

Do Chords Last Longer as Songs Get Slower?: Tempo Versus Harmonic Rhythm in Four Corpora of Popular Music

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Tempo Versus Harmonic Rhythm

Allan Moore (2001, p. 42)

— “... the consistent appearance of a snare drum on the second and fourth beats of a bar allows this length [i.e., the bar] to be standardized.”

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Average chord durations overall in the RS 200, in bars

Chords	Mean	Trimmed Mean*	Median	Mode
All chords	4.90	1.42	1.23	1.00
Tonic	6.19	2.03	1.59	1.00
Non-Tonic	1.14	1.03	1.00	1.00

— source: de Clercq 2017, Table 11

* excludes top and bottom 10% of values (i.e., middle 80%)

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“Axis” progression (vi – IV – I – V) examples

- Taylor Swift, “You’re Not Sorry” (2008)
— 67 BPM, chord durations = 0.5 bar, **1.79 seconds**
- Justin Bieber, “Love Me” (2009)
— 125 BPM, chord durations = 1.0 bar, **1.92 seconds**
- The Offspring, “The Kids Aren’t Alright” (1998)
— 201 BPM, chord durations = 2.0 bars, **2.39 seconds**

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∴ **A Corpus Study**

Tempo Versus Harmonic Rhythm

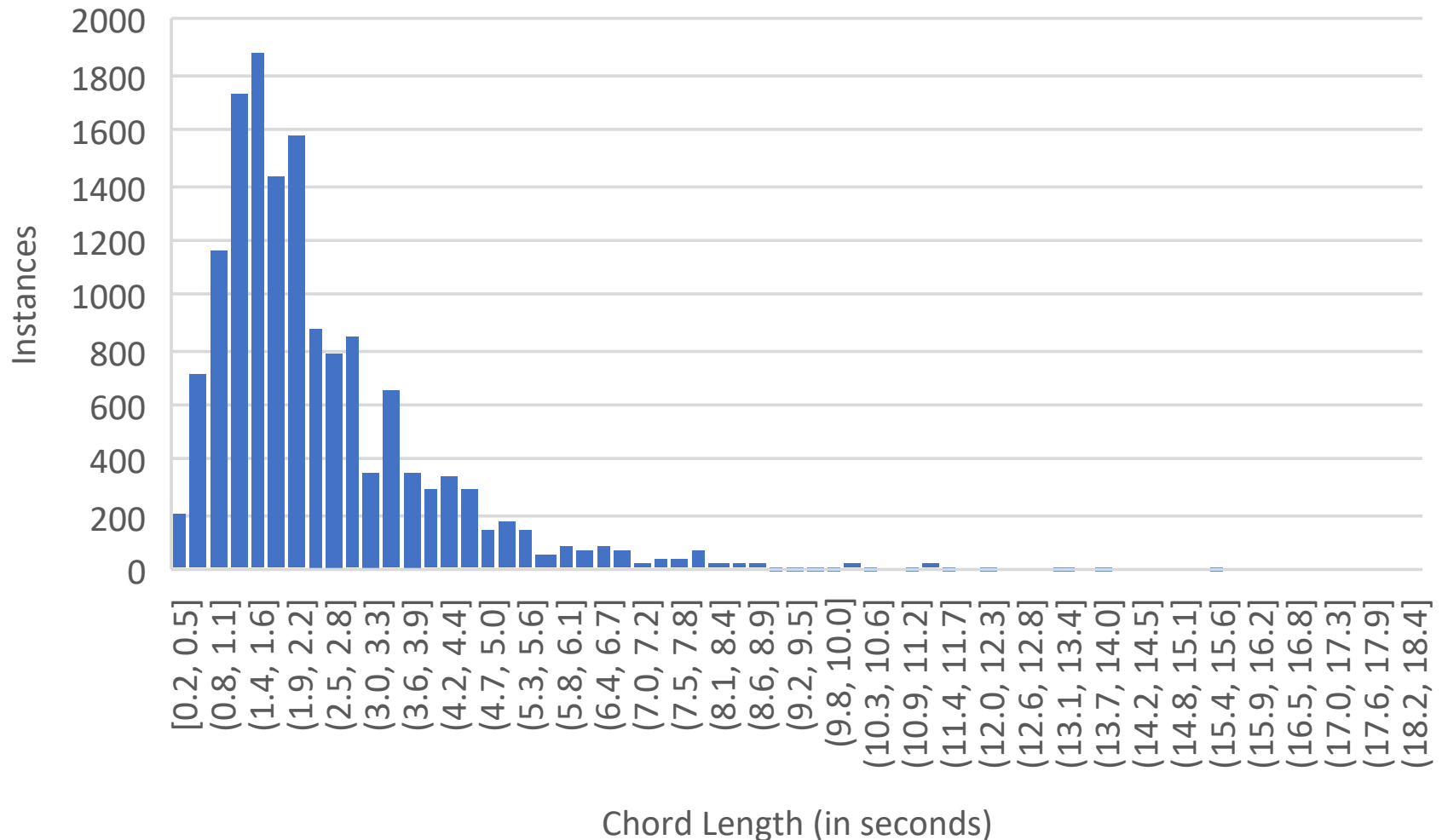
~~A Corpus Study~~ A Corpora Study

- The 200-song *Rolling Stone* magazine rock corpus
— **RS 200** (Temperley & de Clercq, 2013)
- The 200-song *Nashville Number* country corpus
— **NN 200** (de Clercq, 2015)
- The 739-song McGill *Billboard* charts corpus
— **MG 739** (Burgoyne, Wild, & Fujinaga, 2011)
- The 179-song Beatles corpus
— **BE 179** (Harte, 2010)

Preliminary Considerations

Chord lengths (secs) are log-normally distributed

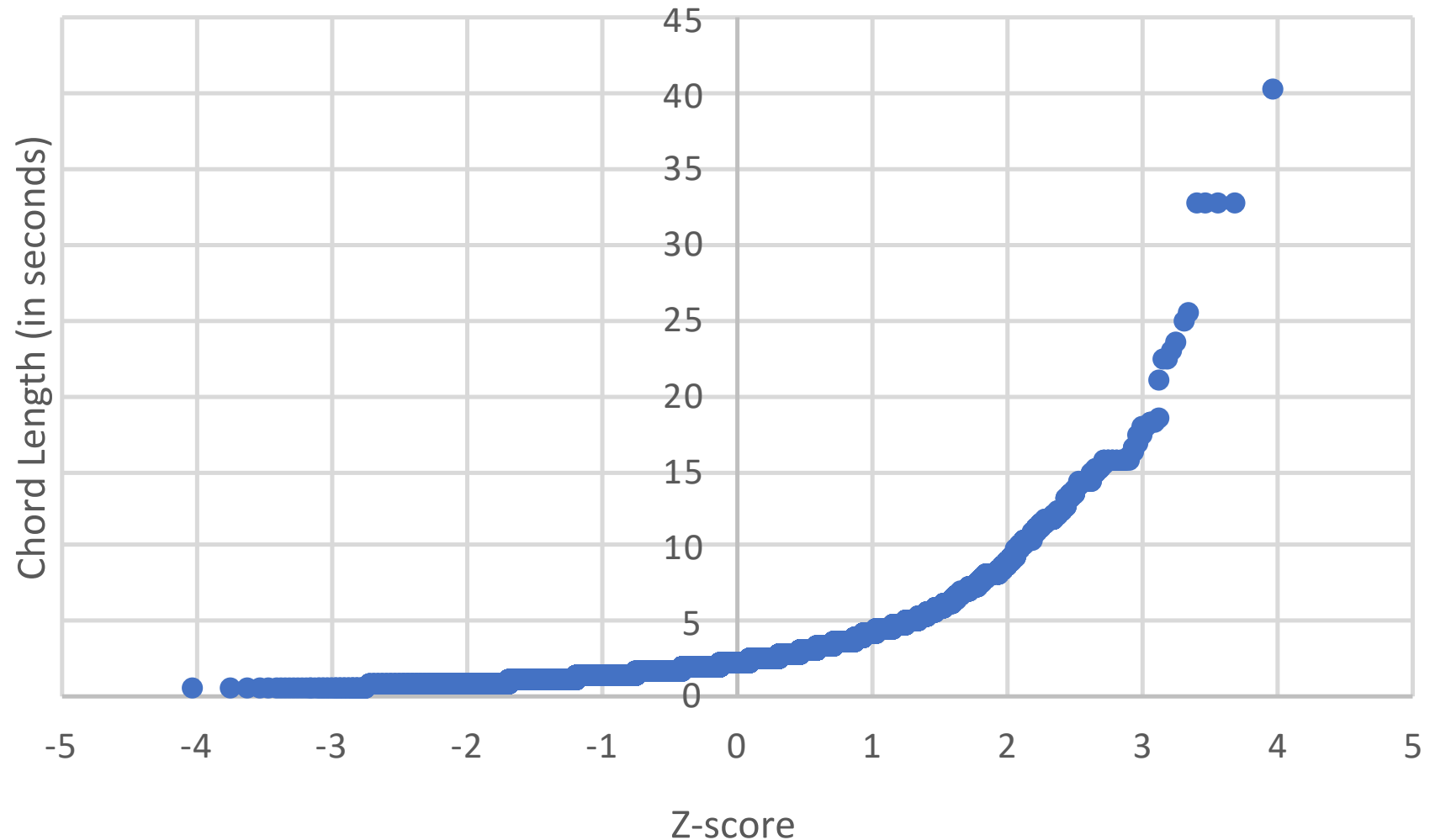
Histogram of chord lengths in NN 200



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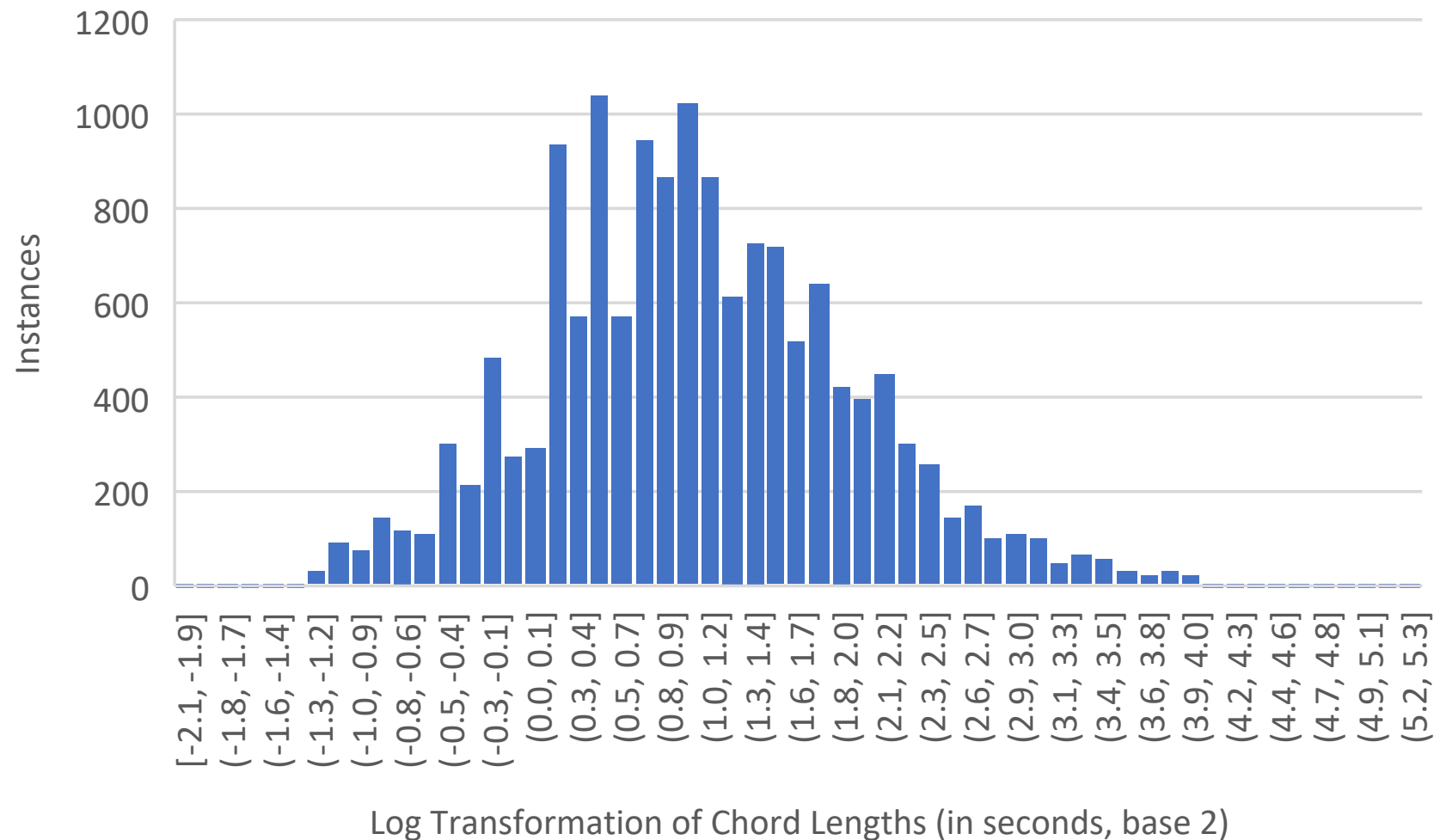
Q-Q plot of chord lengths (in seconds) in NN 200



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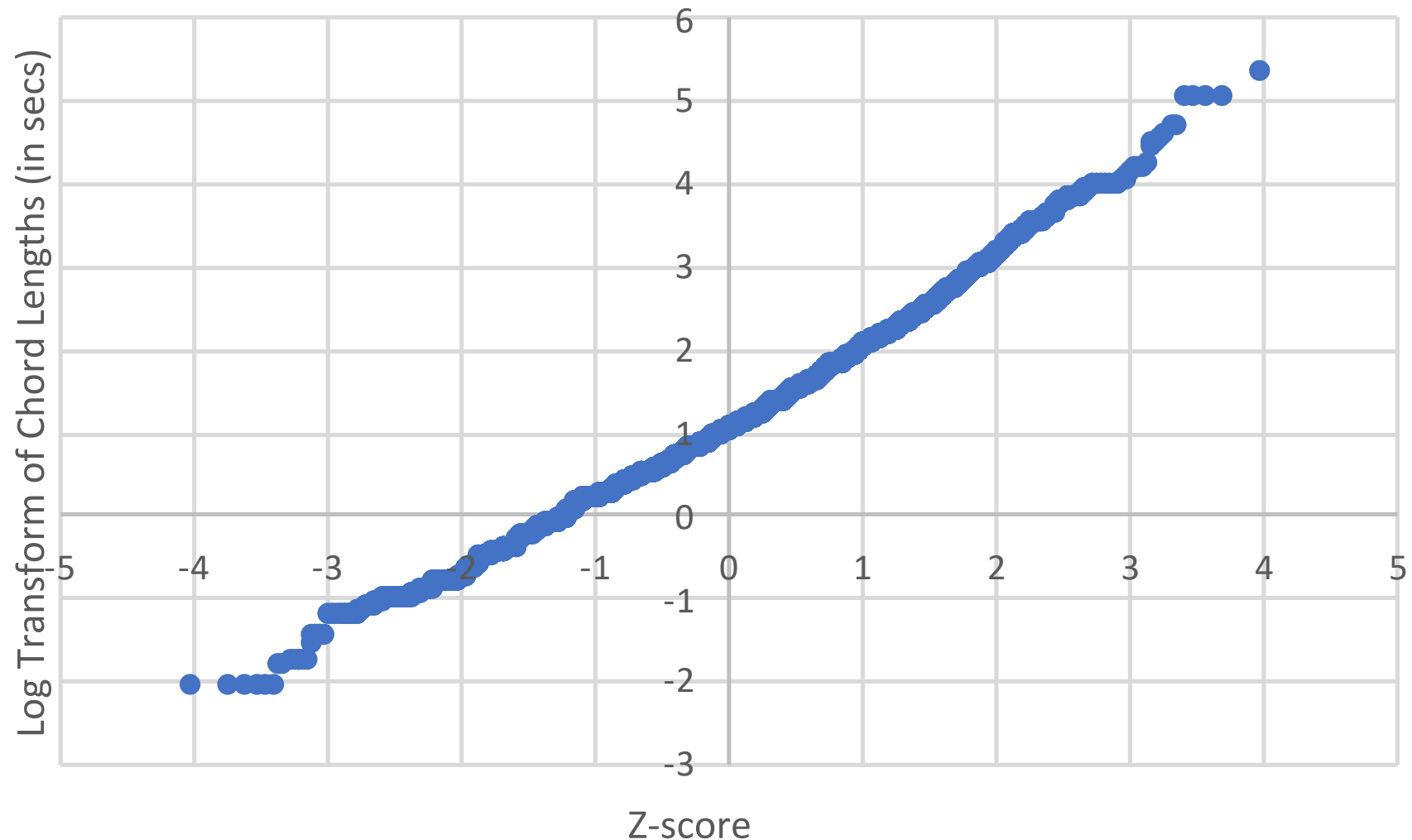
Histogram of base-2 log transform of chord lengths in NN 200



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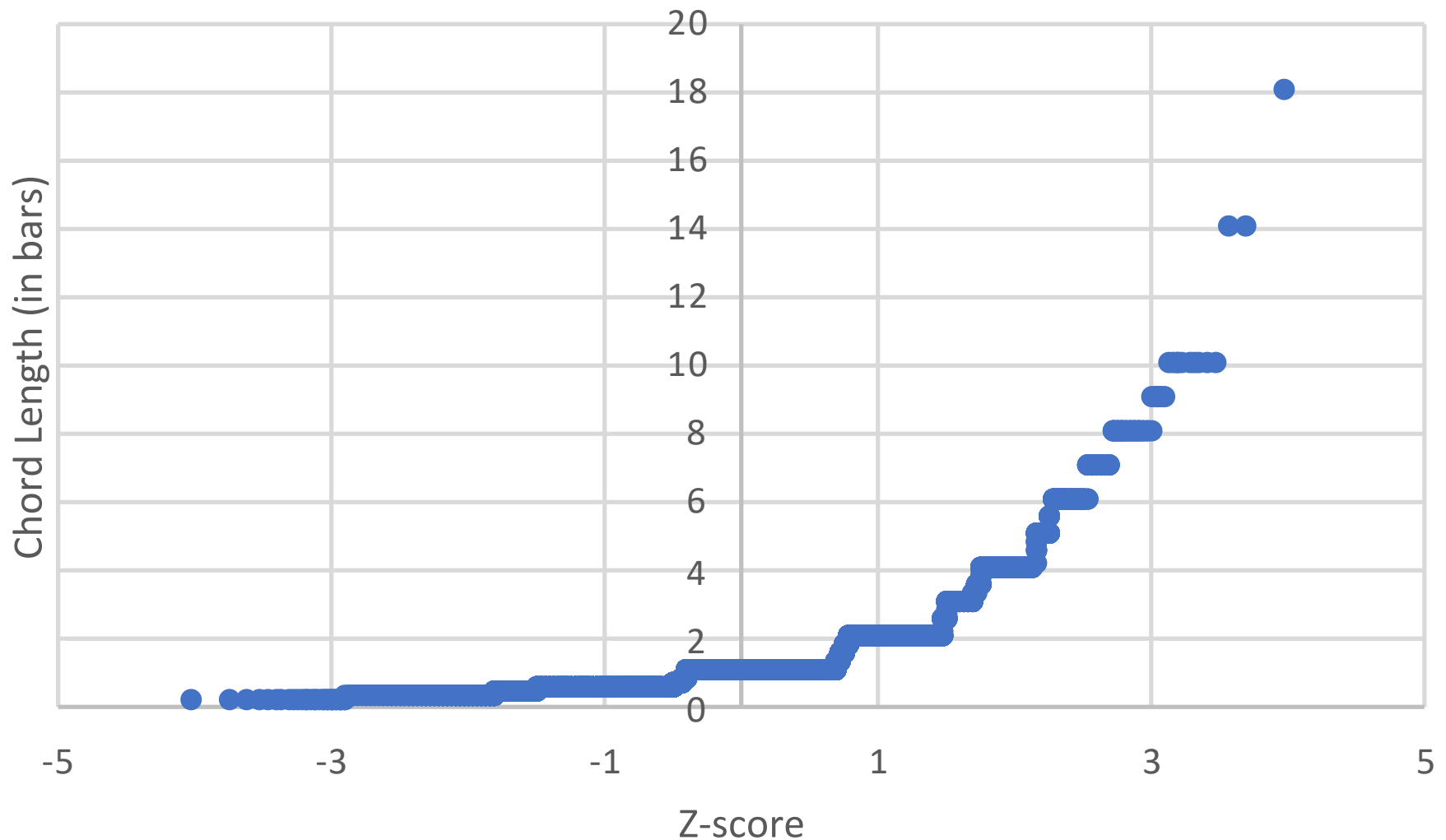
Q-Q plot of log (base 2) of chord lengths (in seconds) in NN 200



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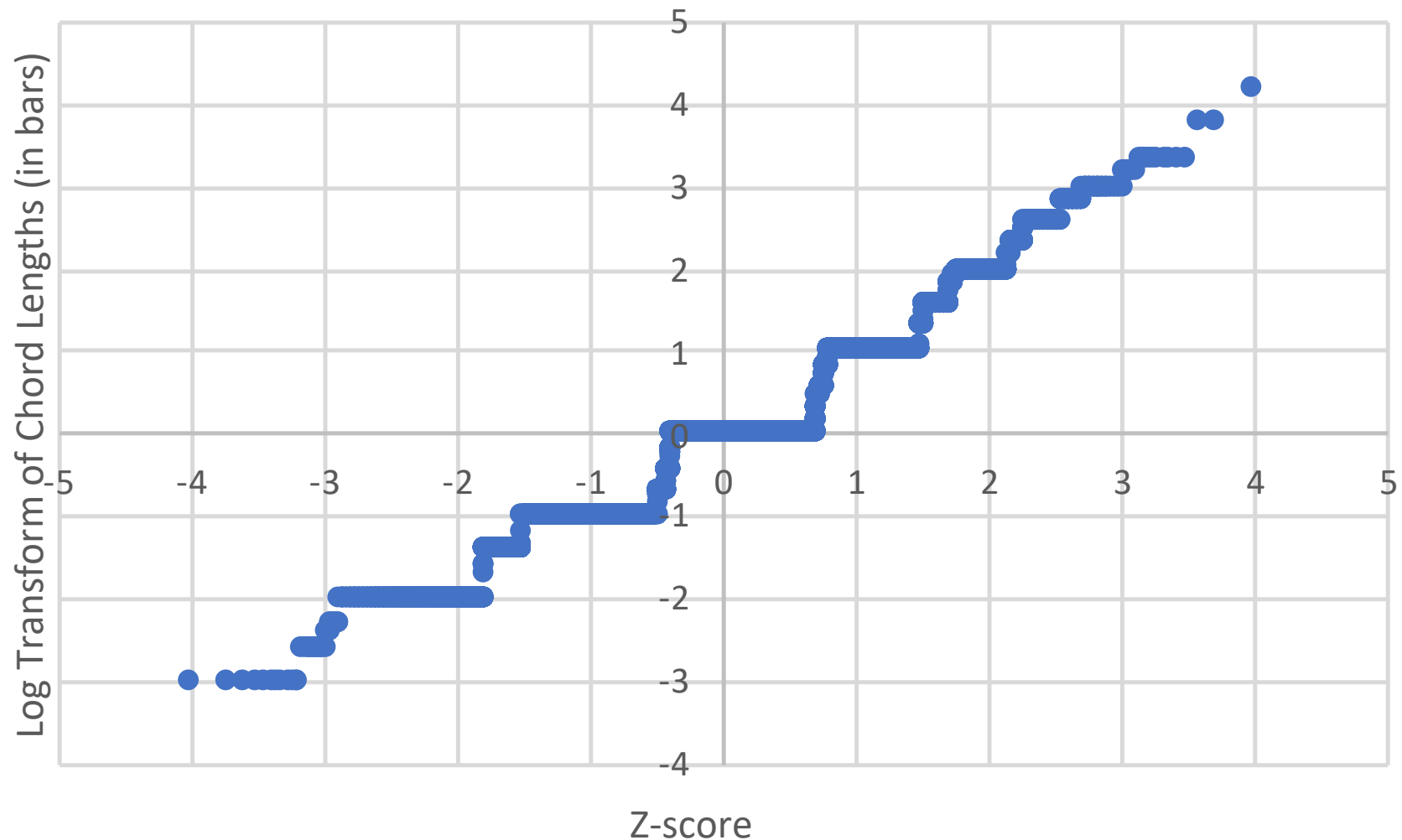
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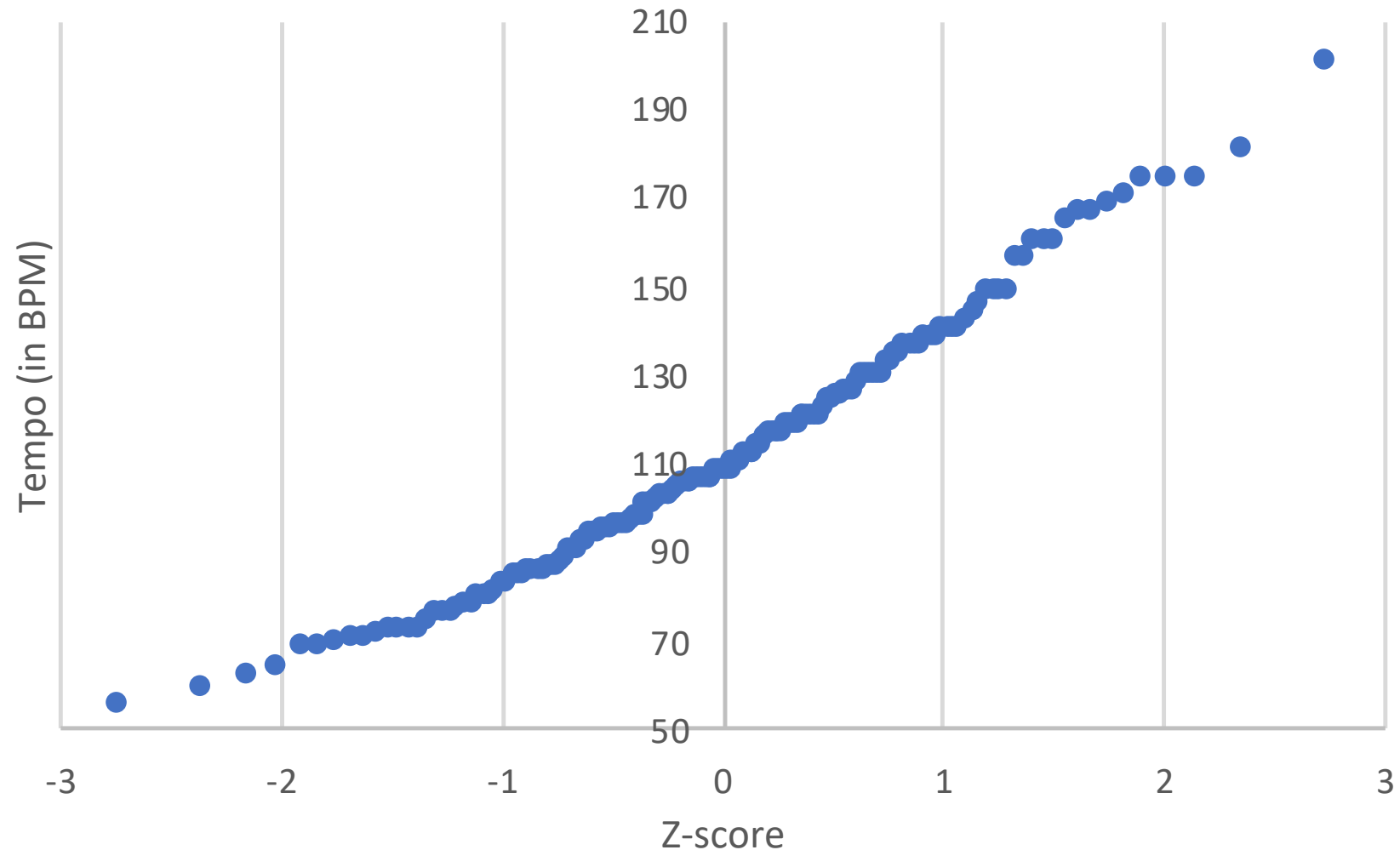
Q-Q plot of log (base 2) of chord lengths (in bars) in NN 200



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Tempo is only weakly log-normally distributed

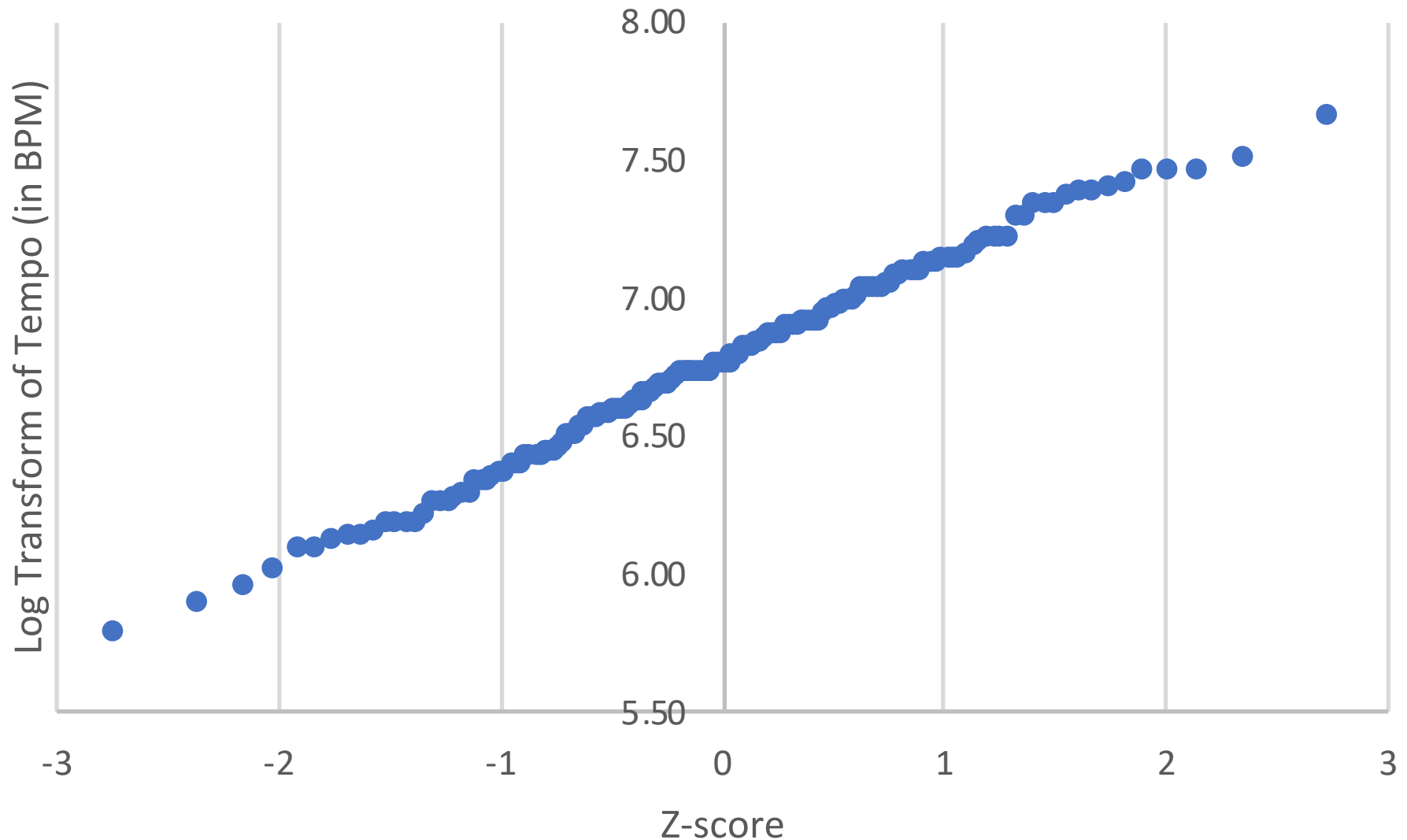
Q-Q plot of tempos (in BPM) in NN 200



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Tempo is only weakly log-normally distributed

Q-Q plot of log transform (base 2) of tempos (in BPM) in NN 200



Experiment 1: Chord Length Versus Tempo

- H_0 : Songs in 4/4 with different median chord lengths have, on average, no difference in tempo
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NN 200 results

Median Chord Length	gMean Tempo	N
0.5 bars	97.8	28
1.0 bar	109.1	85
2.0 bars	121.8	27

Comparison	t (one-tailed)	p
0.5 bars to 1.0 bar	$t(111) = 2.03$.02
1.0 bar to 2.0 bars	$t(110) = 1.96$.03
0.5 bars to 2.0 bars	$t(53) = 3.37$	< .01

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RS 200 results

Median Chord Length	gMean Tempo	N
0.5 bars	100.5	51
1.0 bar	115.6	71
2.0 bars	139.3	29

Comparison	t (one-tailed)	p
0.5 bars to 1.0 bar	$t(120) = 3.18$	$< .001$
1.0 bar to 2.0 bars	$t(98) = 3.31$	$< .001$
0.5 bars to 2.0 bars	$t(78) = 5.80$	$< .0001$

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MG 739 results

Median Chord Length	gMean Tempo	N
0.5 bars	103.1	223
1.0 bar	117.6	305
2.0 bars	139.1	80

Comparison	t (one-tailed)	p
0.5 bars to 1.0 bar	$t(526) = 5.81$	$< .00001$
1.0 bar to 2.0 bars	$t(383) = 5.22$	$< .00001$
0.5 bars to 2.0 bars	$t(301) = 8.57$	$< .00001$

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BE 179 results

Median Chord Length	gMean Tempo	N
0.5 bars	94.3	33
1.0 bar	122.5	76
2.0 bars	128.4	12

Comparison	t (one-tailed)	p
0.5 bars to 1.0 bar	$t(107) = 6.17$	$< .00001$
1.0 bar to 2.0 bars	$t(86) = 0.76$	$.23$
0.5 bars to 2.0 bars	$t(43) = 3.78$	$.0002$

Experiment 2: Tempo Versus Chord Length

- H_0 : Songs in 4/4 with different tempos have, on average, no difference in chord lengths as measured in bars.
- H_1 : Songs in 4/4 with slower tempos have, on average, shorter chord lengths as measured in bars than songs with faster tempos.

Experiment 2: Tempo Versus Chord Length

- H_0 : Songs in 4/4 with different tempos have, on average, no difference in chord lengths as measured in bars.
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NN 200 results

5 bins (N = 32 songs)

gMean Tempo	gMean Length (Bars)	gMean Length (Secs)
74.2	0.79	2.53
93.7	0.96	2.44
108.5	1.01	2.24
124.8	1.21	2.32
153.4	1.36	2.13
High / Low	1.73	1.19

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RS 200 results

5 bins (N = 32 songs)

gMean Tempo	gMean Length (Bars)	gMean Length (Secs)
79.6	0.74	2.22
100.5	0.86	2.03
115.6	0.99	2.06
130.3	1.20	2.22
169.6	1.48	2.11
High / Low	2.00	1.05

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MG 739 results

5 bins (N = 134 songs)

gMean Tempo	gMean Length (Bars)	gMean Length (Secs)
75.9	0.71	2.22
102.5	0.93	2.15
117.2	0.90	1.84
130.7	0.90	1.65
164.3	1.19	1.75
High / Low	1.68	1.27

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BE 179 results

5 bins (N = 28 songs)

gMean Tempo	gMean Length (Bars)	gMean Length (Secs)
80.8	0.68	2.01
101.8	0.75	1.78
121.2	0.89	1.76
131.4	0.97	1.77
152.1	1.14	1.81
High / Low	1.69	1.11

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