

Creativity Over the Lifespan in Classical Composers: Reexamining the Equal-Odds Rule

Aaron Kozbelt (AaronK@brooklyn.cuny.edu)

Department of Psychology, Brooklyn College, CUNY

2900 Bedford Ave.

Brooklyn, NY 11210-2889 USA

Abstract

This investigation extends Simonton's (1977) seminal study of lifespan creativity to eighteen eminent classical composers' total output. Major and minor work production was positively correlated over the lifespan, consistent with Simonton's chance-configuration theory of creativity. However, contrary to Simonton's (1977) null finding, here strong, positive, linear and weaker, negative, quadratic age trends were consistently found in predicting hit ratio (proportion of masterpiece-level music to total music composed per age period). This uniformly replicated in several analyses examining alternative explanations for this pattern. Most individual composers' hit ratios increased with age; none declined. The results indicate that composers' perspicacity in evaluating ideas mostly increases with age, suggesting greater importance for evaluation and elaborative problem solving processes in creative productivity than implied by a chance-configuration account.

Introduction

How does creativity change over the lifespan? Do eminent creators learn to be more creative and to reliably intuit which ideas are worth elaborating? Or is creative productivity primarily driven by chance and by individual differences that are largely impervious to learning or to external influences? Dean Keith Simonton's (1977) seminal study of ten eminent classical composers was one of the first to address these questions in a comprehensive, methodologically sophisticated way. His results strongly argue for the second alternative: illustrious composers apparently do not learn to write a larger proportion of great music as their careers progress, and productivity is remarkably immune to external perturbations like wars or civil unrest. Simonton's (1977) analysis has become a cornerstone of his "chance-configuration" theory of lifespan creative productivity (Simonton, 1984a, 1988, 1997, 1999), the most comprehensive, elaborated, and parsimonious psychological theory of this complex phenomenon.

However, is it really the case that creativity, or at least perspicacity, does not improve, even in distinguished composers? Classical music aficionados may think of Beethoven, Haydn, or Verdi, and be hard pressed to think of any late, major works by these composers that are not critically acclaimed, even when compared to their earlier efforts. In contrast, thinking of comparably lauded early works by these composers is probably much harder (Hayes, 1989; Weisberg, 1999). Nevertheless, Simonton's (1977) quantitative analysis implies that these instances are illusory.

Understanding lifespan learning and creativity clearly has important theoretical and practical implications, and multiple approaches may prove fruitful. For instance, alternative definitions of "great" music might be used to examine how well Simonton's (1977) results generalize. Also, his nomothetic analysis did not investigate individual differences in career trajectory. Varied trends can cancel each other, accounting for the null finding. Of particular interest are two types of trajectories: 1) a completely flat agewise function, consistent with the "equal-odds rule" and a chance-configuration account, and 2) an agewise increase in hit ratio, consistent with an expertise acquisition or problem solving framework. (Of course, trajectories can also decline or exhibit curvilinear functions.)

Simonton's own Darwinian chance-configuration model is the most thoroughly researched theory of lifespan creativity (see Simonton, 1988, 1997). Its basis is the blind generation and selective retention of ideas (Campbell, 1960). Creative ideation follows a constant probability of success, or the "equal-odds" rule. Simonton (1999, pp. 188-197) has further argued that this ratio cannot be increased by any means; a creator's hit ratio stays constant with age.

This theory has profound psychological implications. First, it suggests there is little learning or improvement in perspicacity. Creators lack the ability to judge their ideas or works reliably, either as final products or works-in-progress. At a social level, it suggests that creators have little control over the ultimate fate of their products. Thus, mass-production is the best strategy for those who seek eminence. The chance-configuration theory counterintuitively predicts that the high point of a creator's career will simultaneously result in the most masterpieces and the most ephemera: writing one masterwork does not guarantee further success.

Numerous studies support this theory. High correlations (typically $r = .50$ to $.75$) are often found between the production of major and minor works over the lifespan (see Simonton, 1997). Comprehensive studies of the output of ten great composers (Simonton, 1977) and ten eminent psychologists (Simonton, 1985) also found no agewise hit ratio changes. However, Kozbelt (in press) found a very strong agewise increase (r (age, annual hit ratio) = $.91$, $p < .0001$) in Mozart, a composer in Simonton's (1977) sample.

Thus, at least some composers' hit ratios may improve with age. This is consistent with an expertise acquisition or problem solving perspective (Newell, Shaw, & Simon, 1962; Weisberg, 1999). From this view, creating a musical composition is an open-ended problem, on which composers bring their musical skill to bear. Expertise acquisition studies (Ericsson, Krampe, & Tesch-Römer, 1993) suggest

individual differences in musical ability are largely attributable to deliberate practice rather than innate talent. Likewise, Hayes (1989) examined 76 composers and found that in almost all cases, at least ten years of intensive study were required before a composer wrote his first masterwork, defined by recording counts. This result seems inconsistent with Simonton's (1977) finding of no change in hit ratio over composers' entire careers, since clearly great composers are writing *some* great works in their maturity. Thus, despite potentially important structural differences between expert performance and creative performance (Simonton, 2000), agewise improvement may be a possibility, particularly if skilled performance is a central component of creativity.

As noted earlier, individual variation may overwhelm a seemingly flat aggregate agewise trajectory. Galenson (2001) has found a systematic dichotomy among painters, linking career trajectories (based on the average value of work produced at various times) with creative processes. "Finders" peak early and largely plan their work in advance, proceeding with little revision. "Seekers" peak at reliably later ages and engage in much revision as they work. A comparable dichotomy among composers was suggested by Simonton (1986). He found that the most aesthetically successful works appeared early or, better, very late in composers' careers.

The present study tests the robustness of the equal-odds rule and also examines individual composers. It adopts Simonton's (1977) basic methodology of cross-sectional time-series. However, the present investigation also seeks to vary or improve the measurement of some constructs (e.g., how "masterpieces" are defined or how works can be more sensitively weighted in the analysis). Further, it seems important to confirm that the null finding on hit ratio replicates on a larger sample of composers, since, as noted above, few studies directly and comprehensively examine this important question. Moreover, a career-long flat hit ratio seems inconsistent with the finding that composers generally write no great works in the first decade or so of their careers (Hayes, 1989; Weisberg, 1999). Unfortunately, Simonton's (1977) original data are no longer extant, due to computer technology changes (Simonton, personal communication). While catalogs of composers' works are fairly standardized, many works of questionable authenticity or dating hover at the periphery of such catalogs, so revisiting and extending this type of analysis seems worthwhile.

The four models described above permit a characterization of aggregate and individual career hit ratio trajectories. The chance-configuration theory predicts no change in hit ratio with age, a positive correlation between major-minor work production over the lifespan, and is fairly agnostic on work quality. The problem solving perspective predicts a likely increase in hit ratio and masterpiece quality over time and is fairly agnostic on major-minor work production correlations.

Method

Composers Composers were selected from three sources: one list based on eminence (Farnsworth, 1969, p. 228), one based on performance frequency (Moles, 1958/66, p. 28), and one list of aesthetic significance ratings of composers' masterpieces (Halsey, 1976). The top ten composers in the first two lists were automatically sampled. Other composers who had numerous masterworks listed by Halsey (1976) were also included. The 18 composers examined were J.S. Bach, Bartók, Beethoven, Brahms, Chopin, Debussy, Dvořák, Handel, Haydn, Mendelssohn, Mozart, Schubert, Schumann, Richard Strauss, Stravinsky, Tchaikovsky, Verdi, and Wagner. Collectively, their lives span three centuries and their works account for 54% of all classical music performed (Moles, 1958/1966, p. 28).

Works Chwiałkowski's (1996) comprehensive catalog provided lists and dates of all known works of the 18 composers (6,560 compositions total). Arrangements, revisions, and lost works were excluded from most analyses.

Age at Composition Age at composition for each work was also determined (using Chwiałkowski, 1996). When composition spanned multiple years, the median (rounded up if necessary) was used. For aggregate analyses, works were grouped into consecutive five-year age periods for each composer (cf. Simonton, 1977): 5 – 9, 10 – 14, etc. Thus, each composer contributed data only during his active composing career. Ages were put into mean-deviation form based on the entire sample of composers, yielding an *age linear* variable. Age linear scores were also squared, yielding an *age quadratic* variable to test for curvilinear effects.

Works were also pooled into one-year age windows for finer-grained analyses. A total of 714 age periods were tallied across the 18 composers. *Age linear* and *age quadratic* measures were calculated in the same way for one-year windows as for five-year windows.

Weighting Performance times were used to weight each work. Times were taken from recordings (74% of works), estimates based on scores or listings in composers' work catalogs (14%), averages based on comparable works by the same composer (8%), and estimates using Simonton's (1977) genre-based system when no other information was available (4%).

Masterpiece definitions Four criteria were used to define masterpieces. Two used Halsey's (1976) list of musical masterpieces: 1) all works listed by Halsey, 2) only works given one of the two highest ratings (scores of 1 or 2) by Halsey ('stringent Halsey'). Two used recording counts from 1) the *RED Classical Catalog* (Ford, 2003), or 2) *The Penguin guide to compact discs* (March, Greenfield, & Layton, 2001). Each composer's works were rank-ordered from most to least recorded, and cumulative performance durations were computed from the top down until the total approached 50%. Top works were designated masterpieces for each measure.

Concurrent productivity Two variables were related to overall output. One, *years in interval*, logged how many years per period involved actual composition. This ranged from 1 to 5 (periods when no music was written were not analyzed). The other, *output*, tallied the total amount of music (in minutes) each composer wrote in each five- or one-year period. To minimize overall productivity differences, individual z-scores for output were computed for each composer separately.

Results

Because each composer's works were exhaustively tabulated, not sampled from a larger population, inferential statistical tests are arguably inappropriate (cf. Simonton, 2000). Therefore, effect sizes and parameter estimates accompany inferential results, whose hypothetical *p*-values can be used as a heuristic for discussion.

Lifespan productivity

Lifespan productivity generally increases quickly early in a creator's career, peaks, and then declines more gradually (Simonton, 1977, 1997). When age is expressed in mean-deviation form, output usually correlates positively with *age linear* and negatively with *age quadratic*. When these effects are combined, they form the backwards, inverted J-curve characteristic of creative output over the lifespan.

To confirm this trend for the present set of composers, as in Simonton (1977), data from all composers were put into the same time-series for a multiple regression analysis. To minimize inter-composer productivity variance, z-scores for output across 5-year age periods were computed for each composer separately. These defined the dependent variable. *Age linear* and *age quadratic*, as well as *years in interval*, were then used to predict productivity. A total of 179 age periods were included in the analysis.

The regression was significant, $F(3, 175) = 38.74, p < .0001$, adjusted $R^2 = .39$. *Age quadratic* and *years in interval* were highly significant, respectively, $\beta = -.35$ and $.45$, both $p < .0001$. The amount of variance uniquely accounted for by each variable is given by the squared semi-partial correlations, here $sr_1^2 = .09$ and $.18$, respectively. The regression coefficient for *age linear* was marginally significant, $\beta = .11, p = .08$ ($sr_1^2 = .01$). Thus, the overall lifespan trajectory of total productivity echoes the frequently observed single-peaked function, although its present shape is closer to an inverted U than to a backwards, inverted J.

The peak age for productivity can be computed by finding the residual *output* after regressing *years in interval*, setting up a polynomial regression using *age linear* and *age quadratic* to predict residual *output*, and taking the derivative of the regression equation. When this was done, peak productivity was found to occur at 39.7 years. When untransformed productivity was analyzed, the results essentially replicated (peak = 37.1 years).

When age was statistically controlled, the results indicating an inverted U-curve replicated. In fact, peak age for productivity lies almost exactly in the middle of standardized career lengths ($z = +0.04$).

Major-minor work correlations

Recall that the chance-configuration theory predicts a positive correlation between major and minor work production over the lifespan. Here, major works were defined by inclusion in Halsey (1976). Major and minor works were positively correlated, $r(177) = .36, p < .0001$ ($r^2 = .13$), supporting the chance-configuration theory. However, only two individuals showed statistically reliable correlations: Strauss, $r = -.50, p = .05$, and Bach, $r = .93, p < .0001$. Among individual composers, the median $r^2 = .16$.

Hit ratio over the lifespan

This is the main analysis of interest. Recall that Simonton (1977) found that hit ratio was essentially flat over the entire durations of ten great composers' careers, showing no systematic change with age. However, this finding seems inconsistent with Hayes's (1989) finding that composers write no masterworks in the first decade or so of their careers. To investigate this issue with the present sample of 18 composers, a hit ratio was computed for each composer in each age period using each of the four measures (basic Halsey, stringent Halsey, *RED*, and *Penguin*).

Composers vary considerably in their overall lifetime hit ratios. When defined by all works included in Halsey (1976), these range from .18 (Handel) to .70 (Wagner). The M (SD) hit ratio among the composers was .44 (.17). Thus, to minimize variance due to inter-composer hit ratio differences, z-scores for hit ratios were computed separately for each composer on each measure.

Intercorrelations between hit ratios determined by the four masterpiece criteria were all highly correlated, with correlation coefficients ranging from .45 to .74. To simplify matters, an unrotated, principal components analysis was conducted and revealed two factors. Factor 1 accounted for 71.6% of the variance, with an eigenvalue of 2.87 and loadings ranging from .75 to .91. Factor 2 accounted for 16.1% of the variance, with an eigenvalue of .65 and loadings ranging from .63 to -.36. The stringent Halsey criterion, defining composers' very greatest masterworks, had the lowest loading on Factor 1 and the highest loading on Factor 2, and this pattern was exaggerated in varimax rotated and oblique analyses. This measure was thus analyzed separately. (In practice, the results reported below do not substantively differ depending on whether three or four measures are combined, or if each of the four measures is examined individually.)

Hit ratio multiple regression To test hit ratio trends over the lifespan, all composers were initially put onto the same time-series. Each composer contributed data only during his active composing career. In each age period, individual z-scores of hit ratios from the basic Halsey, *RED*, and *Penguin* measures were averaged, yielding the dependent measure (basic hit ratio). Individual z-scores for *output* in each age period, used as the dependent measure for productivity, were used here as a statistical control. *Age linear*, *age quadratic*, and *output* predicted hit ratio.

Contrary to Simonton's (1977) findings and the