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Seyed Farhad Tayyebi
Istanbul Technical University, Istanbul, Turkey

Yuksel Demir
Istanbul Technical University, Istanbul, Turkey

Extensive Exploration of the Preference Correlations between Architectural Features and Musical Attributes

Abstract: This study investigates the correlations between empirically-based preferencesfor architectural features and self-reported preferences for musical attributes. Altogether, 16 architectural attributes related to architectural complexity, indentation, symmetry, rhythm, pattern, and stress and 36 musical attributes of genres, perceived psychological attributes, Five Factors of Music, and 3-Factors are considered in the study, and their correlations are examined across 61 different demographic classes. In short, after gathering the data, Pearson's correlation coefficient analysis examined the existence of correlation, and Bonferroni correction screened the most reliable ones. Then, categorization and K-mean clustering methods summarized the outcomes to provide a holistic understanding of the discovered correlations. The former reflected a higher number of correlations within genre and FFM in music, and indentation, complexity, and symmetry in architecture. The latter presented interesting correlation trends, including between complicated music and complicated architecture, rap music and the existence of pattern in architecture, and mellow music and simple architectural forms.

Keywords: preference correlations; architecture and music; correlated features;architecture and genre; complexity preferences; architectural preferences; musical taste.

Introduction

Many scholars have discussed the robust interrelations between architecture and music, includingSchopenhauer, Xenakis, Steven Holl, Le Corbusier, John Cage, Daniel Libeskind, Miles Davis, as well as Goethe, who famously called architecture 'frozen music'.[1]The reciprocal impacts of architecture and music date back to ancient

[1]Deborah Ascher Barnstone, "Willem Marinus Dudok: The Lyrical Music of Architecture," *The Journal of Architecture* 20, 2 (2015): 169–92.

*Author's contact information: tayyebi.sf@gmail.com

times[2],continuethroughthe Renaissance[3]and Baroque periods[4]all the way to the present timescharacterized by technological advances that have enabled more interrelated projects. Bloch City by Peter Cook with towers arranged as music staff,[5]and the Chords Bridge in Jerusalem reflecting the harmony of stringed instruments are the two overt interrelations between architecture and music. However, there are also more covert, in-depth interrelations, such as the analogical similarities between the structure of Miles Davis's jazz and the ribbons of Zaha Hadid's architecture, the superimposed shapes of Eisenman's buildings, Gehry's warping system and the parametric architecture of Schumacher, which according to Veal are the mirror images of each other. [6]Similarly, the Toronto Music Garden by Yo-Yo Ma and Messervey is a spatial translation of Bach's Cello Suit #1 in G Major[7] and, conversely, traces of the Ryoanji Japanese garden can be found in the non-intentional compositions of John Cage.[8]Nowadays, the interrelations between architecture and music have passed the previous limitations, and the number of interrelated projects is increasing in numbers.

Among these interrelations, particularconcepts in one discipline are seen as peer attributes in that other discipline, for instance,musical interval and architectural proportion, as well as time in music and either space or span/distance in architecture.[9] While there have been many attempts to uncover theoretical or technical interrelations, no study to date has sought to explore possible correlations between the personal satisfaction of the considered peer attributes. Does a technical translation of satisfactory proportions in architecture result in pleasant musical harmonies? Given the fact that rhythm plays a central part in both architecture and music, is there a correlation of the preferences between the two?

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[2] Markus Bandur, *Aesthetics of Total Serialism: Contemporary Research from Music to Architecture* (Basel; Boston; Berlin: Birkhäuser, 2001).

[3]Napoleon Ono Imaah, "Music: A Source of Inspiration and Harmony in Architecture: An African View," *International Review of the Aesthetics and Sociology of Music* 35, 2 (2004): 169–82.

[4]Hare Kilicaslan and Isik Ece Tezgel, "Architecture and Music in the Baroque Period," *Procedia – Social and Behavioral Sciences* 51 (2012): 635–40.

[5] Michael Fowler,*Architectures of Sound: Acoustic Concepts and Parameters for Architectural Design* (Basel: Birkhäuser, 2017).

[6] Michael E. Veal, "Warps, Ribbons, Crumpled Surfaces, and Superimposed Shapes: Surfing the Contours of Miles Davis's 'Lost Quintet,'" in *CENTER 18: Music in Architecture – Architecture in Music*, ed. by Michael Benedikt (Austin, Texas: Center for American Architecture and Design, 2014), 32–41.

[7] Brenda J. Brown, "Music, Landscape Architecture, and the Stuff of Landscapes," in *CENTER 18: Music in Architecture – Architecture in Music*, ed. by Michael Benedikt (Austin, Texas: Center for American Architecture and Design, 2014), 152–67.

[8] Stephen Whittington, "Digging in John Cage's Garden: Cage and Ryōanji," *Malaysian Journal of Music* 2, 2 (2013): 12–21.

[9] Thomas J. Baker, "Integritas: Modern Relationships between Music and Architecture /," University of Washington, Ann Arbor, 1996, https://www.researchgate.net/publication/34793557_Integritas_modern_relationships_between_music_and_architecture, acc. on August 26, 2024.

In addition, many studies confirm the significance of certain attributes inarchitectural appreciations[10]and musical taste.[11]Among the attributes, some common ones are found influential in the aesthetic preferences of both building features and music pieces; for example, complexity as a significant determinant of musical preferences[12]was found influential when it comes to residential building façade preferences[13]appraisals of storefronts,[14]and building preferences in general.[15]It is interesting to discover if there is any correlation between the preferred complexity level of architecture and music for the same person. Does satisfaction with a simpler architectural form for a specificindividual reflect higher levels of appraisal of a simpler musical composition?

This paper aims atinvestigating the correlations between individual preferences of architecture and music attributes, with an intention to discover if a preference for an attribute in one field may reflect a preference tendency in another field. It is worth noting, without applying a restricted limitation, that this study examines the correlation between a large number of the most common attributes in architecture and music. Despite the questionable essence of such a huge examination, earlier investigations confirmed the do-ability of the study: a study confirmed the possibility of extracting the preferences of a large number of architectural attributes from a limited set of building images[16]and the initial investigative results confirmed the possibility of carrying out the

[10] Moshe Bar and Maital Neta, "Humans Prefer Curved Visual Objects," *Psychological Science* 17, 8 (2006): 645–48; Keith G. Humphrey and Diane E. Humphrey, "The Role of Structure in Infant Visual Pattern Perception," *Canadian Journal of Psychology/Revue Canadienne de Psychologie* 43, 2 (1989): 165; David H. Silvera, Robert A. Josephs, and Brian R. Giesler, "Bigger Is Better: The Influence of Physical Size on Aesthetic Preference Judgments," *Journal of Behavioral Decision Making* 15, 3 (2002): 189–202; Paul J. Silvia and Christopher M. Barona, "Do People Prefer Curved Objects? Angularity, Expertise, and Aesthetic Preference," *Empirical Studies of the Arts* 27, 1 (2009): 25–42.

[11] John M. Geringer, "Musicians' Preferences for Tempo and Pitch Levels in Recorded Orchestral Music," *Journal of Research in Music Education* 58, 3 (2010): 294–308; Gabriela Husain, William Forde Thompson, and Glenn E. Schellenberg, "Effects of Musical Tempo and Mode on Arousal, Mood, and Spatial Abilities," *Music Perception: An Interdisciplinary Journal* 20, 2 (2002): 151–71; Adrian North and David Hargreaves,*The Social and Applied Psychology of Music* (Oxford: Oxford University Press, 2008); Glenn E. Schellenberg and Peter Habashi, "Remembering the Melody and Timbre, Forgetting the Key and Tempo," *Memory & Cognition* 43, 7 (2015): 1021–31.

[12] Josh Gordon and Mark C. Gridley, "Musical Preferences as a Function of Stimulus Complexity of Piano Jazz," *Creativity Research Journal* 25, 1 (2013): 143–46.

[13] Aysu Akalin, Kemal Yildirim, Christopher Wilson, and Onder Kilicoglu, "Architecture and Engineering Students' Evaluations of House Façades: Preference, Complexity and Impressiveness," *Journal of Environmental Psychology* 29, 1 (2009): 124–32.

[14] Yasemin Burcu Çakırlar, "Factors Affecting Evaluations of Storefront Designs and Inference on Store Characteristics," Bilkent University, 2010, http://hdl.handle.net/11693/15093, acc. on August 26, 2024.

[15] Gordon and Gridley, Musical Preferences as a Function of Stimulus Complexity of Piano Jazz; Thomas R. Herzog and Ronda L. Shier, "Complexity, Age, and Building Preference," *Environment and Behavior* 32, 4 (July 1, 2000): 557–75; Cagri Imamoglu, "Complexity, Liking and Familiarity: Architecture and Non-Architecture Turkish Students' Assessments of Traditional and Modern House Facades," *Journal of Environmental Psychology* 20, 1 (2000): 5–16; Pablo P. L. Tinio and Helmut Leder, "Just How Stable Are Stable Aesthetic Features? Symmetry, Complexity, and the Jaws of Massive Familiarization," *Acta Psychologica* 130, 3 (2009): 241–50.

[16] Seyed Farhad Tayyebi and Yüksel Demir, "Architectural Composition: A Systematic Method to Define a List of Visual Attributes," *Art and Design Review* 7, 3 (2019): 131–44.

procedure automatically.[17]In addition, the consideration ofa large number of attributes not only uncovers a higher number of significant correlations, but it also provides an opportunity to apply correlation reduction strategies to providesolid foundation for a more conscious interrelation between the two fields in the future.

Methodology

A three-step methodology was employed to explore the correlations between the preferences of architectural and musical attributes. As shown in Figure #1, the attributes were first defined, and a survey gathering raw data was prepared and distributed. In the next step, the provided raw data were analysed to extract individual attribute preferences, and the outcomes were filtered to distinguish reliable responses. The second phase, therefore, provided a clear set of attribute preferences for reliable responses. Lastly, Pearson's correlation coefficient analysis examined the correlations between every single attribute within different demographic categories. The outcomes were then filtered twice to skim off the most statistically reliable correlations. The discovered correlations were then summarized to provide a conclusive framework of the correlated attributes. The methodology is explained in more details in the subsequent sections, although elaborate information can also be scrutinized in the provided raw data(see Figure #1).

1.Defining attributes & gathering raw data

The architectural and musical attributes are defined based on previous investigations, though they can also be seen as part of the limitations of this study. In a previous paper, the authors applieda systematic method to analyze over 200 diverse architectural forms and thereby extracted the most common visible building attributes.[18]The main attribute reflecting the visual features of a building façade qualities pertains to (i) indentation, which refers to the amount of back and forth, in contrast to being flat, in the building facades, (ii) complexity, concerning the degree of sophistication of the form, (iii) symmetricity, which is the degree of axial symmetricity in the building façade, (iv) rhythm, as in the repetition of solid architectural elements, in contrast to tiny elements like window dividers, (v) pattern that exists in the building as a result of repeated elements, and (vi) stress, concerning the directions emphasized by structural elements or contours of the building constituents.

Different qualities exist in the above feature categories, each of which is one of the attributes considered in this paper. Within indentation, there are three formal

[17] Seyed Farhad Tayyebi and Yüksel Demir, "Musical Preferences Correlate Architectural Tastes: An Initial Investigation of the Correlations Between the Preferred Attributes," *Advanced Journal of Social Science* 7, 1 (2020): 96–108; Seyed Farhad Tayyebi and Yüksel Demir, "Musical Preferences Correlate Architectural Tastes: Preference Correlations between Architectural Material Features and Musical Instruments," *Interdisciplinary Science Reviews*, June 6 (2022): 1–16.

[18] Tayyebi and Demir, "Architectural Composition: A Systematic Method to Define a List of Visual Attributes."

attributes, including *flat* (no or very few indentations in the building façade), *moderately indented* (existence of some indentations and recesses in the building façade), and *highly indented* façade (existence of a large number of indentations with deep recessed areas in the façade). Within complexity, there are *simple* (buildings with a limited number of elements and without any sophistication in their composition), *moderately complicated* (buildings with some formal sophistication), and *fully complicated* (sophisticated building forms, mostly accompanied by a large number of different architectural elements). Within symmetricity, there are four attributes, including *symmetrical* (fully symmetrical buildings), *sense of symmetry* (existence of some balanced elements with clear symmetrical lines; while some elements are not indeed symmetrical, they reflect a sense of symmetry in abstract formal concepts), *partially symmetrical* (some symmetrical elements in an asymmetrical building form), and *asymmetrical* (an obvious asymmetrical formal concept). Rhythm consists of two attributes:*rhythmic* (conspicuous, repetitive elements), and *partially rhythmic* (having a trace of rhythm in small-scale elements). Similarly, the two attributes within the pattern are *regular* (the existence of predictable order in the elements organization) and *irregular* (randomly organized elements). Finally, stress covers two attributes of *horizontal* or *vertical*, reflecting visual emphasis of a specificform. In summary, there are 16 formal qualities that constitute the architectural attributes used in this study. A clear list of attributes and their samples exist is provided in the form of a dataset.[19]

With regard to musical attributes, a review paper summarizing large number of studies introduces four main categories of music taste attributes.[20](I) Genre as the first identifier of musical taste is identified in numerous preference-related studies.[21]It is one of the main identifiers of musical taste used by scholars, though some theoreticians dislike the use of genre as an assigned label, withouthaving a direct link to actual musical attributes.[22](II) Perceived musical attributes, also called Perceived Psychological Attributes (PPA), emerged as another reflector of music preference; Greenberg et al. distinguished 38 PPAs including happy, sad, intense, mellow, and so on.[23](III) The

[19] Seyed Farhad Tayyebi and Yüksel Demir, "Correlations between Architectural and Musical Attributes," Harvard Dataverse, 2021.

[20] Seyed Farhad Tayyebi, Yüksel Demir, Mehmet Nemutlu, and Can Karadoğan, "Graphical Layout of the Musical Preferences Studies: An Overview on How the Studies on Musical Tastes Are Conducted," *Art and Design Review* 8, 1 (2020): 6–30.

[21] Thomas Schäfer and Peter Sedlmeier, "From the Functions of Music to Music Preference," *Psychology of Music* 37, 3 (2009): 279–300.

[22] Alinka E. Greasley and Alexandra M. Lamont, "Music Preference in Adulthood: Why Do We like the Music We Do," in *Proceedings of the 9th International Conference on Music Perception and Cognition* (Citeseer, 2006), 960–66; Stefaan Lippens, Jean-Pierre Martens, and Tom De Mulder, "A Comparison of Human and Automatic Musical Genre Classification," in *2004 IEEE International Conference on Acoustics, Speech, and Signal Processing*, 4:iv–iv. IEEE, 2004.; Cory McKay and Ichiro Fujinaga, "Musical Genre Classification: Is It Worth Pursuing and How Can It Be Improved?" in *ISMIR*, 2006, 101–6.

[23] David M. Greenberg, Michal Kosinski, David J. Stillwell, Brian L. Monteiro, Daniel J. Levitin, and Peter J. Rentfrow, "The Song Is You: Preferences for Musical Attribute Dimensions Reflect Personality," *Social Psychological and Personality Science* 7, 6 (May 9, 2016): 597–605.

five-factor model (FFM), initiated by Rentfrow and Gosling[24]in 2003 and developed in 2011[25]introduces five summarizing attributes of music. The FFM uses MUSIC as an acronym for the five types, namely: Mellow (M-Type), Unpretentious (U-Type), Sophisticated (S-Type), Intense (I-Type), and Contemporary (C-Type). And finally, (IV) 3-Factor is a recently developed categorization based on the PPA. After years of investigation into the concept of musical appreciation, Greenberg and his colleagues organized psychological musical attributes into three dimensions, namely; Arousal (energy level of the music), Valence (sad to happy emotions in the music), and Depth (the sophistication in musical preference distinguishers). Consequently, Genre, PPA, FFM, and 3-Factor are the main musical attribute categories into which all musical appreciation can be placed.

Individual preference correlations between Genre and FFM as well as PPA and 3-Factor have already been investigated;[26]that is, the individual taste for each FFM type can be discovered by their correlated genre satisfaction, and the 3-Factor preferences are revealed by the interrelated PPA satisfaction. Accordingly, the preference rates of particular Genre and PPA can reflect the satisfaction rate of the FFM and 3-Factor attributes. Therefore, for each attribute in the FFM category, two prevalent genres with the highest correlation rates are selected, so thatthey both would be considered genre attributes and so that their satisfaction rates would reflect the FFM attribute preferences. The FFM category and their correlated genres are M-Type (soul/R&B, pop), U-Type (country, rock & roll), S-Type (classic, Jazz), I-Type (heavy-metal, rock), and C-Type (rap, electronica). Similarly, regarding the fact that 3-Factor attributes have either a positive or a negative value, there are three strongly correlated attributes for each positive value, and two strongly correlated attributes for each negative value: positive rousal (intense, forceful, aggressive), negative arousal (mellow/gentle, calming), positive valence (happy, fun/joyful, lively), negative valence (depressing, sad), positive depth (sophisticated/complex, inspiring, poetic/deep), and negative depth (party music, and dance-ability). Finally, 10 genres and 15 PPA are considered in their own right, and as reflectors of opinions about 11 attributes in FFM and 3-Factor categories. Consequently, this collectively gives 25 selected attributes reflecting individual preferences on 36 considered musical attributes.

After selecting all the attributes, the satisfaction rates of the provided list need to be collected. Regarding the significant impact of the number of participants in correlation-related studies, the best way to collect raw data from a sufficiently large number of individuals is through a survey. Thus, a survey is designed to mainly extractpreference rates of the considered attributes, as well as to extractdemographic attributes of the participants, which will later be used to classify the responses (Fig. #1). As traces of education and gender bias exist in many musical taste studies, and

[24] Peter J. Rentfrow and Samuel D. Gosling, "The Do Re Mi's of Everyday Life: The Structure and Personality Correlates of Music Preferences," *Journal of Personality and Social Psychology* 84, 6 (2003): 1236.

[25] Peter J. Rentfrow, Lewis R. Goldberg, and Daniel J. Levitin, "The Structure of Musical Preferences: A Five-Factor Model," *Journal of Personality and Social Psychology* 100, 6 (June 2011): 1139–57.

[26] Greenberg et al., "The Song Is You."

particularly the significance of age and gender in the correlations between architectural and musical attributes has been confirmed,[27]the first part of the survey containsquestions related to age, gender, and education level of the participants.

There are several ways of uncovering architectural preferences.A recent paper that tested eight different methods concludedthat the most reliable method – especially for large sample sizes – is to ask participants to rate several building images to reflect their attribute preferences accordingly.[28]By applying this method, participants only need to rate some building images, then the rates are assigned to all the pre-defined visible attributes of the buildings; finally, the average of each attribute's ratings is assumed to be the satisfaction rate of the attribute. To increase the internal validity of the study and examine the reliability of the collected architectural answers, the split-in-half method is also applied to the architectural images, whereby preferences regarding each attribute are asked via two sets of architectural images and, by comparing the two outcomes, inconsistent answers are removed as invalid responses. Thus, 60 building images in two sets are selected in such a way to have each attribute questioned multiple times in different building forms, and participants are asked to randomly rate the building forms via the 7-point Likert scale. All the architectural samples and their associated attributesare presented in the dataset.[29]

The musical can be extracted either from musical pieces or from contextualized questions. Although music samples may generate more accurate data, its time-consuming essence makes it impractical for this study. Therefore, to provide a larger number of participants compensating for its importance in correlation-related study, and as a limitation of the study, the explained questioning method was thus selected, as it is generally used to gather data in many studies of musical tastes. Participants were asked to express their preferences on 15 PPA and 10 genres by giving their answers on the 5-point Likert scale. The FFM and 3-Factor attribute preferences are then extracted based on PPA and genre preferences. It is worth noting that, while the empirically-based architectural responses are on the 7-point scale, the contextualized musical questions are more abstract and cover a wider range of potential tastes and therefore require a more open 5-point Likert scale.

In summary, this survey contains demographic questions around age, gender, and education, architectural questions include 60 building images, and musical questions cover 15 PPA and 10 genres. The survey was distributed worldwide on the QuestionPro platform to randomly-selected voluntary participants whose answers remain confidential and anonymous.

[27] Tayyebi and Demir, "Musical Preferences Correlate Architectural Tastes: An Initial Investigation of the Correlations Between the Preferred Attributes."

[28]Seyed Farhad Tayyebi and Yüksel Demir, "Extracting Personal Preferences for Architectural Attributes: Examining the Reliability of Several Direct and Indirect Questioning Methods," *AM Journal of Art and Media Studies* 22 (2020): 111–34.

[29] Tayyebi and Demir, "Correlations between Architectural and Musical Attributes."

2. Attribute preferences analysis and filtering reliable responses

The collected responses need some calculations to provide a clear list of attribute preferences. For the music section, the 15 PPA's and the 10 genres do not need further analysis as the questions on these are direct, while the preferences for the FFM and 3-factor attributes need to be extracted from the genre and PPA ratings respectively. Thus, the satisfaction range of the attributes in FFM and 3-Factors are analysed by averaging their correlated attributes to each category. To extract the building attribute preferences, as briefly discussed earlier, the buildings' ratings are assigned to their attributes, then, the average rating for each attribute is assumed to be the final satisfactory rating of every single attribute. Therefore, each set of building images provides a set of attribute preferences; comparing the outcomes enables us to apply the split-half method and erase the unreliable responses. Finally, to increase the accuracy of the attribute preferences for each of the valid responses, the attribute preferences arecalculated once more based on the entire set of 60 images. As Figure #1 shows, three sets of attribute preferences are obtainedfor each participant, by the analysis of the first set of images, the second set of images, and all images.

Once a clear list of attribute preferences is collected for each participant, the unreliable responses need to be filtered out. For the architecture section, participants have to have rated at least 50 buildings within a range of 3 or more to be considered in the analysis. In addition, the mean of the building preferences for each participant must be more than 2 and less than 6, and the standard deviation (SD) of the building preferences must be more than 0.75 to be considered as a valid response. Failure to meet these criteria means the rates are all too similar, either highly satisfying or extremely dissatisfying, and therefore considered unreliable.

Comparing the outcomes for the two sets of building images, the split-half method offers other filtering criteria. As the first criterion, participants with an average discrepancy of more than 1.5 between the outcomes of the first and the second set of images are eliminated. This initial but significant criterion filters out most of the unreliable responses. Besides, the participants with an average discrepancy of less than 0.2 are also omitted; verifying their answers shows that these people rate the buildings mostly similarly, therefore, the extracted attributes' satisfaction ranges are eventually similar. The SD of the discrepancy between the sets can also identify other invalid responses, even if the average of the differences is within the acceptable range. Having a high SD means the outcomes were almost correct for some attributes and disparately wrong for others. Despite its covert essence, considering these people in the correlation analysis could affect the credibility of the study outcome. Thus, as another filtering criterion, participants with a discrepancy SD of over 1.5 are also erased. Once all the unreliable responses areremoved, the outcome of the analysis of all the images is considered as the satisfaction rate of the attributes of the remaining participants (Fig. #1).

The data from the music section also need refining before the correlations could be extracted properly. Participants must rate at least 7 out of 10 genres and

10 out of 15 PPA's to be regarded as valid respondents. The assumption is that neutral participants could reduce the strength of the discovered correlations; participants with a preference range of less than 2 are not taken into consideration. In addition, the mean of the rates must be between 2 and 4, and the SD must be more than 0.75 to be considered a valid response. It is worth noting that the aforementioned filtering criteria areonly applied to questions relating to genres and PPA, as these also reflect the preferences within the FFM and 3-Factor attributes.

Please consider, architecture and music attribute preferences as raw data of the study are provided in the dataset, published on Harvard Dataverse.[30]

3. Analysing the correlations and reporting the valid ones

After filtering out the unreliable responses and establishing clear sets of attribute preferences, the correlations are analysed using the Pearson's Correlation Coefficient. This analysis examines the existence of correlations among two sets of independent variables, without being concerned with the causality of the relationships. As a result, regardless of the underlying reasons, the analysis shows possible correlations between satisfaction rates of the architectural and musical attributes. Regarding the fact that the nature of the scoring system has no impact on the analysis outcomes, difference rates between architectural and musical attributes, which are based on 7-point and 5-point Likert scales respectively, has no impact on the Person's end result.

The correlations between attributes are analysed both for all participants, and among different demographic categories. The demographic attributes of gender, education, and age are run through a correlation analysis to discover probable correlations among participant categories. Regarding the number of samples, the gender section divided the participants into males and females. There are five Education categories, regarding academic education in architecture and music: Architect (having academic education in the field of architecture, regardless of their current position), Musician (having academic education in the field of music), Architect-Musician (referring to those who have academic education in both architecture and music), Educated (those who have at least four years of academic education outside of architecture and music), and Non-Academically-Educated, summarized as Non-Educated (those who have no academic education). Age can comprise a different number of categories. In option one, participants are divided into seven categories. In option two, participants are divided into three categories. And finally,age-based classes divide participants into 2 sets of 7 and 3 categories, namely Age_7_ and Age_3_. Age_7_ includes: Age 1: participants Under 18 years, Age 2: 18-24, Age 3: 25-34, Age 4: 35-44, Age 5: 45-54, Age 6: 55-64, and Age 7: 65 and above. Age_3_ includes young adults under the age of 25, middle-aged adults aged 25-45 years, oldand mature adults which covers all participants over 45.

Further demographic categories can be created by combining two of the factors. The combination of the five Education categories and the two Gender categories delivers ten new demographic classes. In addition, Gender and Age combined create six classes.

[30] Ibid.

Similarly, Education and Age (the Age_3_ module) provide a further 15 demographic classes. However, some of these new categories are deemed invalid as they fail to contain a meaningful number of responses. Lastly, the combination of Age, Gender, and Education creates 30 different categories of participants, 17 of which are valid for correlation analysis based on sample size. Consequently, correlations between the architectural and musical attributes are analysed within 61 different participant classes.

The analysis outcomes need refinements to skim statistically valid and significant correlations. Not all the outcomes from the correlations analysis are. The p-value of Pearson's coefficient analysis demonstrates the statistical validity of the correlation; 0.05 is mostly considered as the critical point, reflecting that the probability of extracting a reliable correlation that was not discovered by chance is 95%. Thus, as the first filtering criteria, correlations where p-value > 0.05 are eliminated. The remaining correlations are then filtered a second time using Bonferroni Correction as the most stringent Multiple Testing Correction. In Bonferroni correction, the corrected p-value = p-value * number of samples; accordingly, only correlations with a corrected p-value < 0.05 are deemed valid. As an example, if the number of participants in a test had been just 20, the correlation must have the p-value < 0.001 to be able to pass the Bonferroni correction; in this case, the probability of discovering a false correlation is 1 out of 1000, which is of course negligible. Thus, the Bonferroni Correlation Correction, as the second filter, is also applied to the outcomes to skim the most statistically valid and reliable correlations.

Although the raw data as well as every single correlation between the attributes across all demographic classes are provided in the dataset,[31] two summarizing strategies are deployed to provide a more holistic understanding of the discovered correlations, namely category-based and cluster-based. In the category-based outcomes, very simple calculations are used to arrive at a summary of the number of correlations across attribute categories with regard to demographic classes. While for the cluster-based mode, the K-mean clustering method, with Manhattan distance, is applied multiple times to put similar correlation trends in the same cluster and provide a general understanding of the correlations. It is worth mentioning that a large number of calculations are carried out automatically via the VBA code writing in Microsoft Excel Developer, to indicate a few of them: analysing attribute preferences, exploring correlations across large number of classes, and summarizing outcomes.

Analysis outcome and discussion

Once the responses from over 1000 participants were filtered in the ways described above, this study was left with 505 valid responses, mostly from the USA but also from Iran, Turkey, Germany, Denmark, Canada, France, and the Netherlands. Similar ratings to architectural images and lack of survey completion are the two main reasons fora significant drop in the responses that can be deemed valid. The correlations between the architecture and music attribute preferences of valid responses

[31] Ibid.

werethen analysed across the 61 demographic categories. Although, full details on the participants, the raw data, and the outcomes of the correlation analysis before and after the filtering are all presented in the dataset,[32]the summary of the outcomes was presented in two modes:category-based and cluster-based. The former, by shedding light on the number of correlations across different attribute categories as well as demographic classes, gives a general insight intothe significance level of the categories with regards to the correlations, to be applied in possible future studies. Otherwise, the latter mode focuses more on the correlated attributes, rather than attribute categories or demographic classes; it shows how specific attributes correlate with each other. Finally, allocating similar correlation trends in the same cluster provides a holistic understanding of the correlations between general preferences of the architectural and musical attributes taken into account.

Category-based outcomes

As the first outcome, the number of correlations in different demographic classes shows how various demographic attributes impact the number and strength of the discovered correlations; in other words, it points towards the fact that a demographical attribute plays a more significant role in the correlations between architectural and musical attributes and, accordingly, that it is a better participant classifier. Table #1 presents the number of correlations among the demographic categories. Note that the number of valid categories in each demographic class needs careful consideration while interpreting the table. Generally speaking, a higher number of categories means a lower number of people in each demographic class and thusa more homogeneous group of people within; these two reasons strengthen the correlation and increase the r-values. For example, compared to all participants presented in the first row, when these participants are divided into 17 classes in the last row, the average r-value of the correlation rises from 0.14 and 0.23 to 0.47 and 0.58 after the first and the second filter respectively (see Table #1).

There are four different classes while considering one demographical attribute, namely Gender, Education, Age_3_, and Age_7_. As the table shows, Education and Age_7_ showed the highest number of correlations after the first filter, with around 400 correlations with a mean value of around 0.3; otherwise, after the second filter, Education had 61 correlations, while Age_7_ presented just 28 valid correlations. Education, compared to Age_7_ and other classes, reflected the highest number of correlations and therefore is the most influential demographic factor. It is followed by Gender, which only divides people into 2 classes; it generated the second greatest number of correlations after the second filter had been applied. Lastly, comparing the age-based classes, either Age_3_ or Age_7_, the stronger outcomes of the correlations in Age_7_ are negligible due to the difference between the number of classes, which are 3 and 7. Consequently, among the single-attribute classes, Education was by far the strongest demographic attribute followed by Gender and Age-based classes.

[32] Ibid.

Among the two-attribute categories, Education/Gender reflected the most robust outcomes and thus was the most influential demographic class. Although Education/Gender and Education/Age, with a similar number of valid classes, showed similar outcomes after the first filter, Education/Gender reflected a much higher number of valid correlations after the second filter; it also possessed the highest ratio of correlations passing the second filter. On the other hand, Education/Age and Gender/Age are of similar significance, since they reflect very similar outcomes, especially when we take into account the number of classes. Consequently, despite a similar level of significance between Education/Age and Gender/Age, Education/Gender was by far the most significant attribute among the two-attribute categories.

Lastly, if we take into account all the demographical attributes, Gender/Age/Education had the highest positive impact on the strength of the discovered correlations. Otherwise, this class, which potentially can divide the participants into 30 categories, requires a huge number of participants to secure the correlation explorations among them. All in all, Gender and Education as well as Education/Gender have the greatest impact on the correlations in practice.

Figure #2 shows the number of correlations that went throughthe second filter, in each of the attribute categories with regard to the demographic classes; it shows which musical and architectural attribute categories reflected a higher number of correlations, and thus was a better reflector of preferences in another field. Overall, the highest number of correlations were within Genre and FFM, while the PPA and 3-Factor presented lower numbers of correlations. Although PPA can be a better descriptor of musical taste, genre-based categories are more correlated and seemingly are better indicators of architectural taste. With regard to architecture, Indentation, Complexity, and Symmetry showed a higher number of correlations with musical attributes, suggesting that they have the potential to be a better reflector of musical tastes. Despite the huge impact of Stress and Pattern and lastly Rhythm in architectural forms, they provided a lower number of correlations with the musical attributes. Consequently, Genre and FFM in music as well as Indentation, Complexity, and Symmetricity in architecture provided the highest number of correlations; they can better reflect the preferences in another field(see Figure #2).

The number of correlations differs across the demographic classes. For the musical attributes, dividing participants based on their Education and Gender provided a higher number of correlations in the Genre and FFM categories; while, PPA and 3-Factor showed more correlations when Education and Age_7 are considered. It means that Education and Gender are critical to the correlations between Genre/PPA and architectural attributes, while Education and Age are the significant factors for the exploration of the correlations related to PPA/3-Factor. Among the architectural categories, the importance of Education as well as both Education and Gender. are visible among all the architectural attribute categories. All in all, although a trace of Age exists in the number of correlations related to PPA and 3-Factor, Education and Gender are the two most significant demographical attributes especially when correlation between architectural attributes and either Genre or FFM are addressed.

Cluster-based outcomes

Various clustering criteria can form various clusters, with dissimilar hierarchical levels. For example, total number of correlations remaining after the first and second filters can result in two different tables of correlations, and accordingly, two dissimilar hierarchies of clustered attributes. Each method has its own drawbacks, which make each one unreliable in isolation. For example, concerning the number of correlations passed, the second filter, as the most reliable outcome, does not cover all the attributes. On the other hand, while correlations passing the first filter do cover all attributes, they do not follow the trends of the stronger correlations after the second filter. Therefore, after various attempts using the K-mean clustering method, three tables of outcomes are considered to acquire a meaningful multi-aspect hierarchy of clusters (Figure#3). The first table of outcomes considered in clustering the attributes with similar correlation trends was the number of very strong correlations, r-value > 0.5 that have passed the second filter. The number of correlations with r-value > 0.25 that passed the second filter was the second considered outcome for clustering. Lastly, since the two mentioned significant outcomes did not cover all the attributes, the number of correlations passing the first filter with r-value > 0.25 was concerned with clustering the remaining attributes. Regarding their level of importance, the outcomes are presented in Figure #3 by the borderline of cells, midpoint dots in each cell either black or red, and the background colour of the cells respectively (see Figure #3).

Despite Figure #3 mainly providing the basis for the attributes clustering, each cell shows whether or not the attributes correlate with each other, before putting them in the same cluster. For instance, it shows that there are positive correlations among different demographic classes between a preference for *sad* music and a *sense of symmetry*, *partial symmetry*, *moderately indented,* and *moderately complicated*. This suggests that people who like sad music also appreciate moderate attributes in a building façade, as opposed to exaggerated architectural features. As another example, a preference for *rock* and *intense music* negatively correlates with a preference for regular patterns in architecture; that is, the more people like rock and intense music, the less likely they are to appreciate the existence of regular patterns in architectural elements. The section that follows discusses stronger correlations, though the graph sheds light on the correlated attributes.

Figure #3 provides the clustering hierarchy in the form of a dendrogram. Since not all the clusters derived from the three mentioned outcomes are univocal, the attributes reflected homogenous correlation trends and univocally presented in the same cluster in different attempts are differentiated by the filled area in the dendrogram. For example, in architecture, *Flat* building façade and *Simple* building forms almost always follow the same trend with regard to correlations with musical attributes; this is represented by the filled area in the dendrogram, though the hierarchical level can also reflect. Similarly, the attributes of a *Sense of Symmetry* and *Partial Symmetry*, *Moderately Indented* and *Moderately Complex*, and *Highly Indented* and *Fully Complicated* are reflecting the same trends and are accordingly put in the same cluster. There is a similar story for the correlation trends among musical attributes; as an example, sophisticated music, Poetic/Deep, and Positive Depth echo similar trends in terms of correlations with architectural attributes. These attributes are also allocated to the same cluster and greyed out in the dendrogram. Please note, in the dendrogram very few attributes are placed near other interrelated attributes whereas they reflect similar qualities in music; on the other hand, whenthey do not present similar correlation trends, they are separated by a dotted line in the dendrogram.

Interestingly, in contrast to a larger number of clusters in musical attributes suggesting more alternatives of musical taste, architectural clusters are limited to fewer clusters. The Pattern and Stress category of architectural attributes reflected very autonomous trends which are placed in very separate clusters; while Symmetry, Indentation, Complexity, and even Rhythm have interrelated trends with regards to their correlation with musical attributes. They formed three clusters suggesting the complexity level of the architectural form and confirming the robust impact of the architectural complexity with regard to musical attribute satisfaction.

Figure #4 shows the details of the correlations, after putting together the attributes of the first layer of the dendrogram, which reflected very similar correlation trends. In the top line of each cell are three numbers; on the left is the number of strong correlations (*r*-value > 0.50) that passed the first filter; in the centre is the number of moderate correlations (*r*-value > 0.25) that passed the second filter; on the right is the number of strong correlations (*r*-value > 0.50) that passed the second filter. Demographic classes within which the strong correlation passing the second filter is valid are presented on the bottom line of each cell, and the classes reflected more than one time are shown with an asterisk. Please note that the demographic class numbers are kept consistent in the table provided here andin the dataset.[33]For the sake of conciseness, the correlations are mostly discussed in just one direction, even though all correlations indicate a two-way reciprocal relationship between two attributes. Furthermore, cluster names are presented with a "~" sign showing the most ostensible attribute of the cluster (see Figure #4).

As the figure shows, ~sophisticated~ music reflected the highest number of correlations with architectural form satisfaction. ~Sophisticated~ music positively correlates with either fully symmetrical or asymmetrical, partially rhythmic, and rhythmic forms among the *architect-musicians*, and ~fully-complicated~ among both *male* and *femalearchitect-musician*. *Femalearchitect-musician a*lso shows a positive correlation between classic music and ~fully-complicated~ building forms. Thus, the more an *architect-musician* likes sophisticated music, the more likely they are to be interested in complicated, rhythmic, apparently asymmetrical, or fully symmetrical architectural forms. Similarly, *mature musicians* showed a positive correlation between the preferences of ~sophisticated~ music and ~fully-complicated~ and asymmetrical building forms; that is, the more *mature musicians* like sophisticated music, the more

[33] Ibid.

likely they are to be interested in complicated architectural forms with an asymmetrical essence. In addition, *male musicians* reflected similar trends between preferences for jazz and ~fully-complicated~ as well as ~sense of symmetricity~ in buildings. All in all, among *architect-musicians, male musicians, and mature musicians, a preference for* sophisticated music positively correlated with a higher level of appreciation for complexity, rhythm, and asymmetry in architectural forms.

To keep the report concise, the rest of the correlated attributes are reflected just by the outcome of the correlations, without discussing the correlations presented in Figure #4. The correlated attributes show that it is more likely to find a *middle-aged male architect* a fan of rhythmic building forms if he/she is interested in music with dance-ability.

The correlations between ~happy~ music and architectural attributes show that among *young males* and *male architect-musicians* it reflects higher satisfaction with symmetrical building forms, and the sense of symmetry respectively. In addition, *mature male musicians* interested in ~happy~ music would be more interested in flat, simple, moderately complicated, and rhythmic building forms. All in all, a preference for ~happy~ music echoes a preference for symmetry, simplicity, and rhythm in architectural forms, among *mature male musicians* and *male architect-musicians*.

Interestingly, the discovered correlations show that the more *female architects* like pop music, the more they would enjoy symmetrical architectural forms.

On the other hand, preference for sad music showed higher satisfaction with ~moderately complicated~ forms among *architects*, especially *female architects, and with the s*ense of symmetry among *architects*, *female architects*, *middle-aged architects*, and *middle-aged female architects*. Having in mind the above mentioned, one can conclude that architects, especially female practitioners, with a preference for sad music are likely to appreciate architectural forms that are moderately complicated with a hint of symmetry.

The more people over 65 like mellow music, the more they are interested in symmetrical building forms. Similarly, a preference for ~soul~ music among female architects over 45 years is likely to accompany a preference for ~simple~ building forms.

The contrary correlation trends between ~rap~ music and architectural attributes show that, among architects who enjoy rap music, middle-aged males are less likely to be interested in complicated architectural forms, while mature females are more likely to appreciate such complexity.

Musicians who like rock music are less likely to be appreciative of complicated architecture.

Correlations between architectural patterns and musical attributes show that the more *mature male architects* like ~mellow~ music, and dislike jazz or ~intense~ music, the more likely they are to appreciate regular architectural patterns. Otherwise,*a young male* who likes ~soul~ music would be less interested in regular patterns in architectural forms. In contrast, *female architects* who rate ~soul~ music higher tend to have a higher level of satisfaction with buildings possessing a pattern in their formal structure, either regular or irregular. Lastly, among *mature female architects,* a strong preference for ~sad~ music may coincide with a preference for irregular patterns in architectural forms.

Architectural stress reflected another set of correlations with musical attributes. *Male musicians* who like jazz would be more interested in horizontality in building features. Similarly, among *architects*, *females*, and especially *female architects*, higher preferences for ~sad~ music reflected higher satisfaction with building forms stressing horizontally. On the other hand, a preference for ~sophisticated~ and ~mellow~ music tends to come with a preference for verticality in building forms for young females under the age of 18. Finally, the results also show that the more *architect-musicians* are interested in ~sophisticated~ music, the more they would enjoy seeing stress, either vertical or horizontal, in building forms; men are more inclined towards a preference for verticality.

Consequently, Figure #5 summarizes the total number of correlations between the clusters of architectural and musical attributes. On the chart, grey indicates correlations that passed the first filter. Although these correlations may not be thoroughly valid statistically, they can reveal certain tendencies and, secondly, they may pass the second filter by increasing the number of participants or repeating the examinations. Thus, the greyish lines can give an insight into probable correlations. Otherwise, blue and yellow colours indicate positive and negative correlations respectively, having passed the second filter; darker colours reflect stronger correlations. For the sake of clarity, cluster names in the discussion that follows are written in capital letters (see Figure #5).

As the most significant outcome, there is a large number of positive correlations between a preference for COMPLICATED music and COMPLICATED architectural forms. In addition, preferences for COMPLICATED music coexist with a positive opinion on architectural stress, either vertical or horizontal, in building façades. Therefore, despite the existence of very few positive correlations with simple forms, those who prefer complicated music are more interested in complicated architectural forms possessing formal stress, in contrast to neutral forms with moderate complications.

An enjoyment of DANCE music can correlate with higher preferences for rhythmic and COMPLICATED architectural forms.

Those who like JOYFUL music seem to be more interested in architectural forms with a trace of symmetry or that are fully symmetrical, as well as simple and moderately complicated building forms. Thus, a strong preference for JOYFUL music is accompanied by a higher appreciation for SIMPLE and MODERATELY COMPLICATED building forms.

Those who enjoy SAD music are unlikely to appreciate symmetrical forms; rather it is more likely to find them interested in partially symmetrical buildings with a moderate level of complexity. Thus, a preference for SAD music leads to a preference for MODERATELY COMPLICATED building forms, as opposed to SIMPLE or COMPLICATED architectural forms. There is also a slight tendency towards regular patterns and horizontality.

There is a larger number of correlations between preference for MELLOW music and fully complicated architectural forms; on the other hand, there are fewer but stronger correlations between preferences for MELLOW music and both symmetrical and simple architectural forms. Also, MELLOW music fans are likely to enjoy building forms possessing vertical stress or patterns, especially regular ones. Altogether, MELLOW music followers expressed a tendency toward SIMPLE architectural forms, vertically stressed buildings, and the existence of patterns, especially with regular and simpler structures.

RAP fans show a high number of correlations after the first filter with almost all architectural attributes except symmetry; this trend shows that RAP followers rated the buildings higher in comparison with people who like other musical clusters. Otherwise, both the number of correlations passing the second filter, and the larger number of correlations after the first filter among the RAP followers confirms that it is more likely to find them interested in COMPLICATED building forms. They might be appreciative of irregular patterns and horizontal stress in architectural forms.

The negative correlation between ROCK music and Regular patterns shows that it is more likely to find ROCK followers to be less interested in the building forms having regular patterns in its formal structure.

The rest of the musical clusters do not present any strong correlations after passing the second filter; thus, the results can just provide hints towards probable preference tendencies. For example, COUNTRY and LIVELY music followers may prefer MODERATELY COMPLICATED building forms; the fans of INTENSE music may have a positive attitude towards COMPLICATED and vertically stressed building forms. However, more specific discussions require to consider the demographical classes.

Conclusion

In summary, this study examines correlations between the preferences of 16 architectural attributes and 36 musical attributes, within 61 demographical classes. Despite the fact that every single examined correlation is presented in the dataset,[34]the summary of the results is presented in two different modes for discussion: the category-based mode which is focused on the number of correlations among different attribute categories and demographical classes that show which attributes are better reflectors of preferences in another field, and also which demographic attributesare critical to the correlation between architecture and music. The outcomes confirmed that, among the musical attribute categories *Genre*, *FFM*, and among the architectural attribute categories *Indentation*, *Complexity* and *Symmetricity* reflect higher number of correlations, suggesting that these attribute categories are reliable reflectors of individual's taste in other fields. It also confirms that demographical classes play an important role in the discovered correlations. *Gender* and *Education* have a significant impact on the correlations found between musical and architectural preferences. In

[34] Ibid.

particular, *Gender* and *Education* are the most influential demographic issues for the correlations related to *Genre* and *FFM*; similarly, *Education* and *Age* play the most significant role in the correlations with *PPA* and *3-Factor*. Thus, these attributes require close consideration either in further investigations or in the application of the discovered correlations.

The cluster-based outcomes primarily reveal trends in the correlations that would otherwise remain hidden through the creation of these clusters. In contrast to Pattern and Stress which tend to be more independent, other architectural attributes formed three clusters reflecting the complexity levels: *SIMPLE, MODERATELY COMPLEX, and COMPLICATED.* This replicated the significance of complexity with regard to musical attribute satisfaction, as its importance in building appreciation has been discussed. [35]More trends were revealed with musical attributes and thus higher numbers of clusters were identified, *named COMPLICATED, DANCE, JOYFUL, SAD, RAP, ROCK, INTENSE, and MELLOW.* Interestingly, the identified clusters somehow reflect the trace arousal, valence, and depth, the significance of which has already been stressed by Greenberg.[36]

The accumulated results show different but interesting correlations among demographic classes. *Male musicians, mature musicians,and even architect-musicians who are interested in* sophisticated music tend to prefer complexity, rhythm, and asymmetry in architecture. A *middle-aged male architect* who is a fan of rhythmic building forms would be more interested in music with danceability. Female architects who are interested in pop music and males who are interested in happy and joyful music are more likely to be attracted to fully symmetrical architectural forms. On the other hand, the more architects, especially females, enjoy sad music, the more likely they are to be interested in moderately complicated buildings with a tinge of symmetry in their formal structure, in contrast to fully symmetrical forms. Rock-follower musicians are less satisfied with complicated architectural forms. People over 65 show a higher preference for symmetricity if they are interested in mellow music; similarly, female architects over 45 years prefer simple building forms when they are interested in soul music. In addition, the more *architect-musicians* are interested in sophisticated music, the more they will like the existence of architectural stress, either vertical or horizontal. Among the soul music followers,y*oung males* would be less interested in regular pattern, but *female architects* tend to like patterns, both regular and irregular, in architectural forms.

Finally, the summary of the clusters-based outcomes confirms that, those who prefer COMPLICATED music seem to be more interested in COMPLICATED forms, as well as existence of *irregular patterns* in arranging architectural elements. SAD music followers don't tend to like symmetry in architecture, but do prefer partial symmetry, asymmetry, and *irregular patterns.* JOYFUL music followers seem to have a tendency towards *symmetrical*, *partially symmetrical*, *regular patterns,* and thus

[35] Akalin et al., "Architecture and Engineering Students' Evaluations of House Façades."

[36] Greenberg et al., "The Song Is You."

MODERATELY COMPLICATED architectural forms. There is a tendency in *RAP* followers towards COMPLICATED and MODERATELY COMPLICATED building forms; they also reflect a preference for either *regular* or *irregular patterns* that arise in a sense of repetition in the formal structure. Among the MELLOW music followers, in general, it is more likely to find those interested in SIMPLE architectural forms, as well as the existence of patterns in architectural forms, especially *regularpatterns*.

Overall, the very summary of these correlations reflects certainidentical qualities in audible musical taste and visual architectural appraisals; for instance, the preference correlations between complicated music and complicated architecture, rap and the existence of pattern in architecture, and mellow music and simple architectural forms. In addition, the tendency of SAD music followers toward asymmetry and JOYFUL music followers towards *symmetry* suggests that there might be more in-depth interrelations between the feeling arousal of symmetrical buildings and happiness. These hints/ notion remain to be dealt with in future studies.

Every single discovered correlation has the potential to somehow reflect preferences towardsparticulararchitectural attributes by an individual with a certain musical taste.. Thus, by considering musical preferences of a client or abuilding user, architects can provide insight into the preferred architectural attributes or architectural tastes in general. There may still be a long way to go before such insights are widely utilized in the building design process; however, this paper confirms the existence of numerous correlations between architectural and musical attributes, and thereby providessignificant potential forapplying the resulting insights into future building designs.

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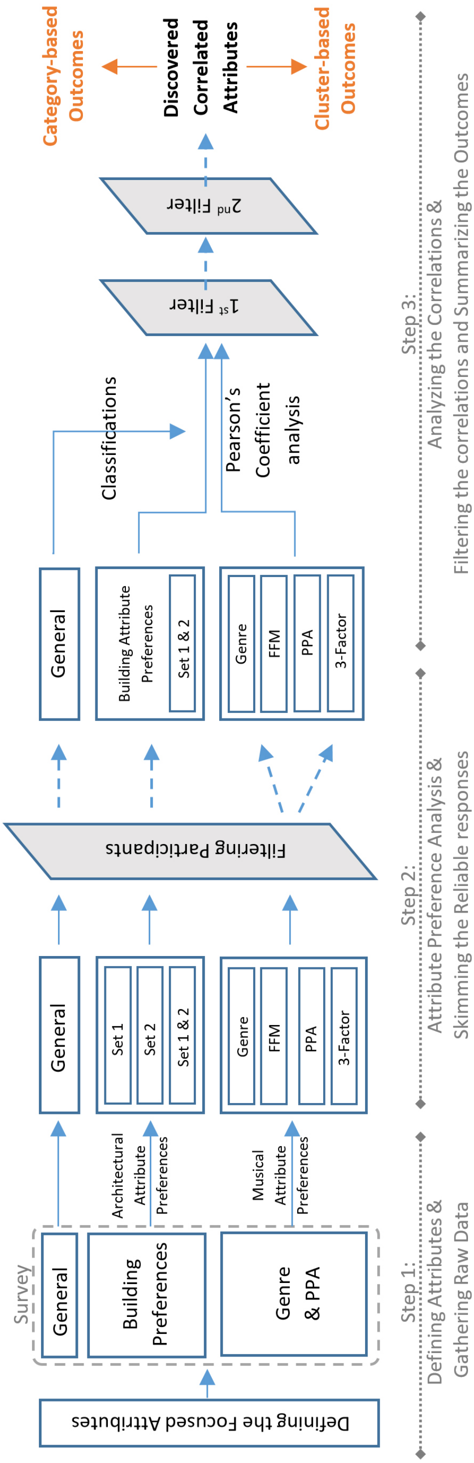

Figure 1: Diagram of the methodology

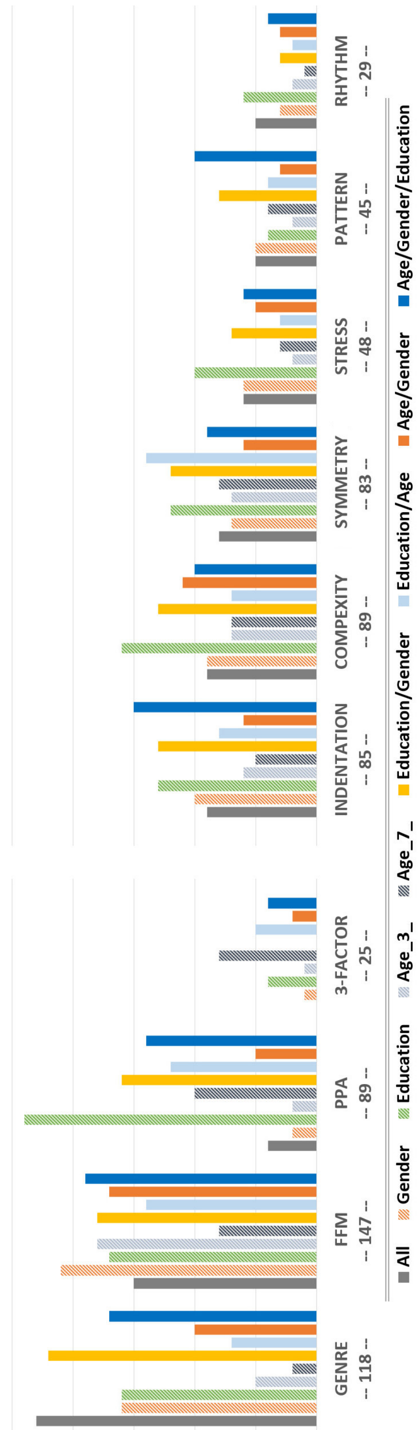

Figure 2: Number of Correlations in each Architectural and Musical Attribute Category

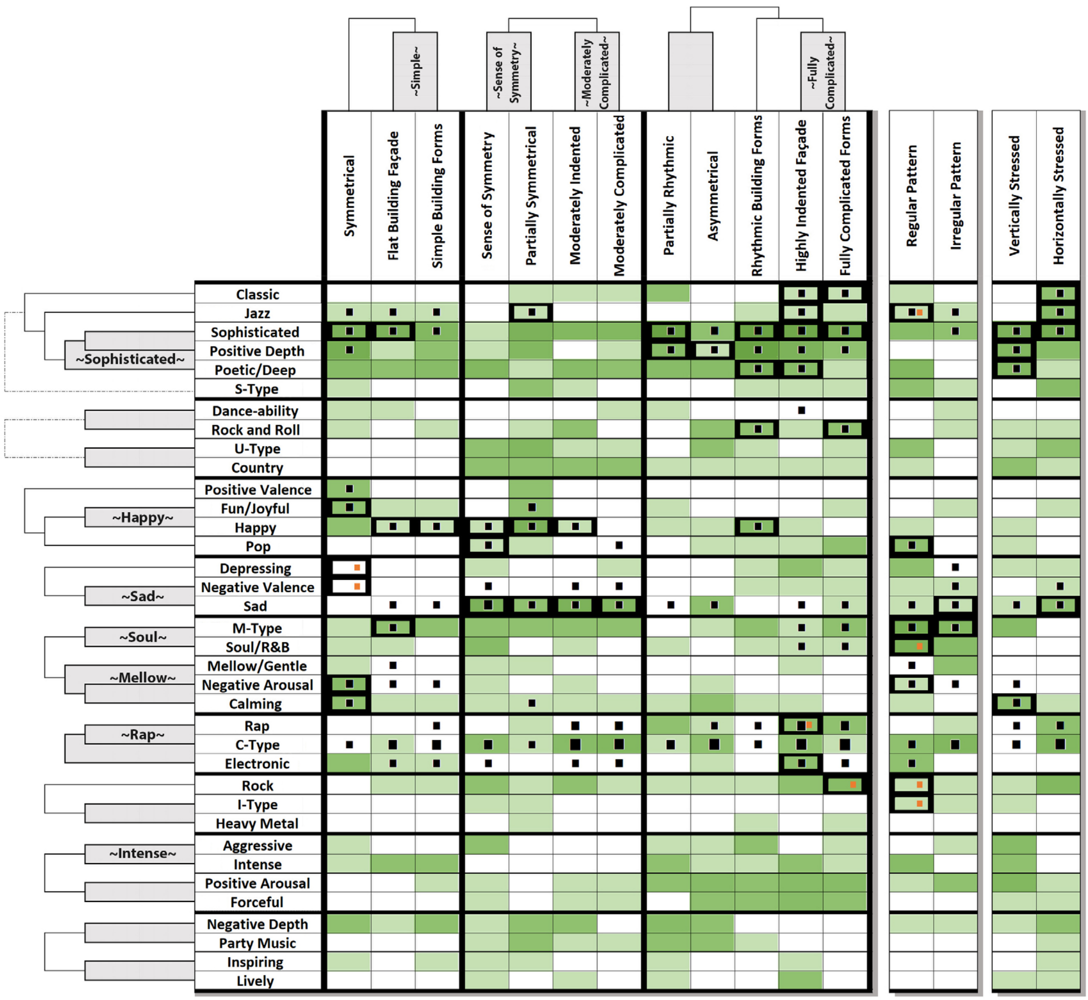

Figure 3: Clustering of attributes base
(Borderline of the cells: *r*-value > 0.5 passed the second filter; midpoint dots: *r*-value > 0.5 passed the second filter, black dot for the positive correlations, and red dot for the negative correlations; background colour: *r*-value > 0.25 passed the first filter, higher the number of correlations reflected by the darker colours)

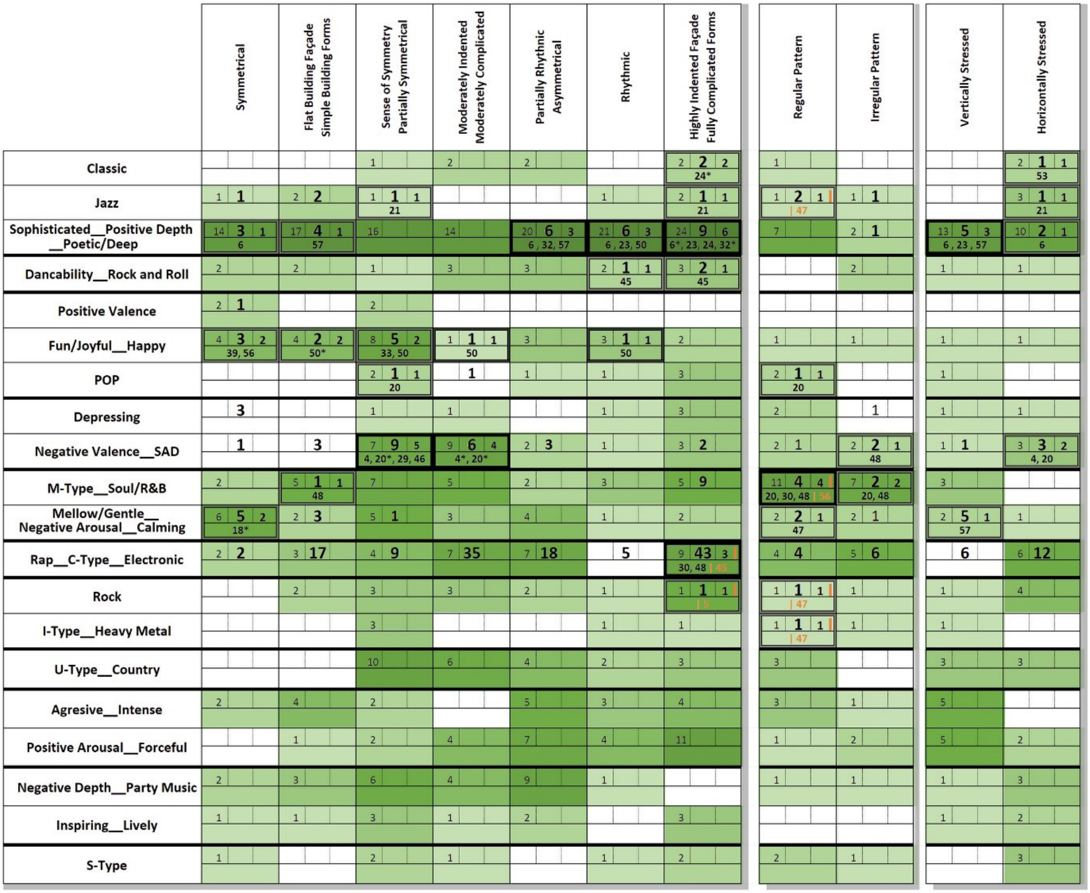

Figure 4: Correlation Details between Clustered Attributes
(Demographic class number: 4: Architects, 5: Musicians, 6: Architect-Musician, 18: People over 65yrs, 20: Female Architects, 21: Male Musicians, 23: Male Architect-Musician, 24: Female Architect-Musician, 29: Middle Aged Architects, 30: Mature Architect, 32: Mature Musicians, 33: Male Architect-Musician, 39: Young Male, 45: Middle Aged Male Architects, 46: Middle Aged Female Architects, 47: Mature Male Architects, 48: Mature Female Architects, 50: Mature Male Musicians, 53: Middle Aged Female Architect-Musician, 56: Non-Educated Young Male, 57: Non-Educated Young Female)

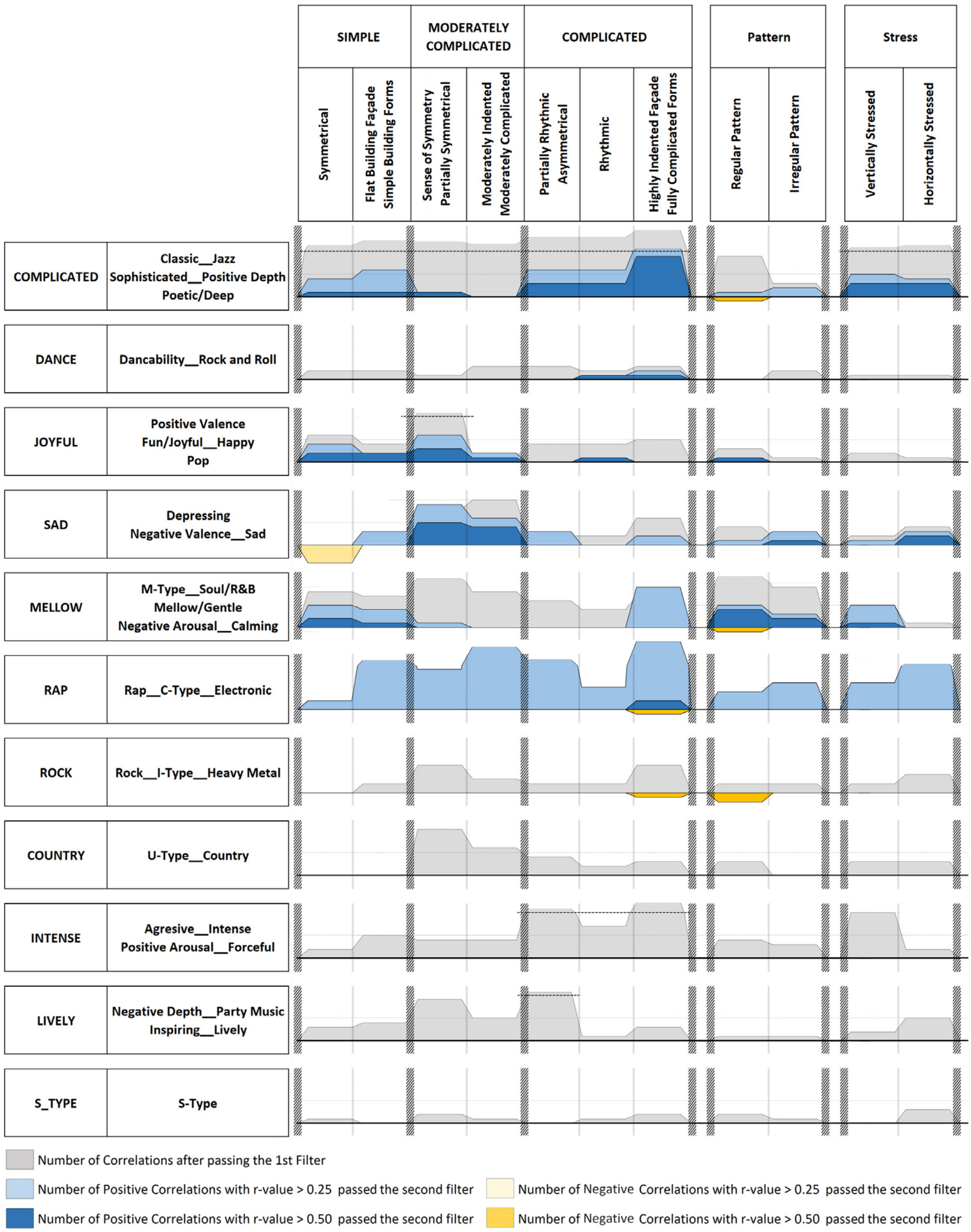

Figure 5: Attribute Cluster Correlations between Architecture and Music

	Number of Categories		1st Filter: p-value < 0.05					2nd Filter: p-value * Sample Quantity< 0.05					Ratio of the Correlations passed the second filter
	Possible	Valid	Number of Correlations	Mean	SD	Max r-value	Min r-value	Number of Correlations	Mean	SD	Max r-value	Min r-value	
All	1	1	**201**	**0.141**	0.053	0.335	-0.154	**42**	**0.231**	0.040	0.335	0.175	21%
Gender	2	2	**307**	**0.167**	0.044	0.370	-0.198	**40**	**0.253**	0.023	0.370	0.207	13%
Education	5	5	**400**	**0.291**	0.059	0.803	-0.628	**61**	**0.383**	**0.039**	**0.803**	**-0.628**	**15%**
Age_3_	3	3	**304**	**0.216**	0.043	0.404	-0.347	**26**	**0.283**	0.016	0.404	0.237	9%
Age_7_	7	7	**416**	**0.309**	0.051	0.709	-0.678	**28**	**0.433**	0.026	0.579	0.310	7%
Education/Gender	10	10	**525**	**0.367**	0.047	0.971	-0.847	**56**	**0.443**	0.022	0.971	0.240	**11%**
Education/Age	15	10	**556**	**0.371**	0.047	0.917	-0.769	**38**	**0.451**	0.019	0.917	-0.451	7%
Gender/Age	6	6	**428**	**0.256**	0.050	0.464	-0.446	**34**	**0.344**	0.022	0.464	-0.446	8%
Gender/Age/Education	30	17	**722**	**0.471**	0.047	0.978	-0.258	**54**	**0.582**	0.019	0.978	-0.898	7%

Table 1: Discovered Correlation across Demographic Categories

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