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The Process of Consciousness and Its Evolution Arising from Granulation and Bilogic

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Abstract

Our objective is to seek symmetry originating in the unconscious, and that is expressed here as reporting in consciousness. The association of psychological constructs that are consciousness and unconscious are to be both understood and interpreted within Ignacio Matte-Blanco's theory and his Bilogic framework. We carry out text mining, using extensively recorded dream reports. The texts themselves, and all the content, termed word corpus, are mapped into real-valued semantic, factor space, using Correspondence Analysis that can also be termed Geometric Data Analysis. Factors can be interpreted. For granulation, this new development is carried out: for texts and words, their factor projections are ternary encoded, to express commonality and exceptionalism. Then determined are clusters of terms and of words with semantic identity. Hence an innovative approach to granulation, and mostly with linear computational complexity. The study here establishes new implementation in analytical methods, and is also to have definite reproducibility in other, relevant and associated domains.

Keywords: Process mining, text mining, psychoanalysis, Matte Blanco Bilogic, causality and foundations of Big Data analytics, ternary – 3-adic data coding, analytical focus and orientation.

1 Introduction

Resolution scale is a most important basis for analytical work and for implementation. Overly aggregating data however, while computationally beneficial, may lead to ethical considerations (O'Neill, 2016). In Correspondence Analysis, also referred to by some authors as Geometric Data Analysis (cf. Murtagh, 2017), qualitative data, with possibly also quantitative data, all is mapped onto a Euclidean metric-endowed factor space. So that is a geometric and semantic

space mapping. In the fifth section, we use selected attributes, a word set here, which are personal names, to create the factor space, and then with all other attributes, from the work corpus here, mapped into the factor space. Then the mapped, both observations constituting the rows in the matrix to be analyzed, and the following constituting the columns in the matrix to be analyzed, attributes, possibly in applications to be termed variables or modalities of response to a questionnaire or survey.

A very frequent analytical method used in the factor space, quite possibly for the active attributes for creating the factor space properties, and for the observations, or respondents, or whatever constitutes the rows of the analyzed matrix, or for the collective mappings that have also the supplementary attributes that can be contextual data, very often the best analysis to pursue is hierarchical clustering, which is very essential in any or all complex systems (Murtagh, 2017). The court case in the following, Bécue-Bertaut et al. (2014), is the closing speech delivered by a prosecutor at Barcelona Criminal Court. The text narrative in a court case undergoes hierarchical clustering that is adjacency-constrained, and that is also in practice, chronological hierarchical clustering. That is, the singleton nodes, also termed the tree's leaves, are always displayed at the bottom of the rooted tree forming the hierarchy. Essentially at issue in that publication was partitioning of the chronological hierarchical clustering. In Murtagh, Pianosi and Bull (2016), in the factor space, analysed were initiating tweets, relating to environmental and lifestyle practice and the resulting and outcome tweets, so seeing what initiating tweets had the best or the less good consequences.

In this work, used will be dream reports over a long period of time that are in a repository, Dreambank (2004). For the dream reports used, some description of the individual at issue is in Domhoff (2006). There is much also in the Barbara Sanders Interview (no date).

2 Granular computing and Matte Blanco's bi-logic

Information granules of human psyche may be considered as a set of minimal entities (which next aggregate in clusters) that convey information given by a Matte Blanco bilogic structure (Matte Blanco, 1975; chapter 5 in Murtagh, 2017; Murtagh and Iurato, 2016; Iurato, 2018) mainly having a basic, irreducible oppositional nature. Information granulation is a process of abstraction through which one just identifies elements that are similar in terms of their functional, spatial or temporal proximity, so they are at the early basis of our perception; these elements are said to be information granules. Formally, information granules are simply represented by a function of the general type $G : X \rightarrow G(X)$ which to each object (to be meant in the sense of category theory) X associates a formal framework of related information granules (e.g., if X is an arbitrary set, then $G(X) = P(X)$, where $P(X)$ is the set of parts of X). (Bargiela and

Pedrycz, 2003, chapter 1).

At the start of the Preface in Matte Blanco (1975), mathematics is associated with psychoanalysis, and in Murtagh (2014), this is pursued a lot further, using in particular, ultrametric ontology, which is a mathematical context for all that is in or with hierarchical clustering. Genealogy can be considered as hierarchical clustering. In Iurato et al. (2016), there is a very clear description, mathematically, of the origin and development of human consciousness.

On the other hand, human beings granulate information in a deep, sub-conscious manner (Bargiela and Pedrycz 2003, chapter 6), and this justifies the possible use of psychoanalytic tools and concepts to study this process of making information. In particular, Matte Blanco's bilogic is suitable to be considered as a possible framework in which such a granulation process takes place, if we consider this as occurring in the formation of irreducible, basic units of bilogic information made by the union of a symmetric part (related to unconscious realm) with an asymmetric one (related to consciousness), to be precise considering this last as a kind of net of asymmetric relations enveloping a certain content of symmetric thought (unconscious), so we may consider the latter as an object X to which is associated, just according to bilogic rules, a net of relations regarding it, say $G(X)$, a kind of lattice surrounding X . Maybe, the following analogy may explain better this last fact: an arbitrary material object X may be seen by humans only if light rays cast on this object X hence they return, by reflection/diffusion, on our eyes, in a geometrical setting $G(X)$ which will be then transduced by our neuroperceptive system until up to become an image of consciousness. So, this bilogic information process is formally analogous to that of information granulation, as described above. So, after having clarified minimally what possible links may hold between Matte Blanco psychoanalytic theory and granular computing, we go on deepening these relationships, taking into account the other, information granulation, already.

3 Mapping One's Thinking and Activity Here with Dream Reports

Much dream reporting is available from Dreambank (2004). Analytics of this data is described in Domhoff and Schneider (2008). A predominant person is Barbara Sanders (the first name is often Barb) and there is description of her in Domhoff (2006). About her is marriage and some children but then separation from her husband, and some interest in other males. We use this textual data reporting on lifestyle, of course with dreams having certain orientations, and dream fundamentals are related to the unconscious, but both recorded here, and with reminiscence, all is converted or at least expressed, not directly as unconscious logic but more as an expression of conscious logic. Our main objective in this analysis is to have such a data source, hence such a lifestyle narrative. Our objective then, in our analytics, is to map out the narrative evolution.

First the set of dream reports and the word set, with frequencies of occur-

rence of each of the words, the fundamental and creative mapping of a selected set of names, will be carried out. This creates a factor space, that also can be termed a latent, hence foundational, semantic space. For the frequencies of occurrence data, “profiles” are most at issue, and these are with frequency of occurrence values related to the total number of values. The chi squared metric is used for the profiles, of frequency of occurrence data, and that is mapped into the factor space that has the Euclidean metric.

This method is Correspondence Analysis, also in some books, termed Geometric Data Analysis, and in many domains of application, initial development and application work was carried out by Jean-Paul Benzécri and, in social science, by Pierre Bourdieu. While factors are interpreted, using the observations and attributes with the highest contribution to inertia of the axes, usually hierarchical clustering is also carried out in the analytical process. Cf. Murtagh (2017).

An important practical approach for the mapping of qualitative data, that can include also quantitative data, mapping into the factor space, is the determination of the factor space using active variables and possibly active observations. Then there follows the mapping into the factor space of all other variables and observations that are then termed as supplementary and, possibly also, termed as contextual. All the mapped data can therefore contribute to interpreting the causality that results in the data.

Furthermore, if the active variables and possibly active observations are quite possibly aggregated data, the method used here can both fully relate aggregated data and individual data, and therefore more individual information is not lost by being aggregated, as described in O’Neill (2016).

For narratives, some important references are as follows. In Bécue-Bertaut et al. (2014), the concluding presentation by the legal attorney in a court case was analysed using hierarchical clustering that was chronological, having the hierarchy’s leaves or singleton clusters in chronological order. Other narratives in the U.S. Supreme Court were under investigation in Murtagh and Farid (2015). In Murtagh, Pianosi and Bull (2016), we examined Twitter tweets, in the factor space determining how an initiating tweet was related to all other tweets in a given time period.

Here, we extend the following method from Murtagh and Iurato (2018). Semantic relations and hence clusters were determined and listed. That included related words used with personal names.

This is the essential method here. From the factor space, for each factor with perhaps a selected number of the most important factors used, we investigate all that is projected both positively and negatively on a factor, and what is near zero on a factor. The latter expresses commonality and lack of exceptionality or any such form of being unique and anomalous, and hence exceptional. Thus for the ranked factors, each factor in turn provides the positive projections for exceptionality, the “at or near zero” projections for commonality and shared properties, and the negative projections for exceptionality. Thus each factor has three clusters. There is the factor ranking, from the eigenvalues that relate to the inertia of the axes that form the factors. From the factor ranking, a ternary

hierarchical clustering is formed. Rather than partitioning by taking some level of the hierarchy, as is standard in agglomerative hierarchical clustering that is a binary hierarchy, here we have a divisive ternary hierarchy. For clusters that can constitute a partition, we determine identity of cluster memberships at all levels of the ternary hierarchy.

In addition here, this is to be a chronologically sequenced hierarchical clustering: from a ternary hierarchical clustering, we will examine the narrative or evolution of the dream reports.

This is a novel approach, seeking to have essentially qualitative data, and with characterisation in regard to specificity and exceptionalism contrasted with standard commonality. In a later section, we will look for repeated dreams with this specificity or exceptionalism, so that these can be considered as Matte Blanco's symmetric logic of the unconscious. This analytics then is contrasted to Domhoff and Schneider (2015) using autocorrelation of time series.

4 Narrative from Dream Reports

In Murtagh and Iurato (2018), there are 421 dream reports from 2 December 1960 to 17 February 1989, and each dream report has between a few words and about 900 words. In total there, these 421 dream reports have 3789 words, potentially comprising a word corpus and examined for relationships and also the relationships with the factors in the semantic factor analysis space. Word symmetries, hence forming, and being determined as, granular clusters here, this was done for these personal names: mother, father, and names that were daughter, youngest daughter, oldest daughter, ex-husband, two brothers, two female friends, boyfriend.

For comparability and so on, it is required that each word in the word corpus here is at least five times used. It is natural that many words are used in some dream reports only, so that the dream reports crossed by the set of retained words is this here: 1568 retained words for the 421 dream reports; the number of non-zero frequencies are 37344, i.e. the times that a word is one time or more than that in a dream report; and that is 5.657% of the set of dream reports crossed by the word set here.

5 Word Corpus from Succession of Dream Reports, Mapping into Euclidean Metric Endowed Semantic, Factor Space

In order to focus the analysis carried out, the name set was focused on. The name set selected was as follows. There are 43 names, and many of them are described here, as follows:

mother, father, Ellie (middle daughter), Howard (ex-husband), Dwight (older brother), Paulina (youngest daughter), Ginny (one of her best friends), Dove

(oldest daughter), Darryl (boyfriend, was to be married, but marriage was instead to Howard), Lucy (a very good friend who was interviewed), Jake (younger brother), Lydia (sister), grandma, Bonnie (long-time friend), husband, Terence, grandfather, mom, Paul, boyfriend, Rochelle (met as a performer), Peter (Pete was a former boyfriend), grandpa, grandmother, Tyler, Judy, Valerie Agnes, Weren, George, Kathleen, Jerome, Andrea, Arthur, Rosemary, Patricia, Dylan, Willie, Harrison, Charla (daughter), Naomi, Elizabeth, Diane.

The 43 names are the active variables here, and the other words used are to be the supplementary set, with 1525 words. This must be checked: with words here that occur five or more times in dream reports, can there be any dream reports with no words retained here. We find two such dream reports, from 29 Dec. 1980 and 26 Dec. 1984. Dream reports with zero contents here must be removed, so therefore the 43 active variables, i.e. the 43 names above, and the 1525 other words, these will be in the analysis, and 419 dream reports.

The Correspondence Analysis creates the factor space from the active variables (43 names) and then maps the supplementary variables (the other 1525 words) into the factor space. The 419 dream reports are active here. The first factor plane has percentages of inertia, obtained from the eigenvalues here, as 4.11 and 4.04 percent of the total inertia, here the sum of eigenvalues. On factor 1, well away from the origin (zero projection), there is the name Harrison, and on factor 2, well away from the origin, there is the name Diane, and respectively associated with these are the dream reports from 12 Feb. 1981 and 29 Dec. 1987. This can be informally expressed as the first, most important, factor is essentially that name and that dream report; and the second factor is essentially that other name and that other dream report.

We could continue to characterise every factor, but a better oriented analysis is to be the following. We will use the first thirteen factors, since all of these have more than 3% inertia, and the cumulative percentage of inertia for these factors is 46.255%.

In Figure 1, the name Harrison is very positively projected on factor 1, and the dream report from 12.02.1981; and the name Diane is very positively projected on factor 2, and the dream report from 29.12.1987. Given the “cloud” of 421 dream reports, the rows of the matrix here, and the “cloud” of 43 active names, therefore the number of factors is one less than the minimum of these, therefore 42 factors. The 13th eigenvalue is 0.6339, and that is 3.02 percent of inertia, and the cumulative percentage of inertia is 46.25. We take 13 factors for this initial analysis. The names of the active columns, active for creating the factor space, these are, as indicated above:

"mother" "father" "Ellie" "Howard" "Dwight" "Paulina" "Ginny" "Dovre"
 "Darryl" "Lucy" "Jake" "Lydia" "grandma" "Bonnie" "husband" "Terence"
 "grandfather" "mom" "Paul" "boyfriend" "Rochelle" "Peter" "grandpa"
 "grandmother" "Tyler" "Judy" "Valerie" "Agnes" "Weren" "George"
 "Kathleen" "Jerome" "Andrea" "Arthur" "Rosemary" "Patricia" "Dylan"
 "Willie" "Harrison" "Charla" "Naomi" "Elizabeth" "Diane"

Hierarchical clustering, with Ward’s minimum variance method, using the

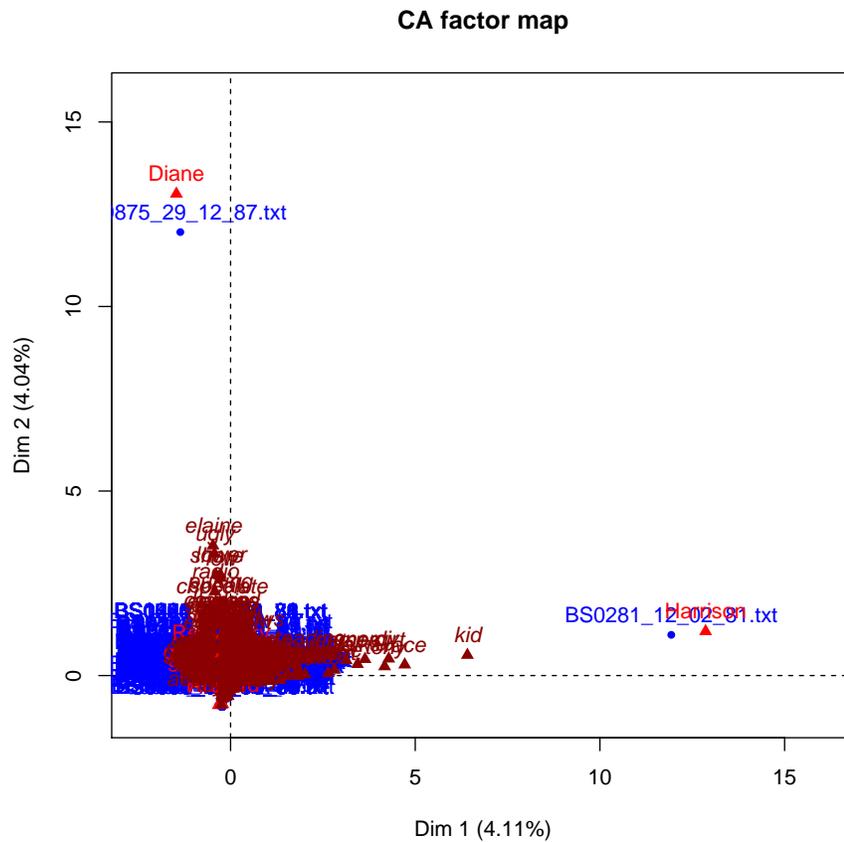


Figure 1: 419 dream reports; 43 names; 1525 other words; principal factor plane here. Percentages of inertia of the clouds for factors 1 and 2: 4.11 and 4.04. In the text, noted are the names and dream report dates that are with very positive projections on factors 1 and 2.

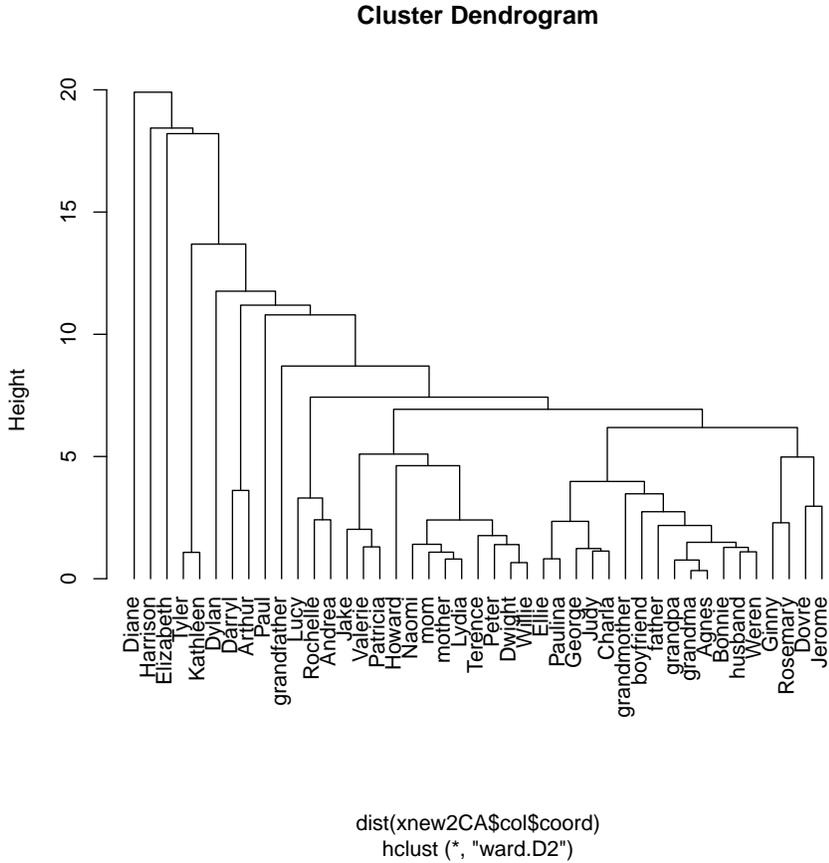


Figure 2: Hierarchical clustering of 43 names in a 13-dimensional factor space.

13-dimensional factor space, this is shown in Fig. 2. We see that “Mom” and “mother” are quite close in their cluster agglomeration, and so are “grandpa” and “grandma”, and in regard to Fig. 1, the names of “Diane” and “Harrison” here are the most separate from all other names. We can partition this hierarchy, or dendrogram.

From the factor projections in the 13-dimensional factor space, ternary coding was carried out, as follows: a projection on a factor ≥ 1 was a value 2; a projection ≤ -1 was a value 1; and a projection at or close to the origin, i.e. zero-valued or greater than -1 and less than 1, that was a value 0. A traditional binary hierarchical clustering was carried out on the ternary coded factor space mapping, and this is displayed in Figure 3. That hierarchical clustering method is Ward’s minimum variance method, and it is a binary hierarchy, from the agglomerative clustering, where clusters, starting with the singleton clusters

are to be merged at each of the $n - 1$ levels in the hierarchy for n objects, here the 43 names, to be clustered.

It is seen in Figure 3 that, from the ternary data coding, “Valerie” and “Patricia” are identical in their ternary data coding, so that they have a zero distance here. Also a cluster of seventeen names was formed with their zero distances which implies identity of the ternary data coding. These seventeen names are: “mother, father, Ellie, Dwight, Lydia, grandma, Bonnie, husband, mom, boyfriend, Peter, grandpa, Agnes, Weren, George, Willie, Naomi”. They are clear in Figure 3. If there were a ternary hierarchy displayed here, then these seventeen names would be in the cluster labelled zero for each of the $43 - 1$ levels in the hierarchy. These names are a set of names that are, for all factors, at or close to the factor’s origin, therefore being common, standard, and with symmetry of the unconscious during one’s dreaming. If a ternary hierarchy was to be displayed, then there would be the root node of all names having three sub-nodes and all the seventeen names mentioned above are in the zero (ternary value here, being node cluster with label 1, 0, or 2). The ternary hierarchy’s display would be, for factor 1, three nodes, for factor 2, three sub-nodes for the previous three nodes, then for factor 3, three sub-nodes for the previous three squared (hence nine) number of nodes. So, in all, with many cluster nodes being empty, there would be 3^{13} singleton nodes, therefore 1594323 singleton nodes, but many empty nodes. That leads to the total amount of nodes, many being empty, being $3 + 3^2 + 3^3 + \text{etc.}$ and that gives 2391483 nodes. Again to emphasise, many nodes are empty.

In Murtagh and Iurato (2018), other words that are mapped onto the same ternary coding of the factor space were determined and listed. Here, from the 1525 other words, 1217 words were for all 13 factors with a 0 coding, that is at or beside the origin. Here, 308 words are not with a 0 ternary coding for all factors and we can, if needed investigate those. It may be best to select certain words and then check their factor space mapping properties.

One other investigation that will be carried out is to see about the evolution of the dreams, from semantic identity of dream reports which can be also interpreted here as observed symmetric reasoning, and therefore symmetric logic of the unconscious, sleeping, status.

In Figure 4, the 419 dream reports, with mapping into the 13-dimensional factor space, these projections are ternary coded, having 0, 1, 2 for, respectively, at or close to the origin, negative ≤ -1 , positive ≥ 1 . The binary hierarchy here, from Ward’s minimum variance method, using agglomerative hierarchical clustering, it can be used for determining clusters to be derived. Here, from the ternary hierarchy, they will be identical clusters at all levels, therefore semantic identity from the factor space based on ternary coding.

Here: for each dream report in the sequencing, we have 13-dimensional ternary coding of each dream report. This is to be considered with minus the next dream report, and then to determine what dream reports minus the next dream report have a zero value, i.e. that the two dream reports in sequence are identical. We find 95 from the 419 dream reports that are identical to each other in sequence.

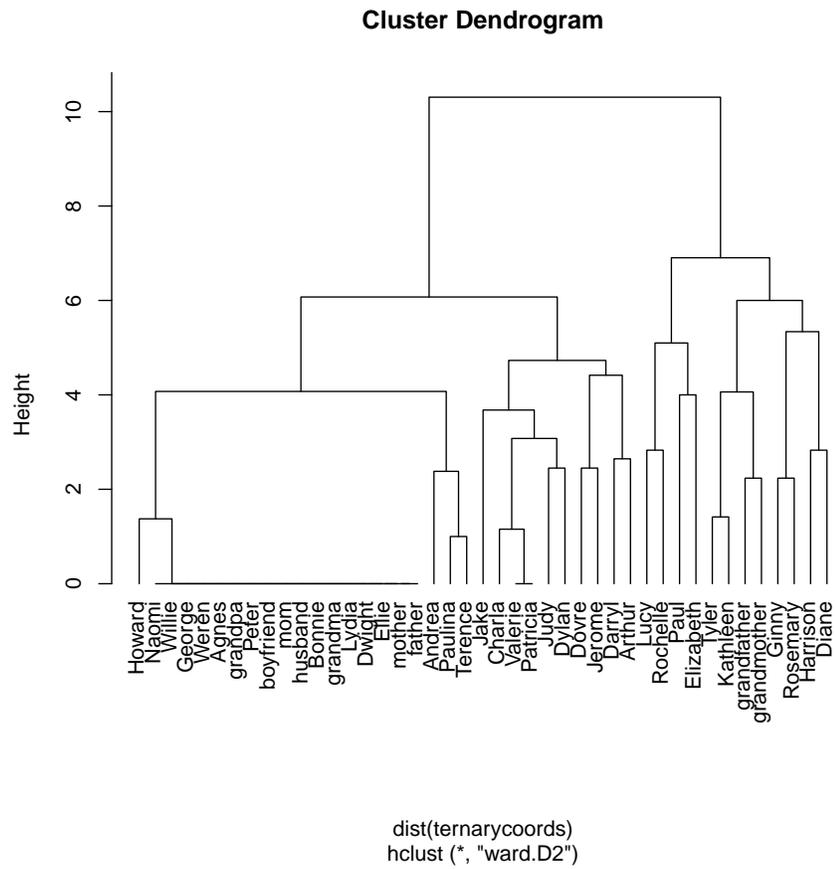


Figure 3: Hierarchical clustering of 43 names in the ternary coding of 13-dimensional factor space.

Hiclust of ternary coded: 419 dream reports, 13-dim. factor space

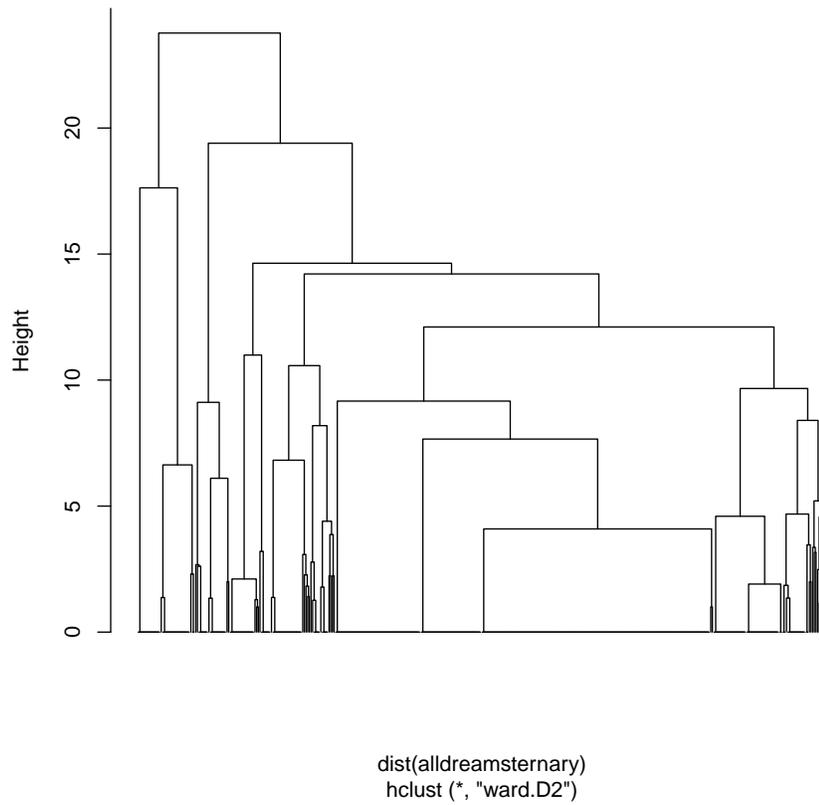


Figure 4: 419 dream reports in 13 dimensions factor space; projections are ternary encoded. For negative projection, 1; for positive projection, 2; for at or near 0, 0. Here Ward's minimum variance agglomerative hierarchical clustering, Euclidean distance.

Sequence of dream reports, from the 419 dream reports:

1, 7, 8, 17, 18, 25, 38, 39, 44, 45, 46, 54, 56, 58, 69, 71, 75, 78, 81, 83, 84, 96, 108, 110, 114, 116, 123, 124, 125, 131, 150, 151, 154, 155, 156, 157, 158, 174, 176, 177, 181, 182, 187, 188, 191, 192, 195, 199, 208, 209, 224, 225, 226, 227, 230, 233, 234, 247, 269, 274, 281, 294, 295, 296, 309, 310, 311, 314, 323, 326, 327, 330, 333, 337, 338, 343, 348, 349, 356, 360, 366, 371, 374, 375, 387, 392, 393, 398, 402, 403, 404, 406, 409, 416, 417.

Each of these have an identical semantic association with the following in sequence:

2, 8, 9, 18, 19, 26, 39, 40, 45, 46, 47, 55, 57, 59, 70, 72, 76, 79, 82, 84, 85, 97, 109, 111, 115, 117, 124, 125, 126, 132, 151, 152, 155, 156, 157, 158, 159, 175, 177, 178, 182, 183, 188, 189, 192, 193, 196, 200, 209, 210, 225, 226, 227, 228, 231, 234, 235, 248, 270, 275, 282, 295, 296, 297, 310, 311, 312, 315, 324, 327, 328, 331, 334, 338, 339, 344, 349, 350, 357, 361, 367, 372, 375, 376, 388, 393, 394, 399, 403, 404, 405, 407, 410, 417, 418.

Days for these, the following is a summary of some of the 95 identical semantic mapping of dream reports. Dates are expressed as day, month, year.

1,2: 02.12.1960, 25.11.1961
7,8: 05.04.1974, 09.04.1974
8,9: 09.04.1974, 26.04.1974
17,18 and 18,19: here these are all NA.NA.1977
(unavailable date but in sequence)
25,26: 03.07.1979, 03.07.1979
38,39: 15.10.1980, 19.10.1980
39,40: 19.10.1980, 21.10.1980
44,45: 04.11.1980, 04.11.1980
45,46: 04.11.1980, 06.11.1980
...
109,410: 08.02.1989, 09.02.1989
416,417: 16.02.1989, 16.02.1989 (Same date here, 2 dream reports)
417,418: 16.02.1989, 17.02.1989

In Murtagh and Iurato (2018), we selected words that were semantically very related through near co-location in the factor space. Here, now, we code the data in the factor space as ternary coding, and then we seek identity for the full set or selected set of factors.

5.1 Computational Complexity of the Analytical Processing

Consider n dream reports, and the obtained word corpus with m words, and the matrix with frequency of occurrence will often have a small percentage of non-zero values. Having a set of active words, to focus the factor space mapping, if there are M such active words, then the factor space is created with singular value decomposition, to have eigenvalues and eigenvectors, respectively the axis

inertias, and the factors. The computational complexity is M^3 . For the ternary encoding and for determining clusters from identity in ternary coded, referred to here as newly determined granules, all of this processing can be of linear computational complexity.

6 Conclusion

An objective of this work is to show how Matte Blanco's bilogic may fit computational granulation. The formation of bilogic units of consciousness may be formally seen as a granulation process. Therefore the possible process of formation of consciousness is by means of granulation and bilogic. Inherent in the analytical process is (i) semantics and (ii) granular clusters. From this work, this can be stated: consciousness arises from a granular process through the bilogic route, and hence acquiring meaning through clusterisation and semantisation.

The new development here of ternary encoding of factor projections, based on commonality and exceptionalism in the factor space, the former, commonality, being at or very close to the factor origin, i.e. zero valued, and the latter, exceptionalism, being certainly and possibly also largely positively projected on the factor or negatively projected on the factor. It is interesting here how what is established as granules (computational in the analytical process, and also interpretative) can be determined through identity in their ternary encoding from the semantic factor space mapping. General work of this sort, using "accurate inferences" and "using traditional forms of content analysis" are in Domhoff and Schneider (2008).

A very major objective here also is to have Big Data sources, so that there will be a very well planned analytical focus, cf. active variables in the factor space creation, and all that is granulation here.

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