# Mapping Evolutionary Aesthetics Using Digital Methods

# Problems Encountered

# *Evolutionary Aesthetics is a scattered multi-disciplinary field. The few researchers that have tried to characterize it, rely on sources that are familiar to them as philosophers. It is worth seeing whether digital methods prove helpful while trying to define the scope and practises of Evolutionary Aesthetics, or whether close reading would answer the research question better. My hypothesis is that some kind of combination of both would be most useful. Digital methods used solely might widen the concept too far and include texts that are not relevant for the field. On the other hand, digital methods might help to include studies that would otherwise be ignored and thus shed light on new and less talked about corners of research in Evolutionary Aesthetics.*

# Data bases used: Helka, Scopus

# Tools used: Excel, SPSS, OpenRefine, Voyant

# Research question: What kind of results will digital methods give trying to find out what kind of a field Evolutionary Aesthetics is?

# Crude thoughts

# PART I

# I Performed an on-line article search on helka.finna.fi using Boolean search terms (evolution\* OR darwin\*) AND (music OR danc\*). Link to results: <https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields>.

# Terms that proved to be problematic for search were ’literature’, ’art\*’’, ’picture’, and ’visual\*’ since they resulted in a big bias in results – for example, expression ’art of’ can be used in many more occasions than only when talking about artistic artifacts and performances. Excluding those terms, however, was problematic since I had to leave too much relevant artilces out. Literature, for example, is a large topic in Evolutionary Aesthetics. One must also keep in mind that the term ’evolution’ does not always refer to biological evolution. Since Aesthetics is not a biological discipline to begin with, I decided to leave it there to paint as broad a picture of the nature of Evolutionary Aesthetics as possible.

# I did not limit the fields on Helka search because of the multidisciplinarity of Evolutionary Aesthetics. I did not limit the time frame, either. However, I limited the search for peer reviewed E-articles. I got 197 685 hits altogether. Helka already performed some analysis for me. I visualized it as the following:

**field deviation:**

[Biology 17 937](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Biology%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Psychology 9 468](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Psychology%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Ecology 7 080](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Ecology%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Music 6 893](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Music%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Evolution 6 100](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Evolution%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Culture 4 800](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Culture%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Sciences (General) 4 738](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Sciences+%28General%29%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Biological Sciences -- Biology -- Zoology 3 536](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Biological+sciences+--+Biology+--+Zoology%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Behavioral Sciences -- Anthropology -- Applied Anthropology 3 456](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Behavioral+sciences+--+Anthropology+--+Applied+anthropology%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

Arts -- Performing Arts -- Music 3 349

[Economics -- Economic Disciplines -- Labor Economics 2 863](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Economics+--+Economic+disciplines+--+Labor+economics%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Language 2 354](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Language%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Botany 2 002](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Botany%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Biological Sciences -- Biology -- Evolutionary Studies 1 481](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Biological+sciences+--+Biology+--+Evolutionary+studies%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Dance 1 301](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Dance%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Music Education 912](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Music+Education%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

[Popular Music 849](https://helka.finna.fi/Primo/Search?filter%5B%5D=tlevel%3A%22peer_reviewed%22&filter%5B%5D=rtype%3A%22articles%22&filter%5B%5D=topic%3A%22Popular+Music%22&lookfor=%28evolution%2A+OR+darwin%2A%29+AND+%28music+OR+danc%2A%29&type=AllFields)

Arts -- High Culture -- Art Music 840

Ethnomusicology 771

This chart is made in Excel. It must be noted that the size of Biology and Culture might still be misleading since the results were scattered – for example, Art Music and Ethnomusicology were categories of their own, aside from Music. The same is true when looking at many biological fields. In order the chart to be representative, I should start combining the categories. It is still worth noting already at this point that in the light of this data, Evolutionary Aesthetics is done mainly in Biology, not within Humanities. Some results need further inspecting, for example those within Botany, to be confirmed appropriate for the purpose of the study.

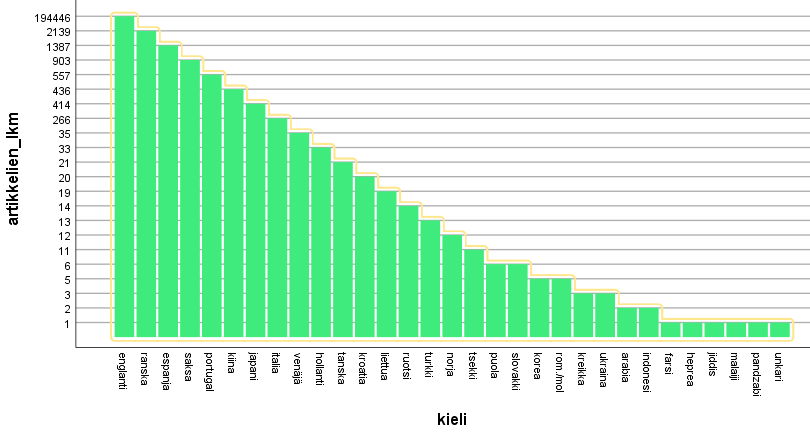
**language deviation:**

Counting language deviation can be considered unnecessary since the search terms were in English although at least some of them appear also in some other languages – but not in all the languages that might include Evolutionary Aesthetics research, such as Finnish.

|  |  |
| --- | --- |
| englanti | 194446 |
| ranska | 2139 |
| espanja | 1387 |
| saksa | 903 |
| portugal | 557 |
| kiina | 436 |
| japani | 414 |
| italia | 266 |
| venäjä | 35 |
| hollanti | 33 |
| tanska | 21 |
| kroatia | 20 |
| liettua | 19 |
| ruotsi | 14 |
| turkki | 13 |
| norja | 12 |
| tsekki | 11 |
| puola | 6 |
| slovakki | 6 |
| korea | 5 |
| rom./mol | 5 |
| kreikka | 3 |
| ukraina | 3 |
| arabia | 2 |
| indonesi | 2 |
| farsi | 1 |
| heprea | 1 |
| jiddis | 1 |
| malaiji | 1 |
| pandzabi | 1 |
| unkari | 1 |

Chart was made in Excel. It shows that English forms 97% of all articles, and the second popular language, French, only 1 %. The rest of the languages are minuscule compared to English, but it is still worth noting that Evolutionary Aesthetics research exists in many countries – and in all continents. However, this notion is valid only if the single texts counted as representatives of minority languages are considered Evolutionary Aesthtetics research. Confirming this requires close reading because of the results derived in the field deviation experiment above.

English having such a prominent position, it can be expected that all the results get from this data are representative of the English articles, and not of the research done in other languages.

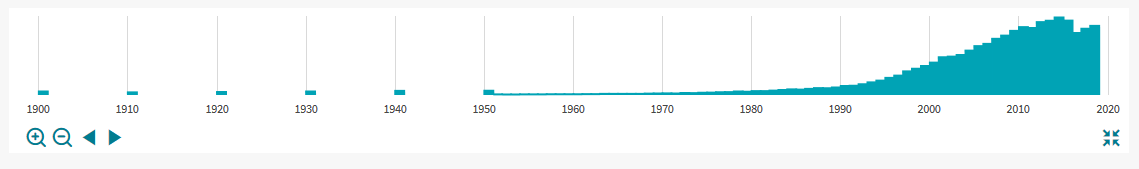


This is a rank order bar chart not to be mistaken with the relative prominence of the language. Graph was made on SPSS.

**source deviation:**

|  |  |
| --- | --- |
| PLoS ONE | 1786 |
| Nature | 868 |
| Behavioral Ecology and Sociobiology | 520 |
| Contemporary Music Review | 342 |
| Science | 262 |
| Popular Music | 248 |
| Frontiers in Psychology | 209 |
| Current Biology | 172 |
| Leonardo | 118 |
| Music Perception | 117 |
| Leonardo Music Journal | 99 |
| Evolution | 88 |
| Fontes Artis Musicae | 85 |
| Evolution And Human Behavior | 83 |
| Proceedings of the National Academy of Sciences of the United States of America | 78 |
| Musicae Scientiae | 60 |
| Molecular Phylogenetics and Evolution | 45 |
| Darwiniana | 44 |
| Annals of the New York Academy of Sciences | 41 |

The most popular journal by far, *PloS ONE*, is published by the Public Library of Science. It was surprising to me that a cult hard-to-get-published-in journal like *Nature* was the second popular journal. This alongside with the fact that also *Science* was among the publishers tells that there is a general interest to publish articles on Evolutionary Aesthetics. The fact that the majority of the articles were classified as science goes hand in hand with the most popular publishing forums. It is noteworthy that this list does not contain even nearly all the articles there was in the data. Chart was made on Excel.

**time deviation (notice that e articles only):** 

# Chart from Helka. Notice the decline of articles in 2016, and the effect of it! Now the field seems to be rising a bit but still behind the best years 2012-2015. The time frame goes hand in hand with the first use of the term ’Evolutionary Aesthetics’ in 1900 by Yrjö Hirn.

Since one cannot download search data but one by one, I had to look elsewhere for the rest of the project. This is actually a good thing in my opinion, because that way I can analyze more data and get a broader view of the matter. I used the same Boolean search terms (evolution\* OR darwin\*) AND (music OR danc\*) on Scopus data base searching through abstracts, titles, and authors. This time, I decided to include all the data base, so also editorials and conference reviews since the database was not so big, and also to get richer (also messier) data. I got 3247 hits so 194438 less than on Helka. This is not surprising among other things since Helka is much bigger and at least some of the results from Scopus are likely to be included in Helka. Link to results: [https://www.scopus.com/results/results.uri?numberOfFields=0&src=s&clickedLink=&edit=&editSaveSearch=&origin=searchbasic&authorTab=&affiliationTab=&advancedTab=&scint=1&menu=search&tablin=&searchterm1=%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29&field1=TITLE\_ABS\_KEY&dateType=Publication\_Date\_Type&yearFrom=Before+1960&yearTo=Present&loadDate=7&documenttype=All&accessTypes=All&resetFormLink=&st1=%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29&st2=&sot=b&sdt=b&sl=59&s=TITLE-ABS-KEY%28%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29%29&sid=92711178ffc734a69a90c0567fe416f9&searchId=92711178ffc734a69a90c0567fe416f9&txGid=87b520b9b09c5214a88b99ac21b1d440&sort=plf-f&originationType=b&rr](https://www.scopus.com/results/results.uri?numberOfFields=0&src=s&clickedLink=&edit=&editSaveSearch=&origin=searchbasic&authorTab=&affiliationTab=&advancedTab=&scint=1&menu=search&tablin=&searchterm1=%28evolution*+OR+darwin*%29+AND+%28music+OR+danc*%29&field1=TITLE_ABS_KEY&dateType=Publication_Date_Type&yearFrom=Before+1960&yearTo=Present&loadDate=7&documenttype=All&accessTypes=All&resetFormLink=&st1=%28evolution*+OR+darwin*%29+AND+%28music+OR+danc*%29&st2=&sot=b&sdt=b&sl=59&s=TITLE-ABS-KEY%28%28evolution*+OR+darwin*%29+AND+%28music+OR+danc*%29%29&sid=92711178ffc734a69a90c0567fe416f9&searchId=92711178ffc734a69a90c0567fe416f9&txGid=87b520b9b09c5214a88b99ac21b1d440&sort=plf-f&originationType=b&rr)=

For the comparison, here are equalent information to the Helka search from the Scopus one:

**field deviation:**

|  |  |
| --- | --- |
| Arts and Humanities | 1116 |
| Computer Science | 871 |
| Social Sciences | 627 |
| Engineering | 431 |
| Mathematics | 327 |
| Psychology | 309 |
| Medicine | 266 |
| Agricultural and Biological Sciences | 241 |
| Physics and Astronomy | 209 |
| Biochemistry, Genetics and Molecular Biology | 200 |
| Neuroscience | 197 |
| Business, Management and Accounting | 109 |
| Earth and Planetary Sciences | 88 |
| Multidisciplinary | 79 |
| Environmental Science | 53 |
| Economics, Econometrics and Finance | 45 |
| Materials Science | 38 |
| Health Professions | 36 |
| Decision Sciences | 30 |
| Immunology and Microbiology | 23 |
| Chemistry | 19 |
| Chemical Engineering | 15 |
| Energy | 13 |
| Pharmacology, Toxicology and Pharmaneutics | 9 |
| Veterinary | 5 |
| Dentistry | 1 |
| Undefined | 4 |

It can be noted that the biggest field takes roughly the same percentage of the top 6 field. It is interesting that this time it is Arts and Humanities, not Biology, that dominates. In fact, Biology did not make it to top 6 at all in the Sopus data.

**language deviation:**

|  |  |
| --- | --- |
| English | 3015 |
| French | 77 |
| Spanish | 55 |
| German | 34 |
| Russian | 22 |
| Portuguese | 19 |
| Italian | 15 |
| Chinese | 11 |
| Japanese | 8 |
| Czech | 7 |
| Turkish | 4 |
| Romanian | 3 |
| Slovenian | 3 |
| Dutch | 2 |
| Hungarian | 2 |
| Lithuanian | 2 |
| Polish | 2 |
| Arabic | 1 |
| Bosnian | 1 |
| Croatian | 1 |
| Estonian | 1 |
| Greek | 1 |
| Malay | 1 |
| Serbian | 1 |
| Swedish | 1 |
| Ukrainian | 1 |
| Catalan | 1 |
| Undefined | 1 |

English forms 92% of all the languages. The result is consistent with the Helka graph since in both less than 10% of the articles were in some other language than English. Graph was made on Excel.

**source deviation:**

My data consisted of 2000 sources from Scopus. I used the Excel ’find and replace’ tool (find ’ "\* ’ ; replace with blank) to get rid of the https:// addresses. I used the clean-up tool OpenRefine’s ’facet’ function to see the most frequent sources. I included only the ones with more than 5 publications on the data. The results were (http://127.0.0.1:3333/project?project=2273176231010):

[Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)](javascript:%7b%7d) 77

[Frontiers in Psychology](javascript:%7b%7d) 21

[PLoS ONE](javascript:%7b%7d) 18

[Music Scholarship](javascript:%7b%7d) 17

[Proceedings of the National Academy of Sciences of the United States of America](javascript:%7b%7d) 16

[Frontiers in Neuroscience](javascript:%7b%7d) 15

[Scientific Reports](javascript:%7b%7d) 13

[Advances in Intelligent Systems and Computing](javascript:%7b%7d) 12

[Astronomy and Astrophysics](javascript:%7b%7d) 12

[Communications in Computer and Information Science](javascript:%7b%7d) 12

[Contemporary Music Review](javascript:%7b%7d) 12

[Annals of the New York Academy of Sciences](javascript:%7b%7d) 11

[Physics of Life Reviews](javascript:%7b%7d) 11

[Proceedings - 40th International Computer Music Conference, ICMC 2014 and 11th Sound and Music Computing Conference, SMC 2014 - Music Technology Meets Philosophy: From Digital Echos to Virtual Ethos](javascript:%7b%7d) 11

[ACM International Conference Proceeding Series](javascript:%7b%7d) 9

[Interdisciplinary Science Reviews](javascript:%7b%7d) 9

[Language and Music as Cognitive Systems](javascript:%7b%7d) 9

[Monthly Notices of the Royal Astronomical Society](javascript:%7b%7d) 9

[Soft Computing](javascript:%7b%7d) 9

[Studies in Computational Intelligence](javascript:%7b%7d) 9

[Music Theory Spectrum](javascript:%7b%7d) 8

[Musicae Scientiae](javascript:%7b%7d) 8

[Philosophical Transactions of the Royal Society B: Biological Sciences](javascript:%7b%7d) 8

[CEUR Workshop Proceedings](javascript:%7b%7d) 7

[Computer Music Journal](javascript:%7b%7d) 7

[Frontiers in Human Neuroscience](javascript:%7b%7d) 7

[Proceedings - 31st European Conference on Modelling and Simulation, ECMS 2017](javascript:%7b%7d) 7

[Research in Dance Education](javascript:%7b%7d) 7

[Biology and Philosophy](javascript:%7b%7d) 6

[Current Biology](javascript:%7b%7d) 6

[Nature](javascript:%7b%7d) 6

[Organised Sound](javascript:%7b%7d) 6

[Physica A: Statistical Mechanics and its Applications](javascript:%7b%7d) 6

[includeeditProgress in Brain Research](javascript:%7b%7d) 6

Computer Science dominates the forum for discussion. *PloS One* appeared on the top of the results also this time. *Nature*, however, made it to the list but did not reach as good of a rank as with the Helka data. Since the Helka results consisted of 20 journals, here is a similar Excel graph on the Scopus results:

**PART II**

I exported data from the first 2000 Scopus hits as CSV. 2000 maximum number allowed by Scopus to be exported (all citation information could have been exported). The data consists of abstracts and author names.

It must be noted that all the first 2000 hits didn’t contain this information so the actual n<2000. The size of data being thus unclear can be counted as a flaw of this preliminary trial, since the exact size is linked to the biases and hence should be visible.

**core terminology:**

I exported the abstracts as an Excel (CSV) and deleted the httpps:// address cells to get the abstracts only. I uploaded the abstracts on Voyant as a Notepad file (into which they had for some reason transformed on my computer overnight) to find out what kind of terms form the core terminology of the field. I added the following terms to the stopword list: ’new’, ’study’, ’based’, ’approach’, ’studies’, ’analysis’, ’university’, ’using’, ’research’. More terms could have been added to the list, as can be seen from the Voyant chart below in a more vigorous study, but this does not change the 5 most frequent terms. Most frequent words used in the abstracts were unsurprisingly: [music](https://voyant-tools.org/?corpus=c4b0dcc689f511dbee9c30e093d8a7f9) (432), [evolution](https://voyant-tools.org/?corpus=c4b0dcc689f511dbee9c30e093d8a7f9) (200), [design](https://voyant-tools.org/?corpus=c4b0dcc689f511dbee9c30e093d8a7f9) (154), [time](https://voyant-tools.org/?corpus=c4b0dcc689f511dbee9c30e093d8a7f9) (128), and [musical](https://voyant-tools.org/?corpus=c4b0dcc689f511dbee9c30e093d8a7f9) (123). This indicates that the data is relevant and can be referred to as Evolutionary Aesthetics. Such terms as ’digital’, ’algorithm’, ’optimization’, and ’management’ appeared rather surprisingly on the graph and indicate a quantitative approach from the researchers. This might be due to that the majority of the research was conducted in Musicology. Examining the use of those further might reveal interesting aspects of the field for someone like me, who is interested in Evolutionary Aesthetics but does not have background on Musocology. It would be interesting to see the ratio of the mathematical music research to research on evolutionary research done on other forms of art, like literature.



**key word deviation:**

Key words were counted on the Scopus web site (https://www.scopus.com/results/results.uri?numberOfFields=0&src=s&clickedLink=&edit=&editSaveSearch=&origin=searchbasic&authorTab=&affiliationTab=&advancedTab=&scint=1&menu=search&tablin=&searchterm1=%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29&field1=TITLE\_ABS\_KEY&dateType=Publication\_Date\_Type&yearFrom=Before+1960&yearTo=Present&loadDate=7&documenttype=All&accessTypes=All&resetFormLink=&st1=%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29&st2=&sot=b&sdt=b&sl=59&s=TITLE-ABS-KEY%28%28evolution\*+OR+darwin\*%29+AND+%28music+OR+danc\*%29%29&sid=92711178ffc734a69a90c0567fe416f9&searchId=92711178ffc734a69a90c0567fe416f9&txGid=87b520b9b09c5214a88b99ac21b1d440&sort=plf-f&originationType=b&rr). I moved 12 most used of them to Excel in order to get the following graph:

|  |  |
| --- | --- |
| Music | 502 |
| Human | 406 |
| Article | 300 |
| Evolution | 290 |
| Humans | 265 |
| Computer Music | 235 |
| Evolutionary Algorithms | 181 |
| Animals | 145 |
| Genetic Algorithms | 141 |
| Priority Journal | 140 |
| Female | 136 |
| Male | 133 |
|  |  |

’Article’ and ’Priority Journal’ are probably index keywords, and can be ignored here. The result is that different human derived words are the most common by far. To make this more visible, they should be combined for the sake of the graph. Music and algorithm derived keywords are popular, as well.

**central contributors:**

I used the Excel find and replace tool (find ’ "\* ’ ; replace with blank) to get rid of the https:// addresses after each author name on each row (one or more authors per cell) leaving 2000 rows of author names. Some of rows do not contain author names since they were not available on Scopus so n<2000 again. I edited multi-valued cells on OpenRefine splitting them by comma. Then I counted facets of the names to see which ones appeared most frequently. Since 83 cells did not include names, the original n=2000-83=1917. The top authors followed by hits were:

[Ravignani A.](javascript:%7b%7d) 14

[Perlovsky L.](javascript:%7b%7d) 10

[Floros A.](javascript:%7b%7d) 9

[Fukumoto M.](javascript:%7b%7d) 9

[Vrahatis M.N.](javascript:%7b%7d) 9

[Stanley K.O.](javascript:%7b%7d) 8

[Kaliakatsos-Papakostas M.A.](javascript:%7b%7d)8

[Vatolkin I.](javascript:%7b%7d) 8

[Fitch W.T.](javascript:%7b%7d) 7

[Risi S.](javascript:%7b%7d) 7

[Itoh T.](javascript:%7b%7d) 6

[Rudolph G.](javascript:%7b%7d) 6

[Ting C.-K.](javascript:%7b%7d) 6

[Togelius J.](javascript:%7b%7d) 6

[Cross I.](javascript:%7b%7d) 6

[Hoover A.K.](javascript:%7b%7d) 6

[Killin A.](javascript:%7b%7d) 6

[Dixon S.](javascript:%7b%7d) 5

[Eklund P.](javascript:%7b%7d) 5

[Grazian A.](javascript:%7b%7d) 5

[Scharff C.](javascript:%7b%7d) 5

[Wang Y.](javascript:%7b%7d) 5

[Zaccagnino R.](javascript:%7b%7d) 5

[Fukumoto M.](javascript:%7b%7d) 5

[Patel A.D.](javascript:%7b%7d) 5

[Scirea M.](javascript:%7b%7d) 5

This is an interesting result since the most frequent contributor Andrea Ravignani is a young scholar – he received his doctorate only in 2014 in Cognitive Biology. It must be noted, however, that collaborating in a research group counts the same as conducting research alone in this table. Leonid Perlovsky, the second frequent contributor is an affiliated professor at Northeastern University and a visiting researcher at Harvard with research interests in algorithms and evolutionary models. This provides some reflection on why algorithm was a key concept. They are used often in musicological and neurobiological studies of evolution of music. Analyzing the top authors further analysis is required on finding out who these people are, or in other words, what their backgrounds and research interests are. (All names included in the data can be found here: http://127.0.0.1:3333/project?project=1546613096264.)

**FINAL THOUGHTS**

Most relevant outcomes in my opinion were the central contributors, core terminology and key concepts, field deviation, as well as the most popular journals. Still, the main outcome in this brief study was that using search terms was too crude. Better method for finding a desired data set that would describe all of the field of Evolutionary Aesthetics might be neuronetworks or machine learning. Furthermore, in the light of my experiment, I would say using more and different kinds of data sets and comparing the results with each other is the best way forward because the results seem to depend somewhat on the data set. Finding out relations of the writers using social networks analysis (with tools such as igraph, sna, statnet, or sonia) might be interesting, too.