UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

The Sound of Sustainability: An examination of sound sustainability in the Center for Integrated Research on Sustainability and UBC Farms

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2. ABSTRACT

Sound is a medium that can be utilized in many ways to measure the human and non-human interactions of a space, highlighting its impact on the emotions and actions of various sentient species within its proximity. Because of this, sound indicates the level of sustainability within a space. Focusing the Centre for Interactive Research in Sustainability (CIRS) and UBC Farms as examples, this research paper explored how the acoustic elements of these two spaces impacted their ecological processes.

Our research used various literature to back up our findings. Examples include the very notion of how sound connects humans with their surroundings and the qualities within it (Gallagher, 2016, p. 11), how sound can indicate the contexts in which organisms reside in (Farina et al, 2011, p.1258), the way various different sounds generate soundscapes provide information about sentient activity in the area (Wissman, 2014, p. 1) and how soundscapes bring forth certain human imaginations (cultural, recreational, artistic ones amongst others) to showcase how they can potentially affect occupants and the environment around them (Pijanowski, 2011, p. 204). This alongside our fieldwork in the two locations, proved why sound can be another component that can shape our interactions with the environment.

The research involved the use of sound recordings to gain a better understanding of the acoustic elements in an environment. These recordings were obtained through Zoom H5 devices acquired from Bret Peterson of UBC's Geography Department. The recordings were then processed with The Reaper Program, a program which made it easier for us to analyze and process the impact of sound on the environment. Using this program, we edited our recordings to an appropriate level for this research. We also interviewed SEEDS representatives and CIRS employees to acquire more information about the acoustics that have been built into the features of the environment.

Because of this our research was very fieldwork heavy. Time was spent recording the sounds in several different sections of the CIRS building and UBC Farms.

Our research focused in raising awareness of the importance of sound in providing further insight into the environment and therefore motivating researchers to perceive their surroundings through different perspectives, not just from a visual one. In addition, soundscapes also alter the perception and behavior of species within the area, influencing their level of comfort and idea of sustainability within the space.

3. INTRODUCTION

Sound is often underemphasized as a potent factor influencing the interactions between human beings and the space they inhabit. Through our research we planned to explore the often-overlooked medium of sound as a valuable tool of gauging sustainability in space through the lens of human geography. The construction of buildings or locations in Canada during the 21st century allows for a wider range of resources to be utilized. This access to resources along with the wealth of UBC allows for questions about the specific nature of material use to be a viable research question. Two areas of interest in UBC is the Center for Interactive Research in Sustainability at UBC. Through our research, we hope to find out how materials, interior design and designated usage of space can affect the sonic and sustainable perception of a space. Our research will focus on the distinct ways in which sonic environments shapes how both humans and nonhumans relate to space. The sources that we have reviewed explore this relationship and expand on ways of thinking about sound. Sonic geography is still a relatively new sub-discipline and we will place our research within the existing literature. Therefore, we wish to acknowledge a possibility that we may also use UBC Farms as a topic of research depending on how our research progresses.

4. STATEMENT OF THE PROBLEM

The aim of our research is to explore and expand the various ways that sound can be used as a unit of study in Human Geography. Sonic Geography is a relatively new discipline to Geography and our research aims to examine and explore the potential ways in which sound can be further utilized. We choose to focus on sustainability as a lens to explore sonic geography as it allows us to narrow our scope of observation, focusing specifically on how sustainability is manifested through sound. We choose sustainability as a focus in our research because it is instrumental to addressing the environmental challenges and changes that we face both on campus and globally. Our research will build on this urgent need to explore sustainable alternatives and uncover new ways of understanding this problem. There is very little research that touches on both sonic geography and sustainability, so our research will be addressing a gap in the literature and hopefully lead to further interest in building on our findings. Since our research is examining a new area of study, the nature of our study is exploratory and is meant to reveal new possibilities for studying sustainability. This research is important because it will provide a new way of understand and approaching sustainability apart from a reliance on visual cues. The way we understand and communicate sustainability through spaces is almost always visually, so our research will build on the existing literature of sonic geography, while expanding the possibilities and potential of sound.

3. *Literature Reviews*

Michael Gallagher's paper *Listening geographies Landscape, affect and geotechnologies* calls for an expanded listening in Human Geography, expanded listening refers to exploring the many ways humans and non-humans respond to sound (2016). Where much of the research around sonic geographies is anthropogenically centered, Gallagher expresses a need to include nonhuman actors when analyzing sonic environments. Our idea of using sound to address the complexity of our world, is inspired by Gallagher's musings; "every space and place, sounds and resounds, every living body and being vibrates, and every kind of material, object and surface has acoustic properties" (2016, p. 3). Gallagher's article examines the many different applications that sonic geography can be developed towards, especially when expanded listening through various instruments is considered. Sound has a massive "capacity to connect humans to many other kinds of entities, materials, and processes" (Gallagher, 2016, p. 11). The Sounds ability to connect, makes sound especially relevant to geographers in analyzing when space. Using this idea of expanded listening to explore relationships between humans, "materials, animals, and geophysical phenomena" (Gallagher, 2016, p. 12). Our research aims to respond directly to Gallagher's call for expanded listening, by exploring not just human relationships to sonic environment, but non-human actors as well.

Jonathans Prior's paper *Sonic environmental aesthetics and landscape research* provides insight into research around sound and landscapes (2014, p. 6). Prior makes his case for expanding sonic geographies beyond preference based studies that focus on what sounds are pleasing and which ones are displeasing. While preference based sonic research produces valuable work, an over emphasis on these kinds of studies overshadows other avenues for exploring sonic environments. Prior expresses the importance of recording in bringing awareness

to sounds that are hidden “or at the periphery of everyday awareness” (2014, p. 13). In our research we will use audio recordings, to do just that bring greater awareness to hidden sounds.

Atkinson’s article *Ecology of sound: the sonic order of urban space,* focuses on exploring urban soundscapes and looks bring awareness to the “invisible yet highly affecting and socially relevant area of urban enquiry” (2007, p. 1905). There is a distinct sonic pattern to the ebb and flows of urban landscapes, shaped by the time of day and the use of space. Focusing on soundscapes that we have become desensitized and detached from will bring a new found auditory sensitivity to our experience of urban landscapes (Atkinson, 2007).

Our research also sources from Kang and Zhang (*Semantic differential analysis of the soundscape in urban open public spaces*), whose research raises the idea that urban soundscape and acoustic comfort are important components of physical comfort, and that a reduction in noise level does not necessarily lead to better acoustic comfort in urban areas (2010). Through the auditory perception of participants and additional data gathered from questionnaires done post-experiment, Kang and Zhang finds that the integration of particular-sound types results in varying levels of acoustic comfortability; despite the high sound levels of water and music, acoustic comfortability is promoted (2010). Furthermore, their research also suggests that people generally preferred nature sounds over artificial sounds.

Hong's study (*Influence of urban contexts on soundscape perceptions: A structural equation modeling approach*) adds to this, by aiming to “explore the holistic relationships among the soundscape and landscape across various functions of space in urban environments and to examine the effect of urban context on soundscape perceptions” (2015, p.79). In Hong’s finding he notes a strong correlation between the visual environment and the respondents experience of the soundscape. More visually appealing environments produced a more pleasurable response to

the sonic environment. With our research emphasizing on the Avian soundscapes, Farina, A., Lattanzi, E., Malavasi, R. et al suggest that “soundscape could be regarded as an important indicator of a physical, energetic and meaningful context in which organisms live” (Farina, Lattanzi, Malavasi, et al, p.1258), highlighting the idea that every soundscape is part of a network of wider soundscapes.

Adding to the idea of relationships between soundscapes and the urban environment, Wissmann’s (2014) work *Geographies of Urban Sound* examines the various sounds of traffic, music, construction and other urban functions and how it can “help to create unique soundscapes essential to the place-based character of each city” (p.1). In addition, Wissmann (2014) examines the effects of sound on people in urban environments and how they engage with their space (p. 1). Utilizing examples obtained in countries such as Germany and the United States, Torsten Wissmann (2014) takes a more methodological approach to the geography of sound in urban landscapes (p. 2). By giving heed to the idea of how sound affects urban dwellers and their daily activities/routines, we can look deeper into how people interact with the landscape because of sound (Wissmann, 2014).

With regards to how sonic environment establishes a spatial relation with ‘non-human entities’, Warren, Katti, Ermann, and Brazel's study concerning bioacoustics in, *Urban bioacoustics: it's not just noise* provides insight towards acoustics measurements, urbanization, and how it relates to the earth's biosphere. The review looks to characterize the spatial distribution of noise in urban landscapes and examine the possible contribution of spatial variability of noise levels to acoustic divergence in animal signals. The researchers divide their review into two sections. The first, focusing on “addressing the effects of noise on animal communication systems”, and “identifying critical areas in need of further research” (Warren et

al. 2006). The second, presenting an examination of the ways that animal behaviour can benefit from incorporating ideas and information from the fields of architecture and urban design. They note that “high levels of noise mask acoustic signals, potentially making it more difficult for animals to defend territories, attract mates or attend to other important communication signals such as begging, alarm or distress calls” (Warren et al. 2006), indicating a marked shift in the way animals behave in their daily lives due to human activity. Countering these negative effects, however, the paper finds that “two alterations of animal signals can mitigate the effects of masking noise: changes in amplitude and changes in frequency.

Each of these changes in signal design might occur as “short-term phenotypically plastic responses, long-term phenotypically plastic responses (e.g. via song learning) or as evolutionary responses via natural selection” (Warren et al. 2006). The main conservation concerns regarding anthropogenic noise are that it may affect the distributions of animal species that are intolerant of different sound frequencies in different ways. This includes but is not limited to affected reproductive success in species. Animals, they find, behaviourally alter signal characteristics (such as minimum frequency, amplitude) and shift the timing of signals to avoid interference from masking noises. Because of this, animals lacking the ability to learn or a similar form of phenotypic plasticity are forced to respond via the processes of natural selection. They may be unable to adapt to the rapidly changing conditions, and die out. The paper aids in research pertaining to the impacts of acoustics on their environments, and the types of precautions either taken, or overlooked by urban planners and engineers alike. However, it leaves many questions unanswered. Namely, which types of species can compensate for the elevated noise levels in cities? What are the effects on animal fitness of prolonged signalling at higher amplitudes? It's well accepted that roads with higher traffic loads have negative impacts on reproductive success.

Yet it is still not clear whether this is due to the direct interference from of noise, whether the noise indirectly affects animal fitness by impairing communication ability.

In addition to this, Jacob Smith examines Chris Watson's studies of sound art, Smith finds that the construction of sound occurs when natural sounds are decontextualized from their surroundings before being re-contextualized as a sonic art piece. However, while this is the case, the implementation of humans into the guidelines are also important to consider in the recordings. Drawing on an example from Watson's piece El Tren Fantasma, the balance of human interference with natural sounds can also prove to be important, as the presence of humans in the narrative speaks more to what is realistically human interference. When recording is happening the question that is posed is how does the balance between the ambient sounds in the environment with sounds of human interference.

Conversely, Pijanjowski asserts that, "soundscapes have many associated human ideals, such as cultural, sense of place, recreational, therapeutic, educational, research, artistic, and aesthetic values" (Pijanowski 204). This article offers a great introduction to the developing field of soundscape and how it can potentially affect the environment and shape our lives. For instance, assessing the impact of soundscapes on wildlife. This article provides recorded media and statistical analysis of the relationship between sound transmission and landscape, which proves that sound has a significant impact to our environment. We will examine and evaluate all characteristics and values at our chosen research site the CIRS building. The CIRS building offers us the opportunity to explore the social, natural, and sustainable aspects, and so far, we have visited the locations and have pointed out several sounds that may be significant to our research. For example, the muted footsteps in the carpeted floor of CIRS building or the noise of construction workers and their machineries beside the UBC Farm. These sounds can aid our

potential argument, which is the idea that sound is another major component other than visual presentation of a location that could create impact and shape our behaviours and opinions about them.

4. *Methodologies*

Our research explores the sonic environments of both the Centre for Interactive Research on Sustainability (CIRS), and the UBC Farm at the University of British-Columbia, in Vancouver, British-Columbia, Canada. Our focus centres around exploring the intricate relationship between soundscapes and biotic (human/non-human) actors. More specifically, how the concept of sustainability is conveyed through the soundscapes of these spaces. We chose these spaces because both represent an aspect of sustainability in a unique way.

Opened in 1915, the UBC Farm has served as both a conduit for agricultural, environmental, and sustainability studies, and has also exemplified sustainable concepts in practice and functionality. The farm encourages student and faculty led food production, which is often resold to various campus owned businesses. Moreover, the farm encompasses a vast open expanse of land that is lined by a dense layer of trees, which either purposefully or accidentally insulates the area from loud city based noises. It was this design decision that intrigued our team to research the acoustics of the space itself.

Conversely, the CIRS building presents sustainability through a much different lens. The building acts as an office space, learning environment, energy production centre, research environment, and most importantly a showcase of 21st century sustainable design. Every aspect of the building is designed to shift the mindset of development towards what value the structure can add to the environment. To this end, the building employs a multitude of architectural decisions aimed at reducing energy and water consumption, while producing energy and usable

water passively. Furthermore, most of the building's materials are either recycled, or waste/energy efficient in their production. The ways in which both these spaces promote concepts of sustainability, made them noteworthy concerning our research focus, especially with CIRS being ranked with the platinum standard of LEEDS. Through our research, we seek to contribute to the literature surrounding sonic geographies, that calls for a technique known as expanded listening, in the field of human geography. By applying expanded listening techniques to our research, we hope to identify various ways in which sounds are at work in these spaces. Following the completion of our report, we plan to submit our research to the *BC Studies: The British Columbian Quarterly,* which has recently sent out a call for sound studies that combine both an audio and a written component to their delivery. We will primarily explore our posed research question through audio recordings and conducted interviews & meeting sessions.

Recording

To conduct the portion of our research concerning audio data we used two Zoom H5 series recording devices, borrowed from Doctor Bret Petersen of the UBC Geography Department, one being omni-directional and the other single directional. Audio recordings were chosen as the preferred method of data collection due to the uniqueness of the concept, and in the critical-role they played in conveying the idea of sustainability through sonic geographies. We used a program called Reaper to process and edit our audio files. Reaper also allowed us to compose our recordings in such a way that would be conducive to presenting our research in an engaging manner. We arranged each recording to highlight sounds to help demonstrate our point. This was achieved through two methods through the Reaper Sound editing program. The first, being direct edits to the properties of the sound files. The second, focused more on the artistic arrangement and composition of our audio drift. Audio files of this quality allowed us to understand the subtleties of acoustic design, and how our perceptions of spaces are shaped

through sound. However, audio data is inherently limited. Most obvious, it can be extremely difficult to connect the concept of a three-dimensional space, to a curated audio drift, no matter how in depth the method or explanation. Moreover, sensory perceptions are perceived differently between individuals. In composing an audio drift, a major challenge our team had to overcome was how we would present our findings in a way that could illustrate our focus with as little of a bias as possible, and with as little room for miscommunication of ideas. In this way, we define our research as being qualitative, as opposed to quantitative.

Interview

To improve our understanding of the CIRS building, we conducted a series of interviews and arranged round-table meetings with relevant personnel involved in the architectural design, representatives from SEEDS, and employees working in the building itself. The interviews were mostly informal, focusing on whether acoustics were incorporated into the design of the CIRS building and, if so, how this was achieved on a materials level, and design level.

The knowledge gained from the interviews & tours, as well as the breadth of information shared with us during our meetings, enabled us to pose how sound was not only considered in the design process CIRS, but how the aims of the building itself are represented in the sounds that occur within it. Much like our audio recordings, these exchanges were qualitative in nature, looking to draw a connection between the quantified data necessary to the building's construction and the qualitative experiences of the individuals who occupy the space five days a week. The limitations of these interviews, however, are those of interest bias, to the extent that all the information conveyed to us about the space was done so by individuals with a vested interest in not only the CIRS building, but how our research could make the space seem more attractive. Being aware of this, our team had to adapt a critical approach to measuring the building's true

level of sustainability, and whether or not this concept could actually be discerned through an audio drift.

Problem Statement

We have identified a set of key problems that we will likely encounter and try resolve through our research. One issue will be dealing with the discrepancy between what our recorders pick up and what we are hearing in the field. The sounds we may have found to most prevalent in the field might not be reflected in the recording. We can attempt to resolve this through editing our final sound files, to more accurately reflect our experience of the sonic environment in the field.

Another potential problem is our tendency to overcompensate due to our innate bias towards certain sound clips. Knowing that we have a bias could lead to us 'intentionally' making choices that may affect the study and the final sound project. Our hope is that by having a large team, our individual biases towards certain sounds will be compensated, and that we can represent a diverse sonic experience of the CIRS building. In addition to this, our team's diverse academic interests will help us avoid overemphasizing certain sounds, as we are all coming to the research with different perspective and interests.

The last problem we have identified will be dealing with recording in the field and how to address recording people using the space, which leads to ethical dilemmas. Hay's address to ethical delimas mentions that it is likely that the researcher would have to "'violate' one of the three ethical principles – justice, bene cence or respect for other" (2010, p.42). Our group consensus agreed that the best way to deal with this issue will be turning off our recorders or deleting recordings that contain conversations that sound personal or private. We worried that if we got consent from everyone in the space that we are recording, it would distort how people use the space.

7. ANALYSIS

Our objectives are slated towards applying our theory and observations into the CIRS building and the UBC farm. The different locations and characteristics of our two-selected location allows for deeper analysis of the difference between urban and “natural areas”

The main Lobby of the CIRS was found to be very effective in blocking sound disruption from outside of the building. At the main chamber our noticed that the building was constructed around wooden supports and steel joints. There is a great many windows on the wall facing the north west direction, allowing for a lot of light into the building. Behind these windows and in front of the 4 floors of the CIRS was a great empty space.

As our group walked to the upper floors of the building, we noticed that this space was probably designed to allow for optimal light exposure into the building and the 4 floors. The floors in the building opts for recycled tires and hollow floors over cement, adding an element of recycling and adaptability to the building. However, the gap behind the West facing windows also allows for sound to travel unopposed throughout the main building from the lobby area, which could prove distracting on people working in or outside of the office spaces on the 2,3 and 4th floors.

“The propagation of the signal depends both on the medium through which it passes (air, water, solid media, etc.) and on the arrangement of reflective and absorptive surfaces of that medium (e.g., vegetation, buildings, and water bodies).” (Pijanowski, 2010).

This is further compounded by the ability of the recycled tire surface to allow for the transmission of sound in-between floors. The stairs going from the lobby going to the 2nd floor also causes mini vibrations and generates a lot of sound as the stair rails and components also does not absorb sound.

“Unwanted sound, or noise, is a common issue in cities globally, and the problem has spread to more rural and remote areas with the expansion of motorized transportation networks” (Pijanowski, 2010).

The wooden supports also absorb less sound than traditional concrete, which allows for more sound to escape. Throughout the recording of the CIRS, our group decided to categorize the sounds into different vectors of recording. By pointing our sound recorders upwards, we captured sound waves that bounced off the wooden ceilings of the different floors of the CIRS. Meanwhile, by pointing the recorders low, we were also able to hear if the tire-floors reflected or absorbed sound differently than the ceiling.

The soundscape created for the UBC farm is a completely different portrayal of sustainability in relation to the CIRS building. Unlike the CIRS building where we identify sounds made from sustainable material and water system, the sound of nature is our primary focus. The purpose of the soundscape is through editing the various sounds we captured at the farm and edit them through the software, Reaper. After processing the sound, our group converted the sound files into a recording that we believe can become powerful medium in promoting the idea of sustainability. We sorted the sounds captured at the farm into three different categories which are the mechanical sounds such as motor, power generator, engines of vehicles and construction, the man-made sounds such as chatter and footstep, and the sounds of nature which are the wind, the chicken, the birds, and the trees. To convey the message of sustainability, we decided to use the concept of recycling. Therefore, we decided to emphasize the sound of our footsteps as an intro as well as our ending.

When we first enter the farm, we tread on gravel ground and slowly onto the grassfield. It is significant to note that the sound of construction was prominent just outside the entrance of the farm. As we move into the farm, urban noise fades away since the farm is surrounded by large dense trees which act as barriers. Therefore, this is where the sound of nature becomes very clear and soothing to farm visitors. The sound we encountered initially was the sounds of chicken, followed by loud mix of bird sounds. According to Tse’s study (2012), pleasant sounds have found to have positive impact on people's health and well-being. In addition, other researchers

have slowly recognized the importance of nature and how it “has been associated with many measures of wellness, including a reduction in symptoms of stress [...], depression and anxiety, and improvements in positive outlooks on life, concentration, and productivity (Reese and Myers, 2012).” On the other hand, chicken are also a representation of sustainability directly.

Chicken from the farm are used for local restaurants on and around the UBC campus, which will likely decrease the University and consumer’s carbon footprint as locally grown food reduces the cost of transportation. In addition, the sound of wind is another major source of natural sound throughout the entire farm. When wind collide with trees, we can hear a distinct sound that is crisp and soothing to our ears. We can further emphasize the significance of trees where they are a major source of oxygen production. Therefore, the provide the natural service of reducing carbon in our atmosphere which can improve the overall air condition in the region.

Regarding UBC farms, we noticed a definite contrast between the construction happening outside of the farm and the strong sense of “nature” once we stepped into the farm. Referring to the video recording showed in our presentation slide, urban sounds can prove to be overpowering and distracting to people in the environment. The trees lining the farm perimeter acted as a buffer for industrial sound and noise pollution. Due to this, our group payed more attention to the sounds of birds in the trees and the chicken over anthropogenic noise.

8. SIGNIFICANCE OF PROPOSED RESEARCH

Our exploration into the concept of Sonic Geographies is rooted in our curiosity towards understanding the surrounding environment from different perspectives. Often, our observation of a space lies with perceiving the space visually. Often, orthodox research methods in geography are very much reliant on what the researcher ‘sees’ to deduce an argument(examples being questionnaires, tallies of people, cars etc.). However, the concept of ‘sound’ to provide an insight into the environment is equally as important, and can bring a new perspective towards further research.

The concept of sound should not be underestimated as a medium of conveying information. Numerous literature reviews that we’ve gathered as the basis of our study (as shown above) have repeatedly emphasized the importance of sound as a means towards forming the environment.

Beginning with the broader implications of sound, Atkinson's study provides insight into the notion of observing sound, illustrating to us that if we become more observant towards the sounds that are around us, we will have a better understanding of how 'sounds' shape our environment. Often, our reliance on visual perception to interpret the world also greatly reduces our ability to view the same space from other perspectives, namely sound(in this case). The significance of this research, therefore, is to raise awareness of sound as a strong means of providing insightful findings towards spatial research.

Furthermore, Shen's research introduces the idea that soundscapes exist and disappear rapidly; our perception of soundscapes in a space also alter, depending on what role we play. For example, as locals traversing through an everyday space, we may not be as perceptive to individual sounds as tourists who are in the same space. One focus on soundscapes within shopping malls shows that 'background music' can "make an effort to adjust the emotional condition of the users, so that creating a comfortable and soft environment" (Shen, 2014). Studies show that the use of background music "systematically affects the users' feelings of space impression" (Shen, 2014). Subsequently, research into this area provides significance towards people create spaces that serve a specific function *(ie: study rooms vs locations of food consumption)*, and how we can create the optimal space to achieve the space's intended purpose.

What we can gather from this is, what we tend to perceive as the environment around us, is only the tip of an iceberg to a wider extension of information and observations, only accessible through other mediums aside from visual means. The use of sound, being a source of information that we often neglect out of habit, can provide fruitful insights and knowledge into our surroundings, as seen in our research. Therefore, there is large inherent value in recognizing sonic geography as a approach of comprehending the space around us, and is worthy of consideration when conducting further research. The use of sonic geography, and the data that can be gathered with visual observations combined, will be beneficial towards furthering spatial research in the field of Geography, bringing overall geographical research forward.

9. FUTURE RESEARCH DIRECTIONS

Throughout our research process, our group could thoroughly think about and explore the possible implications of our research. By analyzing how sustainability is perceived and factoring the context to which sound is processed, the implementation of policy, urban planning, and building design, sound could be used to improve on existing ideas of sustainability.

Using our research materials, we believe that surveys about sustainability and sound can be used to pinpoint ways that UBC farms or CIRS can become even more comfortable and sustainable to occupants of either of the spaces. The sound files that we have recorded can be used to create clips to play to the participants to find out if the sounds are perceived as sustainable or not given the different contexts that are prevalent in both UBC farms and CIRS. By using the information gained from the proposed survey's, modifications to space and different ways of detecting and improving sustainability can unleash a future of improved sustainability for everyone.

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