How to redraw Bell Beaker networks in Southwestern Europe?

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EDITOR’S NOTE

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1. Introduction

1.1. The Bell Beaker: a pan-European “phenomenon”? 

It is now accepted that the Bell Beaker is part of a large group of shared drinking ware cultures, known between 2400 and 2200 BCE in Europe (Risch et al. 2015; fig. 1). Decorated Bell Beaker ceramics are often considered to be acquired exogenous objects or prestigious goods with a high symbolic or identity value, but we now know that only a few vases actually travelled through Europe. Indeed, the majority of the vases correspond to more or less carefully and locally made products, as demonstrated by studies of the origin of clays in the South of France (Convertini 1996), in Catalonia (Clop García & Molist Montaña 1998), or in the Czech Republic (Všianský et al. 2014). Thus, it is now difficult to impose the Bell Beaker as a culture in the strict sense of the term,
because this gives the illusion of a homogeneous phenomenon, which in reality is not the case at the regional level. As shown by the results of recent genetic studies, it is clear that the Bell Beaker phenomenon set ideas and people in motion across Europe, especially from Central Europe (Haak et al. 2015, Olalde et al. 2018). South-eastern France and Central Iberian Peninsula are two essential territories for the development of the Mediterranean Bell Beaker. After a brief overview of the latest research in these areas, we propose a reflection on the setting up of a network analysis protocol at the scale of the regions of Provence and Madrid.

1. (Pre-)Historical entities and supra-regional shared drinking sets in the temporal windows between 2400 BC and 2200 BC

1.2. Preliminary comments on the southern Bell Beaker

1.2.1. In Provence

In south-eastern France, over the past twenty years, many specialized academic works have been carried out on various elements of the Bell Beaker material culture, despite chrono-cultural difficulties (D'Anna 1995, 1999, Cauliez 2011, Lemercier 2004). My research has focused partly on the study of the settlement patterns of sites “with Bell Beaker”, in order to obtain a general vision of how space was occupied during the transition between the Late Neolithic and the Early Bronze Age (Caraglio 2016a, 2016b). The goal was therefore to describe the complexity of these societies based on their settlements, and to reassess the historical-cultural interactions traditionally mentioned by researchers in order to go beyond the essentialist understanding of the Bell Beaker. I thus developed geostatistical protocols using a Geographic Information System (GIS)
involving 94 domestic sites with Bell Beaker. The results obtained show the high variability in location choices made by populations with Bell Beaker. The preferred positions correspond to medium to steep slopes, at altitudes of 150 to 300 m, oriented eastwards, on marked or minor prominences, on plains or hillsides (fig. 2).

2. Main trends concerning the settlement of domestic sites with Bell Beaker in south-eastern France

We also carried out a systematic assessment of the artefact assemblages in Provençal sites with Bell Beaker artefacts, based on the quantity of decorated Bell Beaker vases and metal objects, the presence of Bell Beaker common ware, Late Neolithic ceramics, Early Bronze Age ceramics, barbed and tanged arrowheads, nail-shaped scrapers, long flint blades and ornaments (Caraglio 2015).

The use of multivariate statistical analyses (Multiple Correspondence Analyses and Clustering Analyses) enabled me to develop a typology for sites with Bell Beaker (fig. 3):

• Type 1: sites with ceramic assigned to the Early Bronze Age and the Late Neolithic and with 1 to 5 decorated Bell Beaker vases;
• Type 2: sites with ceramic assigned to the Late Neolithic, and with 1 to 5 decorated Bell Beaker vases, Late Neolithic long flint blades, ornaments and some metal artefacts;
• Type 3: sites with ceramic assigned to the Late Neolithic and Early Bronze Age, Bell Beaker common wares, and with over 5 decorated Bell Beaker vases, barbed and tanged arrowheads, ornaments and some metal artefacts.

Surprisingly, this typology does not seem to depend on specific chrono-cultural criteria. For example, we were able to suggest at least three “nuances” of Bell Beaker, independently of previously known ceramic styles. We can assign them to three scenarios (Caraglio 2018, Gallay 1976). This shows the complexity of the relationships maintained by the different populations at the end of the third millennium BCE in Provence. These relations can be interpreted through the conceptual apparatus of “métissage” studies, considering F. Laplantine’s words (2015): “the ‘métissage’ is at the same time the resistance against the oppression of standardization and against the exacerbation of identity particularisms”.

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3. Proposal for a tripartite typology of Provençal sites with Bell Beaker

Clustering via the representation of individuals on the factorial map [1, 2] of the MCA of the nine domestic set variables according to the results of S. Cabut on SAS 9.4

1.2.2. In the Central Iberian Peninsula

From the very beginning of research on the Bell Beaker culture at the beginning of the 20th century, studies focused on the Iberian Peninsula. This is often mentioned as the original cradle of Bell Beaker culture, as J. R. Harrison (1974) sums up very well with a series of diagrams on the different diffusion hypotheses. However, the popularity of this working hypothesis – and its persistence today – is above all due to the charismatic personality of its creators (Jeunesse 2014, Garrido Pena 2005). The Meseta, in the Central Iberian Peninsula, seems to be somewhat less explored by researchers at first in comparison to the coastal areas of the Tagus estuary and Andalusia (Harrison 1980: 126, 140). It is nevertheless a central area which interacts with the other peripheral Bell Beaker areas (Harrison 1977: 55). Around the 2000s, a lot of the research on the Bell Beaker in the Madrid region concentrated on the Meseta, as shown by the synthesis carried out by C. Blasco’s team (Blasco Bosqued 1994, Blasco Bosqued et al. 1988, 2005, 2007, 2008), and the important ceramic study by R. Garrido Pena (2000).

Over the past ten years, in-depth studies, in particular on the ditched enclosure site and the necropolis of Camino de las Yeseras (San Fernando de Henares, Madrid), have elucidated the characteristics of the Madrid Bell Beaker in a third millennium BCE village (Liesau 2017, Liesau et al. 2014, Blasco Bosqued et al. 2011, Ríos et al. 2011–2012). At the same time, preventive archaeological activities provide new data on the Bell Beaker in non-funerary contexts. However, these latest discoveries do not allow to discuss a homogeneous Bell Beaker “horizon”, nor to attribute a chronology to it, as it is difficult to distinguish domestic Bell Beaker sets from contemporaneous non-Bell Beaker sets (Blasco Bosqued et al. 2014).
As far as settlement patterns are concerned, lowland deposits with Bell Beakers, located on fluvial terraces, coexist with other deposits located higher up. However, it is not possible to define this situation as a hierarchical ranking of the territory, as there does not seem to be a link between location and visibility or between height and the surface area (Blasco Bosqued et al. 1994, Ríos Mendoza 2011). Nevertheless, most of the raw materials were sourced in the Manzanares River basin, which may demonstrate a will to rationalize and make movements more cost-effective in order to meet the population’s different needs.

2. Network analysis and Bell Beaker

2.1. An old question

The Bell Beaker beaker is generally associated in the literature with the image of the archer-metallurgist consuming alcoholic beverages, but in 1976, D.L. Clarke established a parallel between the symbolism of textile motifs, perceptible on engraved stelae, and pottery motifs:

“if the women who intermarried wove the textiles and also made and decorated the fine beakers for exchange then it would be easy to understand how each reciprocally influenced the other, leading to a stable and explicit symbolism in both textile and pottery motifs (…) lasting over half of millennium”.

Weaving and ceramic production activities would had often been linked to feminine practices, and these techniques would have spread through travel and matrimonial exchanges. Some authors have therefore proposed different theories of Bell Beaker diffusion. In 1979, for instance, A. Gallay suggested the existence of five major “networks” of exchanges that would have disseminated specific Bell Beaker elements as “prestige goods” from the different areas with Bell Beaker in Europe. In 2015, M. Besse considered the Bell Beaker as a “mosaic of networks” where “only the Bell Beaker beaker network occupies the whole territory” and provides a “link” to the diffusion networks of the other artefacts of the Bell Beaker “set”. This can refer to direct contacts between individuals, exchanges of ware, diffusion of an aesthetic scheme or other mechanisms (Salanova 2000).

2.2. Main issues

These last considerations raise multiple issues. Their general aim is to better understand, on the one hand, how the Bell Beaker was incorporated into local sequences and, on the other hand, the development of certain collective representations materialized by the European diffusion of the Bell Beaker. They can be defined as follows, as a large roadmap to the general reflexion about the Bell Beaker, for oncoming researches, but out of the scope of this paper:

• in Provence: How did the various Provencal sites react to the appearance of these Bell Beaker ceramics? Can we define the importance of “métissage” between the Bell Beaker entity and the non-Bell Beaker entity? Is there an evolution in the hierarchy of Provencal settlements throughout the second half of the third millennium BCE?
• in the Central Iberian Peninsula: How did Bell Beaker beakers (or the mental representations of these vases and decorations) spread into southern European populations during the third
millennium BCE? To what extent does this distribution transcend geographical constraints?

Can we detect central places for the diffusion of the “concept” of Bell Beaker beakers?

In this paper, we would like to focus on these main issues: Can we detect an evolution of social structure¹ of Provencal Bell Beaker settlements? Can we observe particular social structures between and within the Madrid Bell Beaker sites? We present, in section 4, preliminary results about similarity networks on the Bell Beaker domestic sites in Provence and on the Bell Beaker sites in the Madrid region.

3. Which analysis protocols?

3.1. Which network analyses?

Social Network Analysis (SNA) was developed in the 1930s from social sciences coupled with mathematical concepts (graph theory, sociometry) and has been powered by computer tools since the 1970s (Granovetter 1973). From a theoretical point of view, it helps to mobilize relational information and to study the interactions between different actors, in order to explain social facts. From a practical point of view, it currently provides access to computer tools producing visualizations (graphs) and mathematical indices expressing the privileged position of certain individuals (nodes) within a network (set of links connecting the nodes together). In archaeology, network analyses are in full development (Brughmans & Peeples 2017, Knappett 2013) and lead, despite the scarcity of direct data, to “reconstruct social facts in an indirect way through material remains” (Knappett 2014). In this case, the nodes are archaeological deposits and the links are the relationships between sites deduced from the co-presence of ceramic patterns and morphologies. Finally, as in all human sciences, the aim is to determine specific social structures (Burt 1991) by identifying phenomena of cohesion⁴, equivalence⁵, hierarchical importance⁶, autonomy (or even competition)⁷ between the different social actors (fig. 4).

4. Models of social structures in terms of network analysis

![Network Analysis Diagrams](from Burt 1991)
3.2. Proposal of analysis protocols

An analysis procedure was tested on three different case studies (fig. 5). The first case study, in Provence, is based on data from my thesis (Caraglio 2016), on the presence of various artefacts, generally found in Bell Beaker domestic sites, and which represent sixteen variables, as detailed in section 4.1. Finally, two of these case studies are located in the Central Iberian Peninsula: the first is based on data from the Bell Beaker sites of the Madrid region, an essential area for the development of the European Bell Beaker, while the second focuses on the funeral area with Bell Beaker of Camino de las Yeseras (San Fernando de Henares, Madrid). For these Spanish contexts, data on the shapes, volumes and decoration of the vases are accessible in the various regional museums and in the bibliography (Blasco Bosqued et al. 2008, Blasco Bosqued et al. 2011, Ríos et al. 2011-2012, Garrido Pena 2000). Style of pottery is obviously one of the main archaeological way to access to people interactions because it testifies to social links more than cultural groups: indeed, it is a good witness of co-socialisation, mechanisms of learning or transmission of knowledge, in others words of “communities of practice” (Wenger 1998).

5. Proposal of network analysis protocols based on the Jaccard similarity index for the central Iberian Peninsula and Provence

These data are combined in a simple binary database to calculate similarity indices (abstract distance) between the wares’ assemblages from each deposit. The Jaccard similarity index, for example, is a proven archaeological measure for estimating similarities between two assemblages of artefacts (Besse 1996, Cauliez 2011, Vaquer & Remicourt 2008) and produces values between 0 and 1: the closer the index is to 1, the stronger the degree of similarity between the two assemblages. The similarity matrix between each site, taken in pairs, can be used to design a relational table, and then to build links between nodes. Graphs can be produced using the free and open source software, Cytoscape 3.5.1. This software calculates global (network density)
connectivity) and local (centrality measurement, neighbourhood) measurements of the different networks. We can then compare them and respond to the different problems.

This network analysis approach, which is quite common in archaeology, helps to visualize similarities between Bell Beaker assemblages and to highlight sites with the most similar assemblages (Brughmans 2013, Mills et al. 2013, Bernabéu Aubán et al. 2017). The thickness of the links between sites depends on the value of the similarity index and reflects the intensity of the relationship between each deposit (only links with a Jaccard index greater than 0.3 are displayed). The size of nodes is derived from a traditional measure of centrality in network analysis, the betweenness centrality. This measure is generally used to identify nodes occupying a strategic place in the spread of information. In our study, the information spread is a type of decoration, a specific motif or a type of volume.

3.3. Limits: which analyses for which Bell Beaker networks?

The Jaccard coefficient is “arguably the most popular method to compare entities on binary attribute values, where co-presence of attributes means there is a positive correlation between the entities, and absence of attributes in one or the other has a negative effect on similarity. In the case of archaeological data, which in most cases is sparse, the Jaccard coefficient is especially useful as it ignores all the attributes that are mutually null for the entities being compared” (Habiba et al. 2018). However, network analyses based on this index tend to prevent the detection of homogeneous subsets because they display the totality of possible hardware connections, which are easily influenced by small samples. Thus, the interpretation of the results is often difficult as they do not necessarily reflect communities of practice or the recurrent use of an assemblage of sets or artefacts. Finally, similarity indices must be used with caution as they sometimes refer to subjective or imprecise concepts. One solution is to use bipartite network or “2-mode network” analyses, which are normally more suitable for visualizing diffusion phenomena (Feugnet et al. 2017). In this type of network, there are two types of nodes: for example, one type corresponds to archaeological sites, the other type to artefacts present on the sites. Links cannot be established between nodes of the same type, but only between two different types of nodes, i.e., between sites and artefact types, but never between two sites or between two types of objects. This “2-mode” network can then be projected into two “1-mode” networks: a network of sites, connecting deposits with the same artefacts and a network of objects, connecting objects present in the same deposits. It is then possible to attribute weight to the links. For the network of sites, the weight refers to the number of objects in common between two sites, which highlights similar sites. For the object network, the weight refers to the number of sites where pairs of objects are present, which can highlight the most commonly associated objects.
4. Preliminary results

4.1. In Provence

After several tests with all the 94 Bell Beaker sites of my PhD corpus (Caraglio 2015), I chose to select sites with more than five Bell Beaker decorated ceramics in order to produce more explicit graphs. The network analysis was therefore based on 25 domestic Provençal sites with Bell Beaker. Each site was described according to the presence/absence of domestic artefacts (16 different types): three types of decorated Bell Beaker ceramics, Bell Beaker common ware, Early Bronze Age ceramics, four types of Late Neolithic ceramics, three types of lithic artefacts, three quantities of metal artefacts, ornaments. The sites were then divided into four temporal windows based on known typo-chronological arguments (between 2700 and 2500 BCE, 2500 and 2300 BCE, 2300 and 2100 BCE and 2100 and 1900 BCE). For each temporal window, the Jaccard index was calculated between each site and transferred to a relational chart to draw a graph for each period. Only links with a Jaccard index greater than 0.4 were retained, while the density of links (intensity of similarity) varied between 0.5 and 1. The betweenness centrality was then calculated for each site to identify the “nodes” that have a strategic place for the dissemination of information. In this case, the information corresponds to the “package” of domestic objects. The graphs produced (fig. 6) allowed first of all for a visual analysis of the data. For example, between 2500 and 2300 BCE, when sites with Bell Beaker are the most numerous, some sites and “cliques” (subgraphs) that seemed “central” in the network in the previous period (Type 1 site S11-Le Baou-Roux and Type 3 sites S13-Les Barres and S14-La Grande Baume) disappear in favour of others (Type 3 sites S3-Le Colombier, S7-Les Petites-Bâties and S21-Le Col Sainte-Anne) that last until 1900 BCE. In general, the observation of the four graphs suggests an evolution of the social structure of the groups with Bell Beaker between 2700 and 1900 BCE. Before 2500 BCE, network analysis suggests strong “cohesion” between sites, while after that period, a trend towards “autonomy” seems to emerge.
In a second step, it was possible to compare the overall network measurements between each temporal window. The variation in the value of network density supports the idea of a transition from a situation of cohesion to a situation of autonomy around 2500 BCE. The other indices vary very little from one phase to another.

Between 2700-2500 and 2500-2300 BCE, the connection between the nodes of the network (clustering coefficient) remains stable while the number of intermediaries between two sites (network diameter) increases slightly. Between 2500-2300 and 2300-2100 BCE, the connection between network nodes (clustering coefficient) increases slightly while the number of intermediaries between two sites (network diameter) decreases. Finally, between 2300-2100 and 2100-1900 BCE, these various indices seem to stabilize.

The study, at the scale of Provence, therefore led to a first identification of the evolution of the “hubs” potentially responsible for the spread of the “concept” of Bell Beaker, as well as a first outline of a potential change in social structure during the second half of the third millennium BCE. This stage of analysis can lead to a certain vision of the Provençal Bell Beaker territory, between symbolism and economy, but these results are undoubtedly very debatable and strongly dependent on the intensity of archaeological excavations, the division of the corpus into temporal windows and the chosen method of network analysis. Thus, applying a “2-mode” protocol based more on the shapes and decorations of Bell Beaker vases in south-eastern France could complete these results, and better illustrate the path of certain collective representations materialized by the distribution of the Bell Beaker in the Provençal region.
4.2. In the Central Iberian Peninsula

The two studies were carried out on two different scales: the first focused on a corpus of sites with Bell Beaker from Madrid and the second focused on the Bell Beaker site of Camino de las Yeseras (San Fernando de Henares, Madrid). We describe each site or funerary entity according to the presence/absence of 96 variables: three shape variables and 93 decoration or surface treatment variables for the different known Bell Beaker styles (Garrido Pena 2000).

4.2.1. Madrid region

The corpus of sites with Bell Beaker from Madrid includes 28 deposits and 150 whole, smooth or decorated Bell Beaker ceramics. Data are currently being studied to set up network analysis at the scale of the Madrid region, but the first tests seem to attest to structures of the “chain” or “clique” type, with strong similarities in decorations between relatively distant sites, which suggest (long-suspected suspected) affinities with extra-regional sites, particularly Portuguese deposits.

4.2.2. Camino de las Yeseras (San Fernando de Henares, Madrid)

The Camino de las Yeseras site (Blasco Bosqued et al. 2011, Liesau von Lettow-Vorbeck et al. 2008, 2014, Ríos Mendoza 2011) is located at the east of Madrid and has been excavated for many years by the team of the Departamento de Prehistoria y de Arqueología (Universidad Autónoma de Madrid). It contains a long occupation dating from the third millennium BCE. The Bell Beaker ceramics come from a set of tombs grouped to the southeast of the site and dating from the second half of the third millennium BCE (around 2450-2300 cal. BC). Four different “funeral areas” have been identified and correspond to artificial cavities dug in the substrate (see C. Liesau et al., this volume). These are either primary or secondary deposits, associating one or more individuals with one or more Bell Beaker ceramics. The decoration and form of these ceramics were studied in detail (Caraglio et al., in press). The network analysis is based on 31 whole, smooth or decorated Bell Beaker ceramics (fig. 7).
Once each grave has been described according to the presence/absence of 96 shape and decoration variables, the Jaccard index is calculated for each grave and recorded in a relational table in order to draw up a representative graph for the entire funerary area. The density of the links (intensity of similarity) varies between 0.3 and 1, and closeness centrality can then be calculated for each grave to identify the “nodes” that appear “central” in the dissemination of information. It is important to recall that, in this case, the information corresponds to the set of patterns and shapes present in each tomb. It is then possible to generate global network analysis measurements (network density, clustering coefficient and network diameter). Depending on the results, we can obtain an image of the degree of “cohesion” that exists between the different Bell Beaker funerary areas on the Camino de las Yeseras site. Then, by observing the graph and local measurements, it will be possible to distinguish certain individuals (young or adult, female or male) who may have a “privileged” position in the network, or funeral zones that seem more connected to each other than others, from the point of view of shape and ceramic decoration.

Combined with a recent study on the genome of populations with Bell Beaker (Olalde et al. 2019, Olalde et al. 2018), this first network analysis should provide new information on possible “community of practices” (Wenger 1998) between the local Iberian population and the population with Steppe ancestry, within the same establishment (Caraglio et al., in press).
5. Conclusions

These different studies attempt to outline the beginnings of an answer to the question “why do some representations have more success, are they more contagious than others?” (Sperber 1996: 81) in the frame of the Bell Beaker phenomenon in two Mediterranean areas. Indeed, “in moving through an environment, an agent inevitably encounters various kinds of entity, which are not necessarily understood primarily as natural or cultural artefacts, or via any other kind of representation that has been socially conditioned. (...) But networks alone are not enough to understand the ways in which artefacts can span experiential scales. (...) If an artefact can in practice invoke a person, gesture, or feeling that is not immediately proximate, then it is acting as a sign at some level” (Knappett 2011: 62-100). Nevertheless, we are aware that “archaeologists usually lack direct measures of interaction. (...) The stylistic similarity of artifact types produced by two groups might be low, while the actual group interaction rate is relatively high” (Johnson 1977: 481). But eventually, “(...) networks (...) are made up of individuals linked by their participation in a social group. (...) Communities (...) are formed through the interaction of people and the transmission of knowledge and materials, including those networks that include religious practices. (...) Each of these networks has a community or communities of practice and each may involve daily as well as more temporally marked religious rituals.” (Mills 2014: 163).

In Provence, the presumed shift from a “cohesion” model to an “autonomy” model after 2500 BCE seems interesting. Following the Burt’s definitions (1991), the temporal window before 2500 BCE could represent a period where the interactions between each site with Bell Beaker (all the Types, see in 1.2.1.) with one another are intense. Then, the temporal window (between 2500 and 2300 BCE) where the sites with Bell Beaker are the more numerous (with the beginning of the regional development of Bell Beaker) could correspond to a moment where interactions between sites become more diversified to broker connections between diverse social worlds. The Type 3 sites S3-Le Colombier, S7-Les Petites-Bâties and S21-Le Col Sainte-Anne could have played a “hub” role (in the Rhône valley, the central and the littoral Provence, respectively) for the spread of “Bell Beaker concept” and could have kept the control of the network during the following temporal windows. To conclude as mentioned in Cauliez 2015, in Provence, “the establishment of Bell Beakers does not occur within an environment of competition and rather seems to be the result of slow integration, supported by the absence of radical reactions by the indigenous cultures. (...) At the moment when the Rhodano-Provençal Bell Beaker group develops, several sites are representative of phenomena of cultural mixing; others of processes of assimilation and still others indicate the persistence of Early Bell Beaker productions during the development of the Rhodano-Provençal group. These different cases allow to clearly abandon the hypothesis of rapid disappearance of the local cultures and to support the one of acculturation of the indigenous groups given that both Bell Beakers and local groups interact”.

In the Central Iberian Peninsula, the work is still in progress but some specific “social structures” already can be read for the Madrid region and some strong connection between some specific funerary areas can be observed in the Camino de las Yeseras site, for instance (Caraglio et al., in press).

The aim was to understand the role played by certain southern European “hubs”, emerging at the dawn of the Bronze Age. Using network analyses, it seems possible to follow the different paths of the “concept” of the Bell Beaker, beyond notions of
geographical or genetical proximity, and to better understand the integration methods of the Bell Beaker in the north-western Mediterranean. However, in the current state of progress of the analyses, it is difficult to provide a clear answer to the issues described above. It is therefore necessary to complete and expand the research in order to better adjust protocols to this type of data.

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NOTES

1. Our tripartite typology is probably too strict in comparison to the Bell Beaker complexity in Provence, that why we try to use the term “nuance”, which has blurrier boundaries. Maybe it should be even more accurate to use the term “oscillation” (Capanema et al. 2015) because it describes something more dynamic, like a “vibration” within the interval “be or not to be” Bell Beaker. But we aware that "be Bell Beaker" probably does not mean anything!


3. See section 3.

4. “Cohesion is a symmetric condition aggregated across two actors’ relations with one another within one or more input networks. Corresponding to the concept of a primary group, a clique is then a set of actors within which cohesion is high.” (Burt 1991: 109).

5. “Grounded in the image of status-role/sets within a social structure, equivalence between two actors increases with the extent to which they have identical patterns of relations within the social structure. Actors with identical profiles of relations are equivalent and make up a social category, a group termed a position jointly occupied by equivalent actors.” (Burt 1991: 124).

6. “concerns (the) ability to dominate the whole system across spheres. (...) This vertical axis of organization is broadly conceived and encompasses the prominence concepts of centrality, prestige, social resources, demand and value.” (Burt 1991: 188).

7. “The image here is of an individual reaching diverse social worlds to broker contact between them. (...) Information and control benefits come to those who broker connections between contacts in separate social worlds (...). These information and control benefits lead to higher levels of (competition,) performance and achievement (...)” (Burt 1991: 177).

8. Network density: ratio between the number of observed links and the number of possible links.

9. Clustering coefficient: study of the variety of direct or indirect relationships between the vertices of a graph.

10. Closeness centrality: the notion of centrality refers to the position of a vertex in the graph and reflects the privileged position of certain individuals in the structure or in exchanges.

11. Network diameter: study of the proximity of each vertex in relation to all the vertices of the network.

12. “In most archaeological networks, nodes are sites linked through common attributes, that is, any kind of archaeological evidence. Similarities in specific traits of the material culture are understood as proxy of interactions, such as economic exchanges, cultural affinity, or social proximity. There exists a shared underlying general hypothesis: the more the contexts resemble each other, the stronger was their past interaction. Hence, it makes sense and it is useful to label such networks as Archaeological Similarity Networks (ASN),” (Prignano et al. 2017).

ABSTRACTS

In the middle of the third millennium BCE, at the crossroads between the end of the Neolithic and the beginning of the Bronze Age, the “pan-European” distribution of the Bell Beaker cup questions the link between the Bell Beaker “phenomenon” and the diffusion of Bell Beaker
artefacts by “networks”. The purpose of this article is to question the increasing use of Social Network Analysis (SNA) tools in order to formalize and facilitate the study of the mechanisms of Bell Beaker diffusion in Southwestern Europe. After a brief overview of the latest research on the Bell Beaker in south-eastern France (Provençal region) and in the Central Iberian Peninsula and, we propose a reflection on the setting up of a network analysis protocol at the scale of the regions of Provence and Madrid, which are essential areas for the development of the Mediterranean Bell Beaker.

Au milieu du IIIe millénaire av. n. è., à la charnière entre la fin du Néolithique et le début de l’âge du Bronze, la répartition « pan-européenne » du gobelet campaniforme appelle depuis longtemps les chercheurs à faire le lien entre le « phénomène » Campaniforme et la diffusion en « réseaux » des objets campaniformes. Le but de cet article est de questionner l’utilisation des outils en plein essor de la Social Network Analysis (SNA) afin de formaliser et d’étudier plus facilement les mécanismes de diffusion du Campaniforme dans le sud-ouest de l’Europe. Après une rapide synthèse des derniers travaux réalisés sur le Campaniforme dans le centre de la Péninsule ibérique et dans le sud-est de la France (région provençale), nous proposons une réflexion sur la mise en place d’un protocole d’analyse de réseaux à l’échelle de la région de Madrid et de la Provence, espaces essentiels pour le développement du Campaniforme méditerranéen.

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Mots-clés: Campaniforme, analyse de réseaux, sud-est de la France, région de Madrid
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