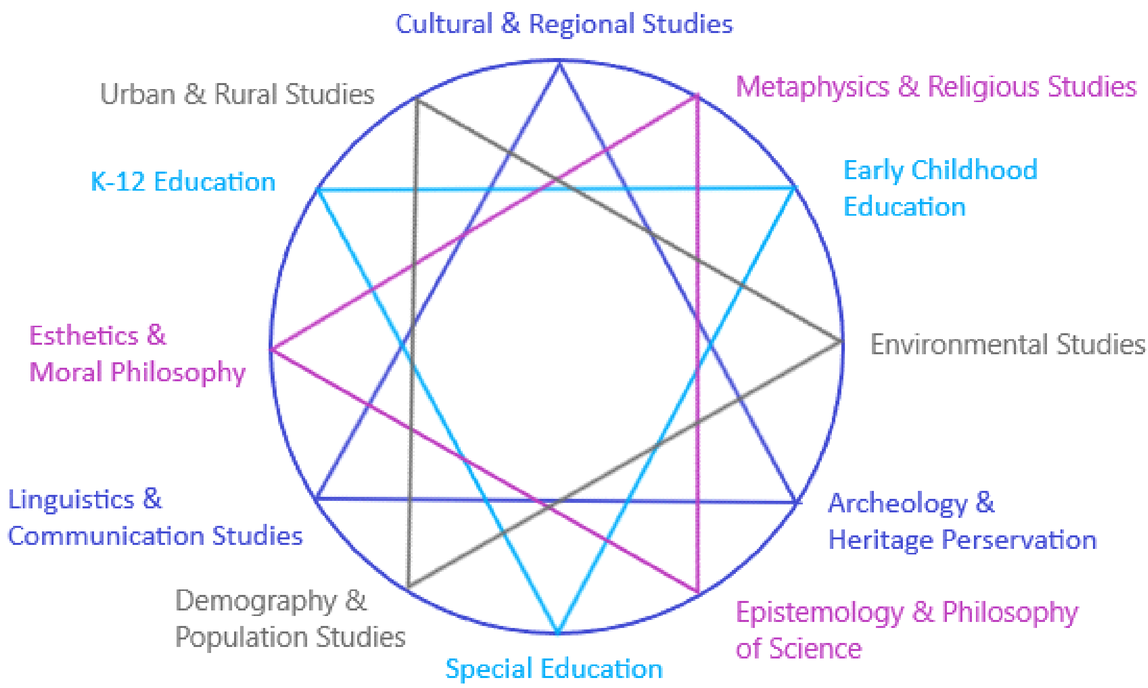


Figure 7: A second single tetra-helix of the social sciences.

Utilizing both social science single tetra-helix, we can imagine the formation of a double twisted tetra-helix, similar to DNA (Figure 8).

Figure 8: The DNA of Social Science.

Conclusion:

The DNA of the social sciences as formed through this multi-disciplinary analogy is complex, strong and inspiring. The disciplines and subdisciplines of the social sciences should not be treated as disjointed, isolated areas of study, but instead should be treated as interconnected and interdependent disciplines stitched together by strong bonds of common theory and methodology along with the significant research and application efforts of thousands of social scientists. If treated so, innovative ways of looking at the social sciences may emerge with intriguing and newly integrated areas of thought and study, possibly fueling the next steps in finding solutions to the concerns of the social sciences.

This analogy can be taken a step further by weaving the DNA of the social sciences together with a single twisted tetra-helix from another discipline, for example: engineering. This new triple twisted tetra-helix (similar to collagen) could then be used as a templet for structured brainstorming in developing new research projects, connecting traditionally siloed practitioners, and providing new insight and innovation to academia. Following the example of engineering, we could then ask intriguing questions such as, "How did the invention of the electric light bulb, the interstate highway system, and the internet impact the global economy, social structure, educational and manufacturing practices, and political power structure?" and "Can we extrapolate these findings into the future with the impact of new technology?"

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