Human Identity in The Space Age
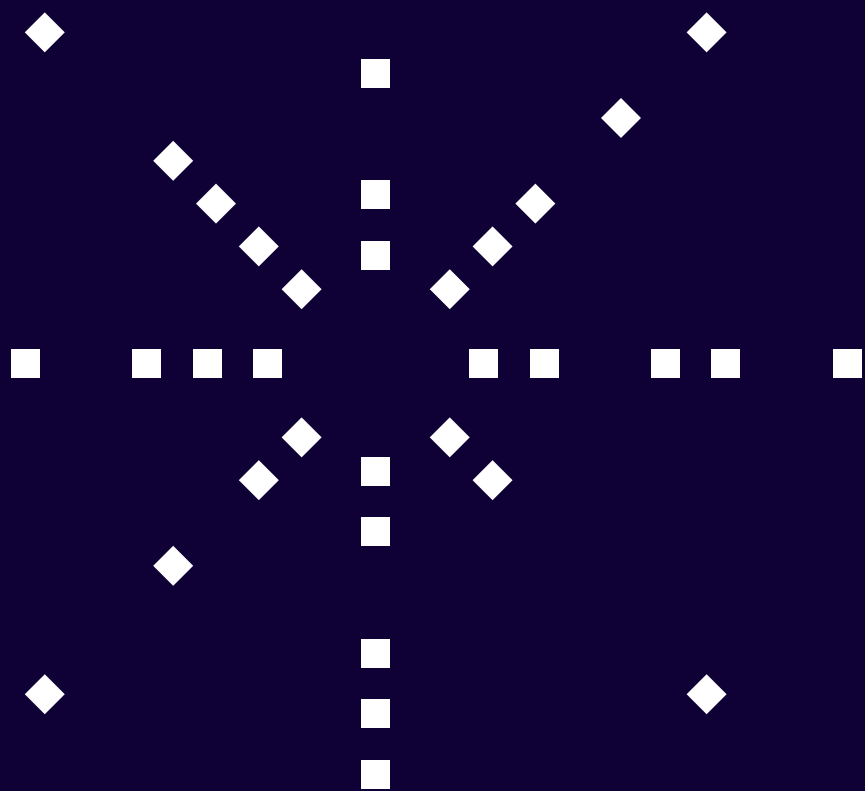
Developing a system for communication in the universe

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Contents

Context

Astronomy, the oldest of humanity's natural sciences, is defined simply as 'the science that deals with the material universe beyond the earth's atmosphere' (*"Astronomy"*, n.d.). It is rather ironic that the field of science which has seen its greatest developments take place with the scientific advancements of the last 100 years does in fact date back through human history long before the concepts of space, planets and stars as we now know them even existed. Yet this natural fascination we have had with the celestial unknown suggests a relevance, and an importance which carries through to the world of today, one in which the possibilities of truly exploring the universe are becoming more and more substantial. While the study of astronomy was limited to mere observation for thousands of years, it is the opportunity for a two-way relationship between us and the universe which has been facilitated by science. We are now at a stage where we cannot just observe, but can broadcast our own messages outwards. And more importantly, we are getting closer and closer to a phase of colonisation. Not this year, and maybe not this decade, but very likely this century. SpaceX CEO Elon Musk plans on beginning his company's Mars colonisation missions as early as 2024 should everything go perfectly (Wall, 2016). With the technological advancements and element of competition added to the space industry by private companies like SpaceX, the progression from people colonising the Earth, to people colonising the solar system and beyond is fast approaching.

Yet, while the privatisation of the space industry does offer the benefits of rapid technological advancements (which in turn can be used by government agencies also), the division of our efforts remains, a recurring theme since the beginning of modern space exploration. The Space Race, symbolic of the over-arching conflict between the United States and the Soviet Union—and the Cold War in general—provided the basis for much of the space industry's development in the latter half of the 20th century. It is evident that competition can clearly be beneficial to development not just in space technology, but in all fields. Realistically, however, human endeavours in space exploration are just that: human endeavours. Not just

American, or Russian, or SpaceX endeavours. Elon Musk himself states 'either we spread Earth to other planets, or we risk going extinct' (Gannes, 2013), proposing the idea that while the space industry is populated by private companies like his own SpaceX, or by competing countries, the importance of the industry to all of humanity cannot be understated. The future of our space exploration, while likely carried out by individual (private or government) agencies is ultimately for the benefit of humanity as a whole.

And so, the position we find ourselves in on the brink of this new space revolution is one of fragmentation. Once the process of colonisation begins, Earth will not be our only home. The missions of colonisation will become representations of Earth on a universal scale, and therefore should be identified as such. In the context of Earth, people have systems of identification—flags, anthems, languages—which they associate with. In the context of space travel, Earth and its people will need such a system.

Therefore, my proposal is to create this identity for Earth. My proposal is not, however, just to create a brand for Earth, or a logo, or a flag. The context of designing for a future where humans have begun to colonise the universe also introduces the possibility of designing for aliens, and this consideration expands the scope of the project beyond traditional design for people. The field of extra-terrestrial communication is not completely uncharted, however our previous attempts—such as the Arecibo Message, or the Voyager plaques—are likely to be undecipherable to alien species. Atri, DeMarines and Haqq-Misra (2011) have proposed the creation a protocol for messaging extra-terrestrial intelligence, which would accommodate the potentially drastic sensory differences between humans and an alien species. This concept of a protocol for sending messages is more relevant to this proposal than traditional visual identities in graphic design, and provokes the development of system which identifies Earth and is transferrable across many different mediums—in turn allowing for reception by the widest possible audience.

Figure 1: John E. Arnold with an Arcturus IV model.
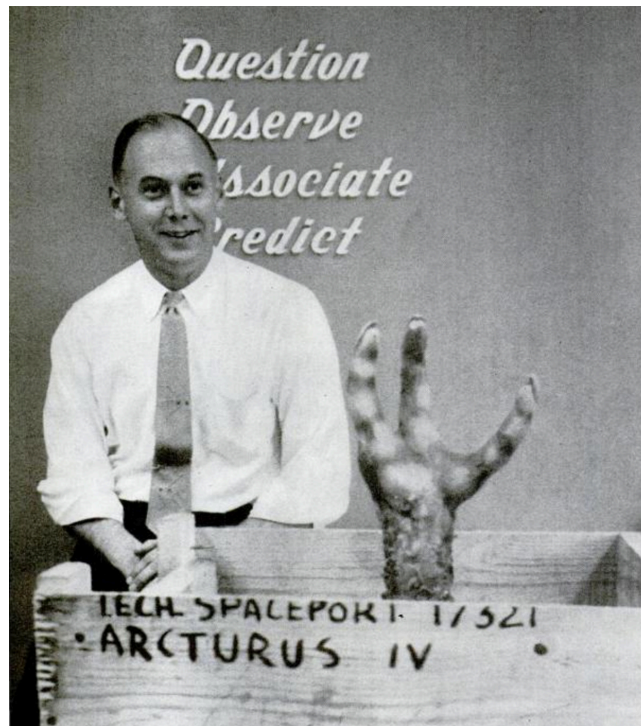
The Alien

The introduction of the Alien in the context of this proposal is more theoretical than practical. In this case, the Alien is not one alien, or even one species in particular, but rather a device which will inform design decisions throughout the project. The concept of the Alien is inspired by John E. Arnolds' 1951 MIT engineering case study Arcturus IV, in which students were required to design for an alien species known as "Methanians". This species had significantly different characteristics from humans, and the intention of the case study was to dissolve 'pre-conceived notions of man-machine relationships and to strengthen the influence of environment on design.' (Arnold, 1953, p. 16). While Arcturus IV was centred around one specified species, the concept of designing for a user (the Alien) with different needs and senses to a human is especially important in the context of space travel. The Alien as a device will enable the consideration of a far wider range of design problems, while also providing a basis for the cross-media translations of Earth's identity.

The Alien's role in considering the multi-media aspect of Earth's identity is important, not because it will require designing for every single possible scenario, but rather that it will enforce the simplification and translatability of the design. The visual representation will need to be simplified to a point where it can be translated to other mediums—say, audio—while still being as close to the same thing as possible. For example, if the audio representation loops (like a morse or binary audio message does), said loop will need to be depicted in the visual version, as well as all the individual elements which make up each loop. To account for the Alien as best as possible, it will be important to consider the sensory aspects of the Alien, much like the students who studied to the Arnolds' Arcturus IV.

Central Proposition

Humanity is on the brink of a defining stage in its history: colonial expansion into the universe. Cross-medium design can be used to create an identity for humanity in this context, which is practically applicable for understanding by both humans and extra-terrestrial intelligence.

Research

Our capabilities to explore space are a direct result of the technological progression of the last century. Design movements from this time are important to look at when considering to human reaction to these technological developments, and thus can inform the design process I will take in this project. Specifically, the ideologies of modernism at different points in the 20th century, and the design applications of futurism and minimalism can be studied in relation to technology, and its impact of human ideology. Berman (1988) describes modernism as being shaped by 'great discoveries in physical sciences, changing our images of the universe and our place in it' (p. 16), directly highlighting the effect of the rapid developments the 20th century and their effects on the ideology. It is therefore apparent that the outputs of modernist art and design are very much reactionary to this technology, and this follows through to futurism and minimalism also.

The impact of technology on futurism is abundantly clear, although complicated—'The glorification of technology became a salient feature ... of Futurism as a cultural phenomenon.' (Berghaus, 2009, p. vii). Stylistically, futurist pieces such as Umberto Boccioni's Unique Forms of Continuity in Space portray movement (in this case of the human form) to 'synthesise every moment (time, place, colour-tone) and thus paint the picture.' (Boccioni, 1914). Given the technological basis of space exploration, a project based around the representation of Earth in the universe should pay attention to the technology which has made it possible, and consider the technology which will facilitate exploration and communication.

Minimalism is also interesting to look at in the context of this proposal, as its focus on simplicity and utility is an idea which will be important in my design work. For Earth's identity to be as media-translatable, and as decipherable as possible, the simplicity of the developed system will be key. 'The phrase "Less is More" is not only used in design, but also closely linked to the term Minimalism ... Minimalism always denoted reduction in an extreme case' (VanEenoo, 2011, p. 9)—the ideologies of minimalism will be essential in developing the project's system in the most effective way.

Figure 2: The Arecibo Message
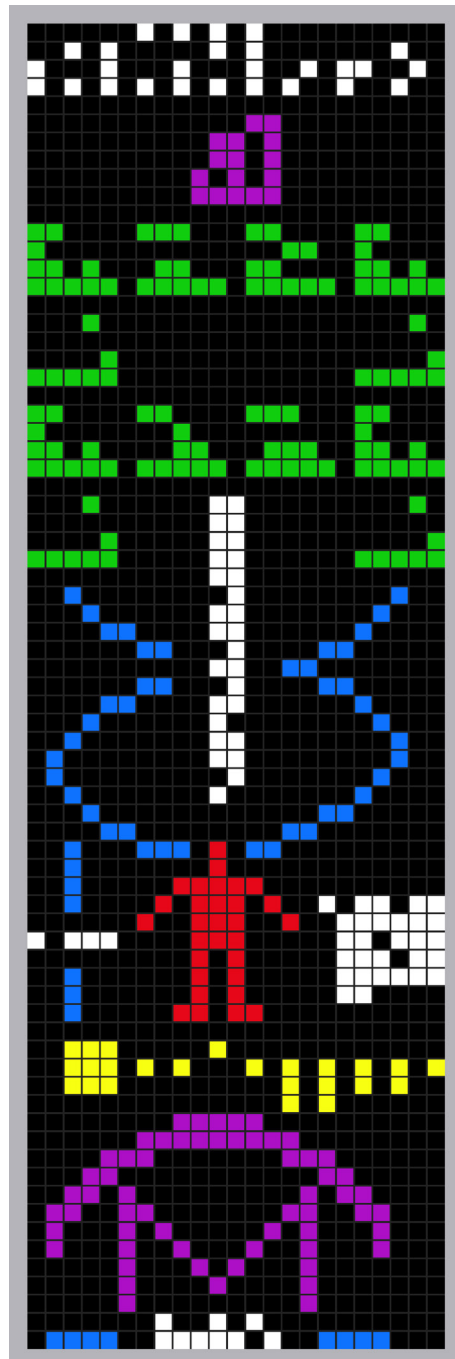
Arecibo

The 1974 Arecibo message was humanity's first message to extra-terrestrials. The system devised for this transmission was a series of figures composed in binary, including the numbers one to ten, the atomic numbers the elements of DNA, and several graphics depicting DNA, a human, and the solar system. The binary system used in this message is a fantastic example of simplifying information into a mathematically-based format, which theoretically could be easily translated across mediums (already the message exists in both visual and audio formats); the 'code' outlined in the representations of the numbers, which then is used to display other elements of the message is the beginnings of a system in and of itself. Theoretically numbers could be used to display any information following this system, although for this project it would be important to retain the simplicity of information which makes an identity effective.

The failings of the Arecibo message are important to consider as well. Firstly, the message, while mathematically based, relies on a pictographic approach. For an alien species unlike our own, which potentially may not even be able to see, let alone comprehend the images in the Arecibo message, much of the information beyond the initial numbers may be completely undecipherable. Further, the length of the message is problematic: 'the broadcast of massive amounts of information assumes the recipient extra-terrestrials will be capable of comprehending a complex message.' (Atri et al. 2011, p. 8–9). Again, my design will need to consider not just the simplicity in design, but also the simplicity in content. It will be important to remove unnecessary components, and carefully consider what information is vital to include in the identity.
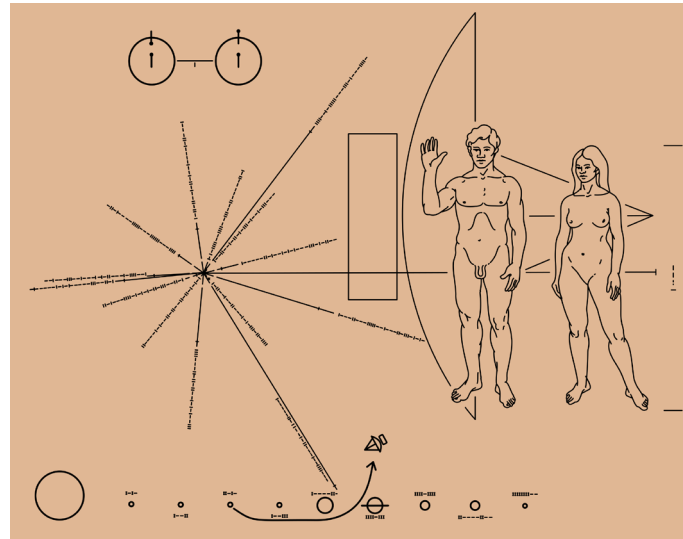
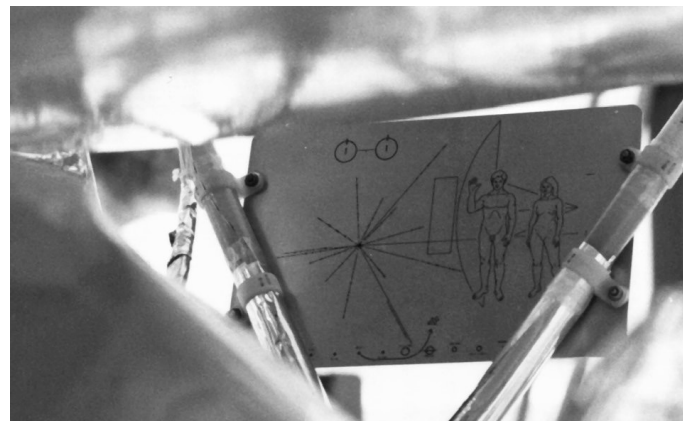**Figure 3:** Image of the Pioneer plaque engraving.

**Figure 4:** Pioneer plaque in place on the spacecraft.

Pioneer

The Pioneer Plaques are attached to NASAs Pioneer 10 & 11 (launched in 1972 and 1973 respectively) spacecraft. Pioneer 10 was the first spacecraft to leave our solar system (Sagan, Salzman Sagan and Drake, 1972), and the concept behind its plaque and that of Pioneer 11 was a demonstration of the 'locale, epoch, and nature of [their] builders.' (Sagan et al. 1972, p. 881). The plaques, like the Arecibo message, portrayed in a visual format: our solar system, the human form, and a hydrogen molecule; although due to the plaques not being defined by binary format, they rendered these figures in immensely increased detail. Of course, the visual medium used on the plaques also has the same problems as discussed with the Arecibo message—only employing one medium in attempted extra-terrestrial communication does not cater for a wide audience. The benefit of the higher fidelity of the Pioneer plaques does however potentially make the information more understandable provided a recipient could see.

The plaques do also use binary to show both the location of the Sun, and a way to calculate the epoch of the launch (effectively the time of launch). The lines of binary depict the distance from the sun, and the radiation periods of specific pulsars (white dwarf stars), a time measurement which 'can be used as galactic clocks for time intervals of hundreds of millions of years' (Sagan et al. 1972, p. 882), allowing for potential deciphering even in the very distant future. This image is therefore a map to our solar system, which theoretically can be followed from almost anywhere in the galaxy at any time. This graphic also employs a mathematical system—the actual numbers used are converted to the measure of a hydrogen element's "hyperfine transition", which is displayed at the top of the plaque. Using the most common element in space as a building block for the display offers a key to aid with understanding for any recipient.

Figure 5: Engravings on the Voyager Golden Record.
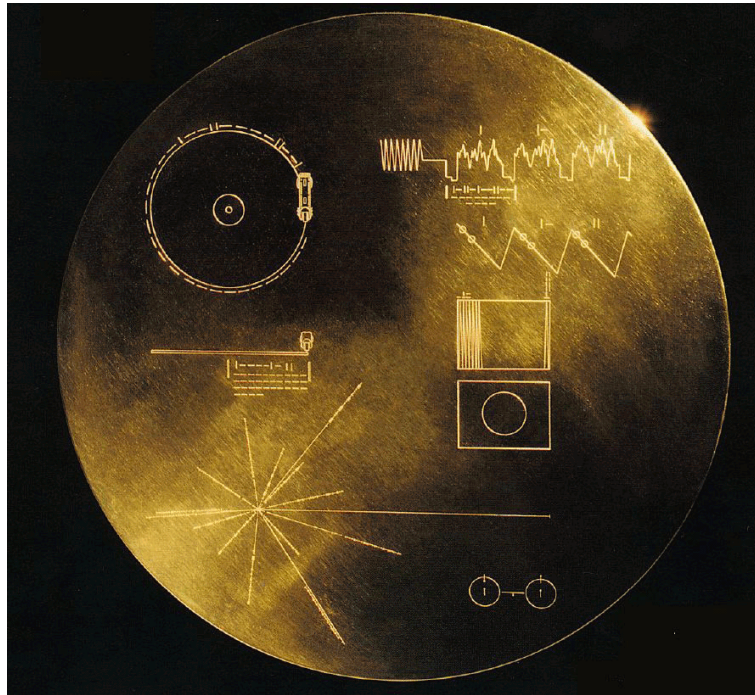
Voyager

The Voyager Golden Records are similar to the Pioneer Plaques; in that they are attached to two spacecraft (Voyager 1 & 2, launched in 1977), although the content of the records is much larger. Containing '115 images and a variety of natural sounds ... musical selections from different cultures and eras, and spoken greetings from Earth-people in fifty-five languages' (*"The Golden Record"*, n.d.), the records are largely focused around human culture. This information is less an attempt at communication and more a "time capsule" for life on Earth.

The etching on the record however, is more communicative. It contains information on: how to play the record, what correct decoding will look like for the first contained image, and—like the Pioneer Plaques—the "pulsar map" for Earth. This information again use the hydrogen "hyperfine transition" system and binary numbers which allows for deciphering, although again the information is stored only in a visual form. Like the Pioneers Plaques, this could again limit the potential audience.

Perhaps the most useful document for researching this proposal is Atri et al.'s Proposal for Messaging to Extra-Terrestrial Intelligence (2011). Although it is aimed partially at the technological aspects of broadcasting a message, it does outline some important points about the maximising the effectiveness of a message.

Atri et al. (2011) highlight the importance of focusing on universally understood information (i.e. mathematics and science) as opposed to culturally significant information—'overly anthropocentric signals that implicitly rely upon certain facets of human culture may go unnoticed by extra-terrestrial listeners' (p. 4). As mentioned earlier, the complexity of the content also needs to be considered; 'greater complexity probably makes it more difficult for an extra-terrestrial listener to decode and decipher the message' (Atri et al., 2011, p. 7). Using maths and/or scientific information to create an encoding system is also recommended, on the basis that regardless of any attributes of a potential recipient, the rules of mathematics and science should be universally understood. Breaking complex information down into a basic mathematical system would also encourage keeping said information simple, and would help with translating the identity between different mediums.

Figure 6: Early ideation.
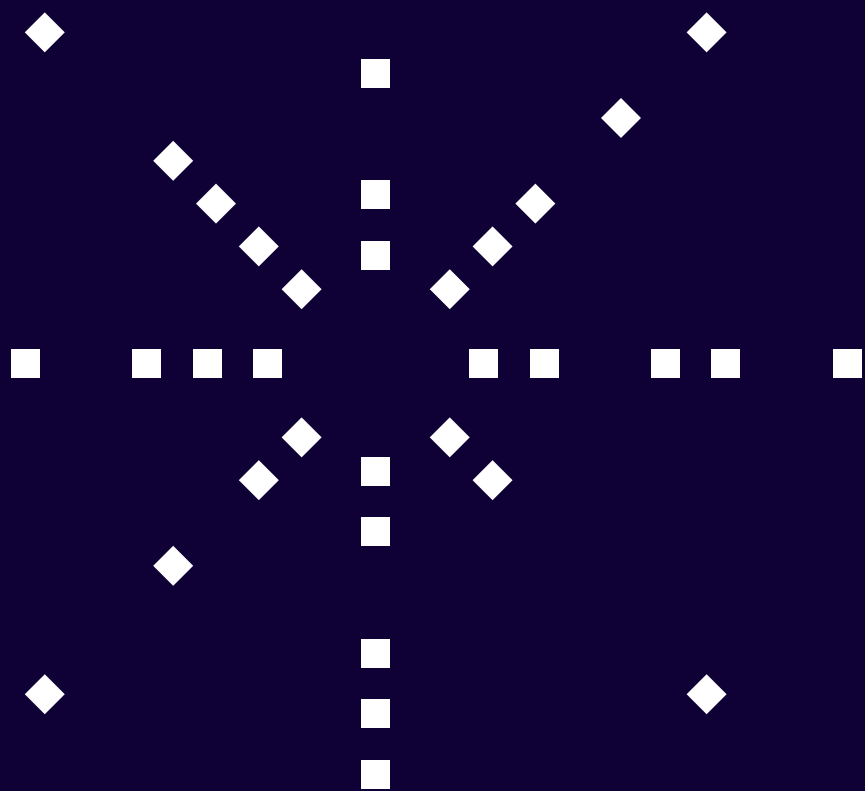
Conceptual Planning

Aim

The aim of this project is to create a cross-medium identity for humanity in the context of our impending colonial expansion into the universe. This identity needs to be understandable by both humans and extra-terrestrial intelligence—a task which requires accounting for variances in the audience's ability to receive communication. Thus, a system needs to be developed which allows the identity to be translated across mediums while still retaining its meaning absolutely.

Mediums

As a base for this identity, I will develop three versions which convey the information over three mediums. These include a visual form, an audio form, and a tangible form. Through the development of these forms, I can design an identity for humanity in the context of space exploration which considers the restrictions of the trans-media requirement, and designing with these restrictions will demonstrate the theoretical ability to translate my designs to other mediums. In regards to the technical properties of these mediums, considerations will be made about the theoretical usage of the identity, for example the audio format or materials used for the audio and tangible forms respectively.

Encoding System

'What we need to develop is an "inverse cryptography" … Cleverness on the part of the sender is then the important factor, not reliance on ingenuity of the recipient' (Callimahos, 1965, p. 7). For the identity to be as widely understandable as possible, a system will need to be devised which accommodates a wide audience, which may receive information quite differently to ourselves (in terms of sense for example). In order for this system to be effective, it will need to be grounded in concepts which should be universally understood: mathematics and science. 'Number will initially be our common idiom of reciprocal recognition' (Hogben, 1963, p. 124). This sentiment is based on the fact that number is one of the universal constants that any extra-terrestrial intelligence should be able to identify in a message. The scientific basis of the system is drawn from the fact that the elemental make-up of the universe is another universal consistency, and therefore should also be understood by extra-terrestrials.

Preceding communications outwards, as discussed earlier, have commonly used binary as a base for displaying information. The effectiveness of this lies in the fact that it is about as simple as possible: 1 or 0. On or off. This simplicity allows binary to convey information in the same general manner regardless of complexity (at the compromise of sometimes excessive length), however crucially the simplicity also lends itself to translating content across mediums. This is evidenced in the Arecibo message, where the visual message is effectively the same in audio format (as it was broadcast). It is therefore likely that my design will use some form of binary encoding in all mediums, to maintain consistency across all three, and ensure decipherability.

The encoding system will also require a "base unit", which acts in the same way as the hydrogen "hyperfine transition" (which is a measure of time) on the Pioneer and Voyager engravings. While numbers can be shown purely in binary, using a unit based in physical reality can give binary codes a context, and be used to further clarify information. This is seen in the Pioneer diagram displaying the pulsars—the hydrogen unit puts the strings of binary into context, and allows them to be deciphered not just as numbers but at the pulsar periods. Therefore, it will be useful do decide on a scientific unit as a base for my system; what is the most suitable will likely be determined by the content of the identity.

Selecting Information

As an identity for humanity, there is obviously an enormous amount of information which could be deemed worthy of including in this project. The content of the identity will likely change significantly over the course of the project, however there are some elements which would appear most important given the context of space exploration housing the proposal.

The first element which should be included is some indication of planet Earth. As the home of humanity, this is obviously a significant part of human history, and will continue to be regardless of what level of interstellar exploration we achieve. This sentiment is echoed in all discussed precedent examples, whether it be through Arecibo's solar system pictogram (which highlighted Earth in particular), or through the pulsar map on the Pioneer/Voyager engravings. The information used to depict Earth in the identity will depend on the system used, although some form of map may be a good choice to ensure understanding without any prior knowledge of the planet.

**Figure 7:** Initial sketches of potenital visual concepts.
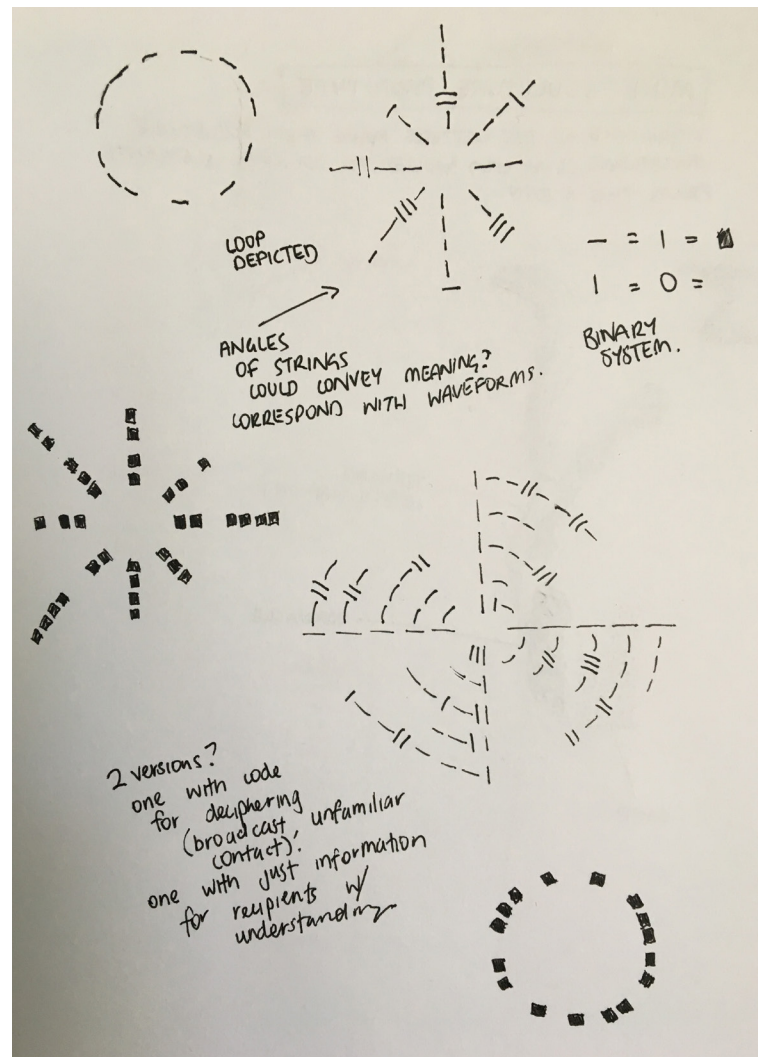
Another element that will be included is a signifier of the human nature of the identity. In keeping with the theories of Atri et al. (2011) this information should be scientifically grounded, and attempt to avoid information of cultural significance which may be irrelevant to extra-terrestrials. Thus, a form of description of the unique properties of human DNA, or perhaps even a property of life on Earth in general may be a good choice for this—DNA was also depicted in some detail in the Arecibo message.

Visual Direction

The visual direction of this project will need to be carefully considered. While the visual form of the identity could on its own take on almost any style, factoring in the audio and tangible forms introduces limitations which will need to be adhered to visually as well. For example, the audio form will potentially be comprised of on/off signals, and will almost certainly be a loop. Therefore, the visual version should not just display the same information as the audio, but also depict in some way the loop, to truly contain the same information and be a directly "translated" equivalent. Binary (or similar) strings can however be arranged in unique ways while still maintaining their meaning, so this format would allow for some flexibility in this regard.

Current ideation has resulted in mainly simple square or lined shapes used in place of binary on/off signals, however this is also still open to change significantly. The symbols/shapes used in the designs could also be used to represent meaning beyond the pure encoded binary. It will also be important to bear in mind the overall shape of any composition, as this could be used to convey meaning while still maintaining the encoded information.
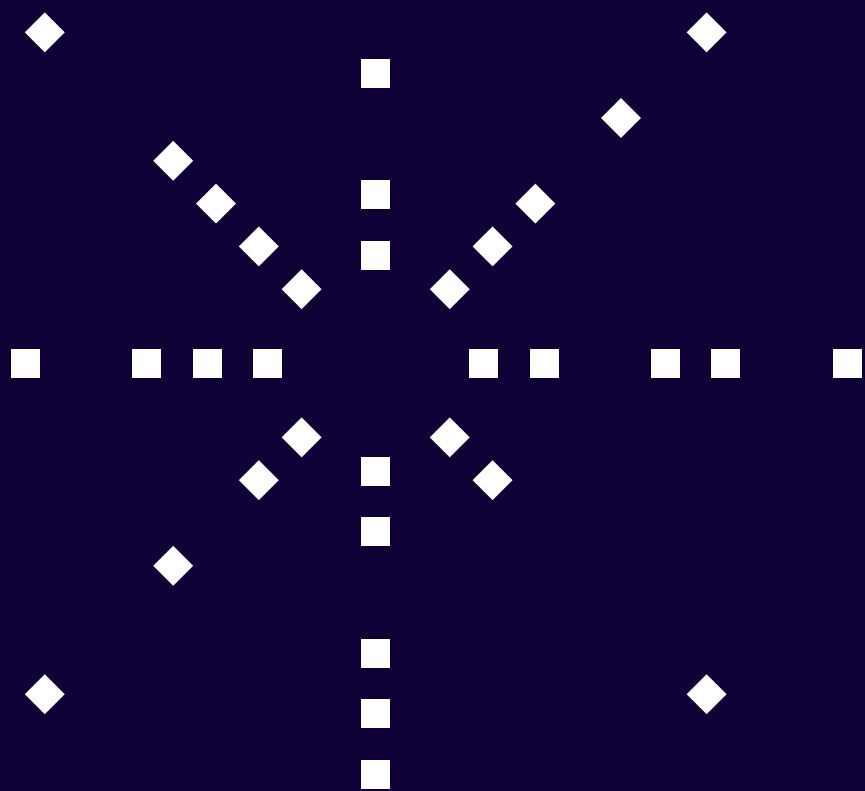
Next Steps

The next steps for this project will begin with further research on what information should be included in the identity. The selection of this information directly influence the design of all three forms of the identity, and therefore it is crucial to select this early.

Following this selection, the design process will begin to take place for the three forms. Changes made to one form will need to be reflected in all three, thus the forms will be designed simultaneously, and each will react to the development of the others.

At various points throughout the design process, it will be useful to test the effectiveness of the encoding system. 'An effective message to extraterrestrials should at least be understandable by humans' (Atri et al., 2011, p. 2). Following this sentiment, I will aim to engage people in decoding the identity, ideally through information conveyed only in the identity (and not external assistance or a "key" of sorts).

The "materiality" of the forms. will also need to be considered, although this will likely come later in the design process. This will also include a consideration of the technological output of the audio (i.e. which waveforms would be used in practice).

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Figure 2. Nordmann, A. (2005). *The Arecibo message as sent 1974 from the Arecibo observatory.* [Drawing]. Retrieved from https://commons.wikimedia.org/wiki/File:Arecibo_message.svg

Figure 3. Salzman Sagan, L. (1972). *The Pioneer Plaque.* [Drawing]. Retrieved from https://en.wikipedia.org/wiki/File:Pioneer_plaque.svg

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Figure 5. NASA/JPL. (1977). *Voyager Golden Record.* [Photograph]. USA. Retrieved from https://commons.wikimedia.org/wiki/File:The_Sounds_of_Earth_Record_Cover_-_GPN-2000-001978.jpg

Figure 6. *Early ideation.* [Drawing]. Author's own.

Figure 7. *Early sketches of potential visual concepts.* [Drawing]. Author's own.