Studying Creative Genius

An Overview of Historiometric Methods
Outline

• Definition
• History
• Applications
• Conclusion
Definition

• “Historiometry is a scientific discipline in which nomothetic hypotheses about human behavior are tested by applying quantitative analyses to data concerning historical individuals” (Simonton, 1990, p. 3)
  • Historical individuals = eminent creators and leaders (aka “geniuses”)
  • Data = biography and history (“names, dates, and places”)
  • Quantitative = both measurement and statistical analyses (or math models)
  • Nomothetic hypotheses: e.g., the “laws of history”
  • N.B.: Historiometry ≠ psychohistory, psychobiography, nor even cliometrics
History

• First historiometric study: Quételet (1835) on the age-creativity relation
• First definition: “historiometry” or “historiometrics”
  • “A new name for a new science” (Woods, 1909): term modeled after “biometry”
  • “Historiometry as an exact science” (Woods, 1911): designed to study the “psychology of genius” and the “causes underlying the rise and fall of nations” (p. 568)
• First historiometric classic: Cox (1926) on the intelligence-eminence relation
• Own historiometric research: 1974ff (albeit major technological changes)
Evolution by variation and [436]

natural selection

Theory of natural selection & variation. For evolution.

1858 Darwin, Eng.
1858 Wallace, Eng.
1840 H.G. Wells, Am.-Eng.
1840 Matthew, Eng.

According to Charles Darwin, the origin of species even in the context of being the first to envelope the principle of natural selection.

Also for Patrick Chambers.
Applications

- Products
  - Masterworks
- Persons
  - Geniuses
- Periods and Places
  - Golden Ages
Products

• Analytical units
• Sampling strategies
• Quantitative measures
• Measurement quality
• Specific illustration
Products

- Analytical units
  - Music: themes/melodies; songs; symphonies; operas
  - Art: sketches; paintings; architecture; films
  - Literature: couplets/quatrains; poems; plays; short stories; novels
  - Science: titles; abstracts; articles; books
Products

- Sampling strategies
  - Population
  - Awards/nominations
  - Random
Products

- Quantitative measures
  - Expert ratings; consumer ratings
  - Performance/recording frequencies; anthology selection frequencies
  - Sales figures, box office, and auction values
  - Awards/honors/prizes
  - Citation indices/quotation frequencies
Products

- Measurement quality
  - Reliability (random error)
    - In general, reliability coefficients (such as alpha) are comparable to the best psychometric instruments (i.e., .80s to .90s)
    - However, some assessments are not unidimensional (e.g., cinematic impact)
  - Validity (systematic bias)
    - Although measures enjoy an undeniable “face validity,” they are also subject to extraneous influences that can undermine their validity (e.g., creation date), requiring the implementation of statistical controls
Products

• Specific illustration
  • “Fickle fashion versus immortal fame: Transhistorical assessments of creative products in the opera house” (Simonton, 1998)
    • 496 operas created by 55 composers who contributed at least one opera to the repertoire
    • Contemporary impact: productions and languages in first decade
    • Current impact: recordings, videos, performances, dictionaries, histories, rankings →
      • global success (composite)
Table 1

Correspondence Between Contemporary and Current Impact Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Zero-order correlations ($r$)</th>
<th>Regression coefficient ($\beta$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Productions</td>
<td>Languages</td>
</tr>
<tr>
<td>Recordings</td>
<td>.48</td>
<td>.37</td>
</tr>
<tr>
<td>Videos</td>
<td>.46</td>
<td>.35</td>
</tr>
<tr>
<td>Performances</td>
<td>.56</td>
<td>.46</td>
</tr>
<tr>
<td>Dictionaries</td>
<td>.42</td>
<td>.31</td>
</tr>
<tr>
<td>Histories</td>
<td>.37</td>
<td>.24</td>
</tr>
<tr>
<td>Rankings</td>
<td>.31</td>
<td>.21</td>
</tr>
<tr>
<td>Global success $\alpha = .95$</td>
<td>.46</td>
<td>.35</td>
</tr>
</tbody>
</table>

Note. All zero-order correlations and standardized partial regression coefficients are statistically significant at the $p < .001$ level or better. The regression coefficients have the effects of performance date and libretto language partialed out. $N = 496$. Operas first produced 1607-1938
Persons

- Analytical units
- Sampling strategies
- Quantitative measures
- Measurement quality
- Specific illustration
Persons

• Analytical units:
  • Individuals (as in psychometric research):
    • e.g. inventors, scientists, philosophers, writers, artists, composers, filmmakers
  • However, individual lifespans or careers may be split into time-series units, such as years, half-decades, or decades (e.g., to study career trajectories), yielding “cross-sectional time series” when $N > 1$
Persons

- Sampling strategies
  - Population
  - Eminence
  - Awards
  - Random
Persons

- Quantitative measures
  - Archival space measures (encyclopedias, biographical dictionaries, histories, etc.)
  - Expert ratings/surveys
  - Lifetime productivity
  - Citations (total, h-index, etc.)
Persons

- Measurement quality
  - Reliability (random error)
    - Again, reliability coefficients in the same range as the best psychometric instruments
    - Moreover, “test-retest” reliabilities may extend across decades, even centuries
  - Validity (systematic bias)
    - Controls often necessary for domain and various demographic variables
Persons

• Specific illustration
  • “Scientific eminence historical and contemporary: A measurement assessment” (Simonton, 1984)
    • all 2026 Scientists and inventors granted entries in three selective biographical dictionaries of science
    • 23 alternative eminence measures (biographical dictionaries, encyclopedias, Nobel, etc.; deliberately heterogeneous in measurement properties)
Table 3
Statistics for eminence, publication, and citation measures
by century and overall \( k = 23 \)

<table>
<thead>
<tr>
<th>Century</th>
<th>N</th>
<th>Reliability</th>
<th>( \alpha ) Eminence</th>
<th>Eminence</th>
<th>Publications</th>
<th>Citations</th>
<th>Eminence Correlated With Publications</th>
<th>Eminence Correlated With Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \leq 15 )</td>
<td>139</td>
<td>0.80</td>
<td>24</td>
<td>1</td>
<td>2</td>
<td></td>
<td>0.54**</td>
<td>0.55***</td>
</tr>
<tr>
<td>16</td>
<td>81</td>
<td>0.85</td>
<td>24</td>
<td>5</td>
<td>19</td>
<td></td>
<td>0.27**</td>
<td>0.14</td>
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<tr>
<td>17</td>
<td>119</td>
<td>0.83</td>
<td>23</td>
<td>4</td>
<td>4</td>
<td></td>
<td>0.43**</td>
<td>0.27**</td>
</tr>
<tr>
<td>18</td>
<td>405</td>
<td>0.83</td>
<td>20</td>
<td>5</td>
<td>8</td>
<td></td>
<td>0.34**</td>
<td>0.26**</td>
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<tr>
<td>19</td>
<td>1075</td>
<td>0.74</td>
<td>17</td>
<td>33</td>
<td>102</td>
<td></td>
<td>0.26**</td>
<td>0.14**</td>
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<tr>
<td>20</td>
<td>207</td>
<td>0.68</td>
<td>13</td>
<td>75</td>
<td>668</td>
<td></td>
<td>0.22**</td>
<td>0.13*</td>
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<tr>
<td>Any</td>
<td>2026</td>
<td>0.78</td>
<td>18</td>
<td>27</td>
<td>125</td>
<td></td>
<td>0.08**</td>
<td>-0.01</td>
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</tbody>
</table>

* \( p < 0.05 \) mathematics 0.88, astronomy 0.89, physics 0.90, chemistry 0.87, biology 0.88, medicine 0.84, technology 0.77, earth sciences 0.73, behavioral sciences 0.85, miscellaneous 0.81;
** \( p < 0.01 \) English 0.89, American 0.76, German 0.86, French 0.88, Italian 0.90, Dutch 0.91, Russian/Soviet 0.83.
*** \( p < 0.001 \)

N.B.: Publications and citations from *Science Citation Index Five-Year Cumulation 1970-1974*. 
Periods and Places

- Analytical units
- Sampling strategies
- Quantitative measures
- Measurement quality
- Specific illustration
Periods and Places

• Analytical units
  • Cross-sectional: domains, cultures, nations, civilizations
  • Time-series: years, decades, generations, centuries (i.e., 1, 10, 20, and 100 years)
Periods and Places

• Sampling strategies
  • Sampling of cross-sectional and time-series units largely contingent on the product or person samples that are then aggregated into the larger units
  • For example, in time-series analysis, the series starts in accord with the earliest product or person in the sample and ends with the most recent product or person in the sample
  • For analytical purposes, the resulting series should consist of contiguous time units (hence, some internal units may have zero aggregate scores)
Periods and Places

• Quantitative measures
  • Products or persons aggregated into cross-sectional and/or time-series units
    • e.g. generational time-series analyses: persons assigned to 20-year period according to 40-year old floruit rule
  • Unweighted versus weighted tabulations
    • e.g. count Newton more than John Flamsteed
    • Thus arises the issue of optimal weighting procedure
Periods and Places

• Measurement quality
  • Reliability (random error)
    • Although reliability also tends to be high, the degree of reliability depends on certain methodological factors, such as the size of the time units (i.e., given the same products or persons to be tabulated, reliability increases with the size of the unit)
  • Validity (systematic bias)
    • Cross-sectional (e.g., ethnocentric biases; population size)
    • Time-series (e.g., discounting; population growth)
Periods and Places

• Specific illustration: First
  • “Galtonian genius, Kroeberian configurations, and emulation: A generational time-series analysis of Chinese civilization” (Simonton, 1988)
  • 10,160 eminent Chinese creators and leaders aggregated into 141 twenty-year periods for 35 achievement categories
  • generational time-series analyses indicated
    • (a) that major and minor figures tend to fluctuate together across historical time and
    • (b) that both unweighted and weighted fluctuations are adequately described by first- or second-order autoregressive models (once exponential trends are removed): e.g., …
<table>
<thead>
<tr>
<th>Category</th>
<th>Unweighted</th>
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<th></th>
<th>Weighted</th>
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<tr>
<td></td>
<td>Trend</td>
<td>$g - 1$</td>
<td>$g - 2$</td>
<td>Trend</td>
<td>$g - 1$</td>
<td>$g - 2$</td>
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<tr>
<td>Inventors</td>
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<td>.24</td>
<td>.25</td>
<td>.31</td>
<td>.26</td>
<td>.23</td>
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<tr>
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<td>.51</td>
<td>—</td>
<td>.40</td>
<td>.34</td>
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<td>.38</td>
<td>—</td>
<td>.21</td>
<td>.38</td>
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<tr>
<td>Biological scientists</td>
<td>.65</td>
<td>.29</td>
<td>—</td>
<td>.49</td>
<td>.23</td>
<td>—</td>
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<tr>
<td>Other scientists</td>
<td>.63</td>
<td>.28</td>
<td>.27</td>
<td>.56</td>
<td>—</td>
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<td>Native religionists</td>
<td>.22</td>
<td>.31</td>
<td>—</td>
<td>.13</td>
<td>.26</td>
<td>.22</td>
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<td>Alien religionists</td>
<td>.60</td>
<td>.75</td>
<td>—</td>
<td>.51</td>
<td>.69</td>
<td>—</td>
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<td>Philosophers</td>
<td>.37</td>
<td>.50</td>
<td>—</td>
<td>.08</td>
<td>.30</td>
<td>—</td>
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<tr>
<td>Nonfiction authors</td>
<td>.87</td>
<td>.44</td>
<td>—</td>
<td>.62</td>
<td>.31</td>
<td>—</td>
</tr>
<tr>
<td>Fiction authors</td>
<td>.61</td>
<td>.37</td>
<td>—</td>
<td>.56</td>
<td>.31</td>
<td>—</td>
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<tr>
<td>Poets</td>
<td>.58</td>
<td>.37</td>
<td>.20</td>
<td>.36</td>
<td>.26</td>
<td>.30</td>
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<tr>
<td>Calligraphers</td>
<td>.29</td>
<td>.16</td>
<td>—</td>
<td>.25</td>
<td>.22</td>
<td>—</td>
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<tr>
<td>Painters</td>
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<td>—</td>
<td>.79</td>
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<td>.11</td>
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<td>Sculptors</td>
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<td>.77</td>
<td>—</td>
<td>-.16</td>
<td>.44</td>
<td>.44</td>
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<td>Architects</td>
<td>.24</td>
<td>.08</td>
<td>.30</td>
<td>.24</td>
<td>.22</td>
<td>.22</td>
</tr>
<tr>
<td>Artisans</td>
<td>.32</td>
<td>.80</td>
<td>—</td>
<td>.27</td>
<td>.80</td>
<td>—</td>
</tr>
<tr>
<td>Musicians</td>
<td>.16</td>
<td>—</td>
<td>—</td>
<td>.07</td>
<td>.17</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. Nonsignificant coefficients are in italics (when estimated).
Periods and Places

- Specific illustration: Second
  - “Intellectual genius in the Islamic Golden Age: Cross-civilization replications, extensions, and modifications” (Simonton, 2018).
  - Zero autocorrelation for theology, jurisprudence, scholarship, biography, and linguistics: Islamic tradition inspired (building on founders)
  - Second-order autocorrelation for philosophy, mathematics-astronomy, medicine, and physics ($\varphi_1 = .40, \varphi_2 = .35$): Extra-Islamic heritage inspired (building on immediate predecessors)
Random fluctuations in the weighted counts of thinkers in the achievement domains of theology, jurisprudence, scholarship, biography, and linguistics.

Positively autocorrelated fluctuations in the weighted counts of thinkers in the achievement domains of philosophy, medicine, mathematics-astronomy, and physics.
Conclusion

- Foregoing focused on the historiometric analysis of exceptional creativity as outcome variables, whether in products, persons, or periods and places.

- Yet most historiometric inquiries are just as interested in the antecedents or correlates of these outcomes, such as multiple and diverse cognitive, differential, developmental, and sociocultural factors.

- Moreover, such investigations sometimes entail extremely complex designs:
  - e.g., products are nested in persons who are in turn nested in periods and places.
References


Further Reading


Evolution by variation and biochemical natural selection

Theory of natural selection & variation for evolution

1859 Darwin, Eng
1858 Wallace, Eng
1813 M. Wells, Am.-Eng?
1858 Patrick Matthew

according to 1859 Darwin the origin of species gave
Wells the credit of being the first to enunciate the
principle of natural selection.

Also for Patient Chambers