Social cohesion and resilience: The sensory experiences of death-related rituals at EBA Ebla

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1. Introduction

This paper shows how Mesopotamian funerary rituals and their accompanying sensorial experiences can be better understood as coping mechanisms to overcome the trauma of loss and consolidate social order. Specifically, it aims at analysing social functioning and community preparedness, response, and recovery through the lens of resilience studies (Kwok et al. 2016), which consider the ability of single and group entities to tolerate, absorb, cope, and adjust to environmental and social threats (Ahmed et al. 2004; Bradtmöller et al. 2017; Butler et al. 2007; Kimhi and Shamai 2004; Norris et al. 2008; Pfefferbaum et al. 2007).

Death is a universal human experience that is likely to have traumatic repercussions within a society. The physical loss of an individual, in fact, may cause multiple disruptions to the status quo not only for the primary victims, i.e. the family of the deceased, who experiences personal losses, but also for the secondary victims—the broader community—who are consequently affected (Norris et al. 1994). The loss of an immediate family member represents a moment of crisis, in which fear and disorientation jeopardise not only the stability of the family unit but also of the community (Hope 2017). In such distressing occasions, families and communities respond with group-affirming sensory experiences, such as funerary rituals, which act both to emotionally comfort the family and to build community (or social) resilience (Becvar 2012). This is particularly evident after the loss of ruling figures who—in societies that conform to hierarchical political organization with a single figure at the top—ensure social order and cohesion (Schwartz 2013). Thus, such a loss could have more far-reaching social and political consequences and dis-
ruptions. Traumatic experiences of loss can therefore include social and political implications, in which emotional, physical, and psychological processes that involve consciously manipulated rituals and ‘sensescapes’, convey ideas of power and social order (McMahon 2019).

In order to highlight the sensorial experiences adopted by communities, this work presents the case study of Ebla (Tell Mardikh) during the Early Bronze Age IVA (EBA IVA, c.2500-2300 BCE). The archaeological site of Ebla, in western Syria, with its extraordinary royal archives of almost 20,000 fragments of cuneiform tablets discovered within the main Archive Room and in small deposits of the Royal Palace G, has provided evidence for the study of local rituals (Archi 2005). In particular, archaeological and written sources have revealed that, during the EBA period, music had an important role in both funerary and royal rituals, with musicians and singers travelling and performing for royal feasts and religious festivals (Franklin 2016). Although we are aware of the importance of sound within past cultures, the analysis of the impact of sound and music in ancient times is a relatively new field of study. It is for this reason that we propose an alternative approach for the interpretation of Eblaite funerary and royal rituals by using GIS-based techniques to analyse ‘archaeoacoustics’, i.e. the evidence of sound in the archaeological record (Witt and Primeau 2019: 79), and to therefore derive insights on how elites built social resilience after the loss of community members.

2. Social resilience and communality

In resilience studies, one may distinguish between political and cultural resilience. As suggested by Faulseit (2016: 7), the latter exemplifies the role of social institutions, such as kingship, in implementing strategies to reinforce community cohesion after stressful changes. In this context, death and loss are considered stressors or disturbances that can affect individuals, small communities, and large-scale societies, while funerary rituals are strategies to overcome such traumas.

Social resilience concerns cultural resilience, in which the community is considered as the analytical unit. Arguably, it is enacted when three types of capacities are implemented by the community: a) coping capacity, or the ability to cope with and overcome adversity; b) adaptive capacity, or the ability to
learn from the past and adjust to manage future everyday challenges; and c) transformative capacity, or the ability to create new social institutions which sustain the new status quo (Béné et al. 2012; Keck and Sakdapolrak 2013; Obrist et al. 2010). To implement these capacities, individuals may need to act collectively with meaningful intent to transform their physical and social environment, so as to mitigate adverse events (Brown and Kulig 1996). For instance, by analysing a number of cases of disaster response, Paton and colleagues (2013, 2014) found that, at several post-disaster stages, a set of social interactions at individual, family, community, and social levels are necessary for the development of adaptive and resilience processes (Kwok et al. 2016). Their studies, which align with others on this matter (see Khalili et al. 2015), clearly indicate that social resilience is reinforced with communal activities that include community participation, information exchange, social support, and shared experiences, such as the performance of traditional/ritual activities (Kwok et al. 2016).

However, social resilience is not only an active and relational concept, but it is also deeply political (Kwok et al. 2016). Practical strategies for surviving and thriving after traumatic events involve conscious political acts that lead social entities to a resilient process of recovery. In this process, communication is a major resource that enables reorganization and adaptive performance of social systems after a traumatic event (Norris et al. 2008; Pfefferbaum et al. 2007). Social rituals are one example of this outcome of communication, as these events promote social gatherings that enable the community to consciously feel part of the same collective entity. Such activities may start immediately before the traumatic event but may also be implemented during or directly after it (Kwok et al. 2016). In the case of the loss of a family/community member, for example, response activities may start immediately after the death of the individual with the preparation of the body of the deceased, and the participants continue with the burial and post-burial rituals. These gatherings may, thus, be essential to reconnect the community and support their response and recovery (Kwok et al. 2016; Lietz 2013; Norris et al. 2008).

Due to the importance of social and political strategies in building social resilience, we argue that the performance of social rituals and the sensorial experience during these ceremonies may have had a critical role in how the community experienced the death—and therefore the loss—of important so-
cio-political leaders. Furthermore, such experiences can be analysed to explore how the community coped, adapted, and successfully strengthened the new social order. This process can be analysed and evaluated through the information that the archaeological site of Ebla provides, enabling us to document the impact of sensorial and symbolic acts to achieve social resilience during the EBA IVA.

3. The Mesopotamia ritual acoustic experience

Arguably, the world can be perceived and understood through our body and senses, which generate physical and emotional responses (Wagner-Durand 2020). Powerful responses, in particular those attached to funerary rituals, are attested in several ancient Mesopotamian textual sources that testify to the sorrow and disorientation of the distressing moment of loss (Archi 2015). For example, the so-called hymn of Ur-Nammu of Ur (c.2112-2004 BCE), in the Sumerian tradition, notes that: “the days are full of sorrow. The mother (...) is miserable because of her son” (Flückiger-Hawker 1999:103). Similarly, Inanna’s *Descent to the Netherworld* text (c.1900-1600 BCE) shows that emotional states were an important part of the mortuary sphere (Black et al. 2001):

They looked at her; it was the look of death. They spoke to her; it was the speech of anger. They shouted at her; it was the shout of heavy guilt. The afflicted woman was turned into a corpse (...) (164-172); (...) She made a lament for her in her ruined (houses). She beat the drum for her in the sanctuaries; (...) She lacerated her eyes for her, she lacerated her nose. In private she lacerated her buttocks for her (176-182).

These examples highlight how emotional and sensorial experiences were vital for the cognition, communication, and acknowledgement of death. These experiences provided a powerful verbal and non-verbal cultural and political negotiation that, through shared values, rituals, and sensorial experiences, ensured emotional and psychological unity among the community.

Of all the senses, hearing had the most central role within the ancient Mesopotamian sensory system (Verderame 2020). At least in oral cultures, hear-
ing was the primary means to learn, explain, experience, and pass on knowledge. This is probably the reason why the Sumerian verb ǧeštu₂ (hearing), in Mesopotamian culture, also takes on the meaning of ‘knowing, learning and thinking’ (Verderame 2020). Textual sources and iconography from ancient Mesopotamia provide written and visible information on music and performances which involved sounds. These documents record the presence of professional musicians and numerous musical instruments at feasts, ritual celebrations and even on military campaigns (Franklin 2016; Nadali 2020; Tonietti 2010). For instance, the written sources discovered at the archaeological sites of Mari, Nirar, Kish, Emār, Tutul, Nagar, and Aleppo provide evidence of ‘musical exchanges’ with singer-musicians and dancers who often travelled between different royal courts (Franklin 2016). Among these performers were local Eblaite musicians, who were repeatedly mentioned in food distribution lists and administrative documents (Franklin 2016). Besides the information on the musicians, texts also describe the most common musical instruments—e.g., lyres, harps, horns, drums, clappers/rattles, flutes—along with human voices, as both musical instruments and human voices were used during lamentation rituals (Cheng 2009; McMahon 2019: 404).

4. Lamenting at Ebla

At Ebla, during the EBA IVA—a period that represents the high point of the city’s EBA trajectory of urbanization and early state formation—archival sources show a number of ceremonies among which kingship rituals, initially interpreted as rituals of the royal marriage and king’s coronation, played a crucial role (Matthiae 2020; Pinnock 2016). On these occasions, the royal couple was involved in a pilgrimage of kingship confirmation around royal mortuary monuments located outside the city (Ristvet 2011), during which they performed rituals and sacrifices to their royal ancestors as a symbolic three-week long ritual of renovation of their regal status (Polcaro 2017).

Three Eblaite textual sources, M.75.G.1823, TM.75.G.1939, and TM.75.G.1672 (Pinnock 2016), are vital for the understanding of kingship rituals. In fact, they inform us that the two main temples of Kura within the city were ritually connected by two crucial stages, one at the beginning and one at the end of the pilgrimage, which involved the highly symbolic enthroneme-
ment of the royal couple (Matthiae 2020) (fig. 1). The first temple, known also as the Temple of Rock (Area HH), stood by the Steppe Gate, whereas the second temple of Kura, or the Red Temple, was located on the western edge of the acropolis (Area D) close to the ceremonial wing of the Royal Palace (Matthiae 2020). The Red Temple played a crucial role within the ritual of kingship and ancestor veneration. The pilgrimage started with the rituals performed by the queen: after leaving her father’s house and being allowed access into the city (following sacrifices and rituals), she entered through the Gate of Kura and then moved to the ‘Temple of Rock’ (Ristvet 2011). From there, the queen travelled to the Red Temple (Matthiae 2020; Pinnock 2016), enacting with the king a long series of rituals for the ancestors at several burial sites of the deified ancient kings of Ebla (Matthiae 2020). At the end of the ritual, the couple solemnly entered the ‘Red Temple’, where they symbolically sat on the throne of their deified ancestors and concluded the complex ritual of kingship renewal (Matthiae 2020).

In addition, the Eblaite texts recorded around fifty Eblaite male singer-musicians (NAR) who could perform at religious festivals and kingship rituals, along with the BALAG.DI that are usually defined as lamentation-priests (Franklin 2016). The Eblaite wailing lamentation rituals, as described in textual sources (e.g. TM.75.G.2334, TM.75.G.2276, TM.75.G.1938) (Archi 2015), can be reconstructed as a sort of liturgical responsory performed by a soloist (orator) and a responding chorus, which possibly responded and sang (Archi 2015). The textual source TM.75.G.2334, in describing the wailing rituals for the princess Tarib-damu’s death, inform us that there were “(...) 6 women (who acted as) the chorus; (...) 1 woman (who was) the wailing woman; (...) (for) mourning (...) Tarib-damu’s death” (Archi 2015: 557–558). The number of NAR recorded at Ebla, thus, could indicate a choral practice, although solo performances were not excluded; moreover, NAR-TUR (junior musician-singers) could be employed as soprano voices in a male choir (Tonietti 2010). The BALAG-DI of Ebla was also used for more than lamentation-singing during a funeral (Franklin 2016), as described in the Eblaite texts previously mentioned which detail the complex series of royal rituals interpreted as a ritual of kingship and ancestor veneration. In those texts, it seems that the BALAG.DI performed also during and after the long sequence of rituals and sacrifices associated with the royal pilgrimage and kingship rituals.
(Franklin 2016). On those occasions, laments, as a set of mournful songs and rituals, arguably had symbolic rebirth/renewal meanings and acted as social coping mechanisms (Franklin 2016).

5. Simulating past sounds at Ebla

As seen above, textual sources from Ebla refer to music and professional musicians and singers as integral parts of life and ritual activities in the EBA IVA city (Nadali 2020). Indeed, while we cannot recover ancient sound waves in the archaeological record (Primeau and Witt 2018; Reed et al. 2010, 2012), archaeoacoustics of Eblaite funerary rituals and mourning can be investigated using GIS-based analysis, thus providing insightful information on the relationship between soundscape and the landscape (Mlekuz 2004; Primeau and Witt 2018; Witt and Primeau 2019). However, modelling sounds over a given landscape is computationally complex, as it depends on a wide range of variables, among which are absorption, ground configuration and terrain shape, physical obstacles, air pressure, wind speed and direction, temperature, and humidity (Mlekuz 2004). This is even more challenging when applied to past sounds within the reconstructed archaeological landscape. Therefore, the resulting model is impacted by a variable margin of error and speculation.

This study uses a combination of GIS-models and analyses performed with the System for the Prediction of Acoustic Detectability (SpreAD-Gis), as developed by the environmental scientist Sarah Reed (et al. 2012). This framework is used to model the potential sound propagation through a given terrain (topographic surface) from both single and multiple sources. The calculation process consists of six stages in which each of the steps introduces additional factors that influence the sound propagation: the spherical spreading loss; the atmospheric absorption loss; ground cover loss (absorption by the ground and vegetation); downwind and upwind loss; terrain effects; and the excess noise propagation over the ambient sound (Reed et al. 2012). There are ten critical inputs necessary for such computation: sound source location and height; a Digital Elevation Model and land-cover raster map; the sound frequency (Hz) and sound pressure (dB); wind speed and direction; climatic conditions; and the level of sound in the surroundings or Ambient Sound (dB(A)). In order to investigate the Early Bronze Age IVA sounds of Ebla, part
of the SpreAD-Gis source code written in Python was modified by the author to allow the software to run with the different sounds analysed in this study. The resulting output represents the estimated sound propagation through the archaeological site of Ebla.

The first action for modelling the past soundscape is to model the past landscape and to calculate surface effects, such as the absorption, reflection and diffraction, due to terrain characteristics (e.g. slopes and landcover) (Mlekuz 2004; Reed et al. 2012). At this stage, the position and height of the sound source, as well as the topography and land cover are important parameters. Sound sources’ location were set on the acropolis near the Royal Palace and in front of the Temple of Kura (Area D), as these were important places for acoustic aspects of the rituals. Height was assumed to be 1.5m above the ground level, as also suggested by Primeau and Witt (2018). The analysis was then performed on a 10m resolution Digital Elevation Model (DEM).

Due to the absence of datasets representing the exact EBA IV A conformation of the site and its surroundings, this preliminary study uses a combination of historical and modern datasets to model the spread of sounds. Maps published by Matthiae and Marchetti were used to create the DEM of Ebla, while data obtained from the ASTER GDEM V2 (Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation Model; NASA 2021) was used to reconstruct the surroundings of the site. A land cover raster map was also required and created using different datasets from both the Service Géographique des Forces Française du Levant (France Armée Service géographique 1943), the CORINE Vector Map (VMAP) or Vector Smart Map (Copernicus 2019; European Environment Agency 1995), and the Global Land Survey (GLS) 1975 (USGS 2012).

In addition, local weather conditions (such as temperature, humidity, wind speed and direction) were required by the GIS toolset to trace the sound propagation more accurately. Model’s climate parameters were set for a calm summer day to recreate a possible scenario with median propagation values and patterns. In this case, the simulated day was assumed to have a temperature of 36°C, a relative humidity of 62% and a wind flowing east at 19.5km/h (Weather Spark 2016; World Weather Online 2020). Subsequently, information about the sound source characteristics were implemented: frequency (Hz), the sound level of the source (dB), and distance from where the sound
level was taken. Data and parameters on past sounds were gathered from a variety of sources and relevant literature (tab. 1), and then manipulated to investigate the sounds produced both by 1) an individual (an orator) speaking with a raised voice, 2) a couple of male and female singers both trained and untrained, and 3) a horn.

Moreover, for the purposes of this analysis it is assumed that, during rituals of kinship and royal funerary rituals, normal activities (including surrounding/ambient noise) were suspended. This assumption ensures to appreciate the maximum sound propagation patterns. The GIS outputs of these analyses are raster datasets that represent the predicted pattern of sound propagation around the source, considering its attenuation due to spherical spreading loss, atmospheric absorption, land cover and ground loss cover, upwind and downwind loss, terrain effect and background sound level (Reed et al. 2009).

5.1. Preliminary results

The GIS analyses performed across several Eblaite sound sources (from both musical instruments and vocal performances) show that, in a calm warm day of summer, these sounds were carried for variable distances, ranging from a couple to hundreds of meters to almost the entire city (figs 2-5). However, it should be borne in mind that these propagation patterns may decrease with louder ambient noise levels, here removed from the analysis. The performed analyses also reveal that most of the modelled sounds originating from the Acropolis could spread to the Temple of Rock, located about 115m away (figs 3-4). Also, they suggest that the starting rites performed near the Temple of Rock and the concluding ones performed within the Acropolis were connected events; hence, people located within both areas (Acropolis and Temple of Rock) could experience both the beginning and the end of the ceremonies. A similar trend is shown in Figure 2, which illustrates the propagation patterns of an orator’s voice. The darker green shades, which represent the maximum extension limits of this sound, highlight that sound could propagate to both the temples of Kura, traveling for around 285m from the sound source to the Temple of Rock—although the model does not consider the absorption due to the material of which the buildings were made. Finally, the last scenario shows the spread of sound from someone blowing a rather small (22cm-long)
cattle horn (fig. 5). This horn, mentioned in the text ARET XV 1 as an instrument belonging to the NAR, was probably used for accompanying singing (Tonietti 2010), with its sound propagating to reach not only both Temples of Kura but also the entire city. While it is difficult to prove this observation at this stage, one might speculate that the horn, whose sound is carried for a longer distance, was used to communicate to the wider community that the ritual was starting and/or finishing, as well as to signal the different stages of the ritual, so that everyone would be aware of key passages in the ritual and when processions were due to pass by.

These sounds, and in some cases their large propagation patterns, created shared meaningful environments of lived experiences, generating memories, (re-)shaping identities, and facilitating novel political negotiations. Certain sounds, such as the horn and human voices, could propagate widely around and beyond the acropolis, arguably impacting a large group of people who, even if involved in their normal daily activities, were able to hear and feel the presence of their fellow community members. This means that people who could not be participants in the rituals could still be included through the soundscape. Eblaite people were consciously or unconsciously attending mortuary and subsequent rituals (i.e. kingship rituals and royal pilgrimage) and thus exposed, partly at least, to a sensorial experience of sounds of rituals related to death and resilience. The involvement of a greater urban community as the audience has been a key factor in the creation, reinforcement, and manipulation of power between the royal members and the community as well as among the different elites (Witt and Primeau 2019), and we can infer the same for EBA IV A Ebla.

6. Sensorial experiences of death: ancestors, kingship, and resilience

The sensorial experience of death is an important physical, emotional, and psychological process that in EBA Mesopotamia involves several consciously manipulated rituals and sencescapes, which convey ideas of power and social order (McMahon 2019). The sensorial realisation of the Eblaite rituals suggests that the process of building resilience during the EBA IV A went through three phases: coping with the trauma, adapting to strengthen the sense of community, and helping facing future losses.
The ancestor worship can be interpreted as a social mechanism used by both the primary and secondary victims to cope with the trauma of death because it helped to reaffirm old bonds based on memory and ancestral connections. At the same time, it also facilitated the creation of new relations based on forgetting older social status and creating/validating new ones (Schwartz 2013). A major theme within the ancestor worship and kingship rituals is the emphasis on the relationships between the ancestor and his/her descendants, who use the forebear to define themselves and their new social role (Peltenburg 2006). Validating this close relationship with the ancestor and his previous social status (while alive), the descendants presented themselves as the natural continuation and guarantor of the old social order. Therefore, not only did ancestor worship transform the deceased social status into a new one, with a new set of social relations and obligations (Hill and Hageman 2016), but it also presents the ancestors’ families/descendants as the natural social prosecutor. In this manner, the descendants (elite or not) were able to reinforce their new status and authority within a social group (Hill and Hageman 2016).

The process of sensorial remembering and forgetting, which is a vital part of the funerary rituals, can be also understood as an important step in acquiring social resilience. In this process, the family and society, while remembering the deceased through ancestor worship, start the social transition of the deceased’s status from a social persona to a non-active social entity (Schwartz 2013). This experience of forgetting the deceased’s old social status arguably helped to inspire adaptive behaviours to form a new social status (Hamilakis 2014). Ancestor worship, thus, ensured a first step in making changes at both the family and social level. After the coping and adaptation processes, the death and transformed the status of the deceased were accepted through embodied communication of the new situation and social status, which was then used to strengthen the compact social system and help guide future encounters with similar crises. In this sense, both the ancestor worship and the kingship rituals are important steps in achieving societal resilience.

Similarly, the societal network formed by the pilgrimage during the ritual of kingship produced a ritual renewal of Eblaite kingship and its corresponding social roles, representing and (sensorially) communicating social resilience across the death of now deified ancestors. This sensorial communication extended throughout governing social networks, which both enveloped and
strengthened the whole Eblaite kingdom (Pinnock 2016). Therefore, while the ancestor worship and the funerary rituals were events both celebrating past accomplishments and acknowledging the strength of society, the kingship rituals were also important political resources to communicate the power of the royal elites and the community in overcoming loss, trauma and, indeed, the royal death itself.

In this perception of royal death, hearing played a central role as it was the primary form of learning (Nadali 2020), and it created a sense of participation and involvement which could emotionally touch even outsiders. It can be envisaged that music/sounds were performed to heighten the emotionality of funerary, kingship and ancestor rituals, and build an emotive memory. The emotive impact of the elaborated kingship rituals which concluded with the enthronement of the royal couple in the Temple of Kura within the acropolis served an important role in communicating authority and social resilience through sensorial experience. The elevated and central position of Kura’s Acropolis Temple, moreover, guaranteed a wider spread of sounds and a broader direct and indirect embodied communication over large parts of the city population.

The sensorial stimulation of these ceremonies, which engaged large groups of people to come together and witness elaborate rituals with musical instruments, powerful singers, and touching lamenters would have left a strong sensorial experience and embedded powerful memories of a strong and resilient royal elite. Some of the sounds were also sensorially linked to other sensorial experiences, such as smell or taste, producing together even stronger persistent memories. Such memories would also facilitate future encounters with similar types of stressors encouraging “prospective remembering, remembering for the future” (Hamilakis 2014: 136). This type of forward memorising, combined with the cyclical rhythm of the Eblaite funerary, kingship, and ancestor rituals represent intentional acts used by the ruling families to communicate, support, and materialise the elite ideology, while strengthening group-affirming sensory experiences to reinforce social norms, identities, and resilience over stressors.
7. Conclusion

At EBA Ebla, elite-led death rituals were used as a source of ideological and political power. There, the necessary transformative process of “distilling a social person into a non-living entity” (Chesson 2007: 109) involved many different ritual aspects (e.g. lamentations as well as music) that created a unique sensory environment. Within it, participants were communicators of their emotional state so that others could engage in multi-sensorial experiences of death, ancestorship, and afterlife.

The GIS-analyses on the soundscape of funerary, ancestor, and kingship rituals at Ebla show that many people may have heard and experienced aspects of such rituals even if not directly involved in them. These embedded experiences left short and long-term impacts on the participants, helping people’s future encounters with similar traumatic events, while affecting the way people experienced the strength of their community and royal members when vulnerable. In this way, the sensory experiences of death and of related rituals could intensify shared emotional experiences to comfort those affected directly and indirectly by the death of the ruler, and to build a community resilience, which in turn reinforced the societal norms/beliefs, identities, and the social-political system. This may have ensured the community to survive the trauma and to legitimise the restructured social order during and after the traumatic event. The sensorial perception of death and the afterlife, therefore, could have mediated between old and new social relations, strengthening the community identity and beliefs, comforting those fearful in their loss, and facilitating a safe transition to a new normality.

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improve and clarify this paper. It goes without saying that any remaining mistakes must be entirely ascribed to the author. Finally, I would like to thank all the experts and archaeological teams that worked at Ebla, because their work and extensive publications made this study possible even in a period when it is impossible to physically experience the site. I also express my regret at the damage that the site has recently suffered but I am confident in the resilience of this city and its team of experts.

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**Fig. 1.** The queen’s journey through the city of Ebla during the kinship ritual according to reconstruction of Ristvet (2011).
Fig. 2. Potential sound propagation of an orator speaking with voice raised at Ebla. HH = Temple of Rock; G = Royal Palace; D = Temple of Kura within the acropolis.

Fig. 3 (above). Potential sound propagation of a female trained singer voice (i.e. soprano) (above) and a female untrained singer (amateur/ little training) singing from the acropolis of Ebla (below). HH = Temple of Rock; G = Royal Palace; D = Temple of Kura within the acropolis.

Fig. 3 (below).
Fig. 4 (above). Potential sound propagation of a male trained singer (i.e. tenor) (above) and a female untrained singer (amateur/little training) singing from the acropolis of Ebla (below). HH = Temple of Rock; G = Royal Palace; D = Temple of Kura within the acropolis.

Fig. 4 (below).

Fig. 5. Potential sound propagation of a horn played from the acropolis of Ebla.
**Tab. 1.** Model inputs data for each sound analysed in this study.

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