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The Senses and Creativity that can be Achieved by Bringing Entertainment in Space

Taiko Kawakami[a]*, Taichi Yamazaki[b]

[a] *General Manager, ASTRAX, Inc., 1-1-4-301 Mukogaoka, Bunkyo, Tokyo, Japan 113-0023, taiko.kawakami@astrax.space*
[b] *CEO and commercial astronaut, International Space Services, Inc. and ASTRAX, Inc., 2-23-17 Komachi, Kamakura, Kanagawa, Japan 248-0006, taichi.yamazaki@astrax.space*
** Corresponding Author*

Abstract

Throughout human history, new value has been created as artists have expanded their activities: after 2023, Japanese entrepreneur and billionaire Yusaku Maezawa plans to take his artists on a trip around the Moon. As space travel becomes more common, there will be more opportunities for artists to perform in space, playing instruments, singing, and dancing. We believe that artists will need different senses and abilities to perform in a different gravitational environment than on Earth, and at the same time, viewers will gain a different awareness of their performance than they do on Earth. In other words, as artists expand the scope of their activities to outer space, the Moon, and Mars, new sensations and new creativity will emerge.

In this paper, we present the details of our hypothesis and the process of testing it to see how this new sensation and creativity will affect and change human life in space.

Keywords: Space Travel, Space Entertainment, musical instruments

1. Introduction

In our lives, exposure to entertainment is an important element in enriching our lives after we have fulfilled our basic needs. It is obvious that artists who create entertainment, whether it be painting, music, or other forms of entertainment, will expand their activities into space in the future. The Tokyo Ska Paradise Orchestra, which I support and which has been active in Japan and around the world for more than 30 years, has nine members. Each member plays the parts of trumpet, trombone, tenor sax, baritone sax, guitar, bass, keyboards, percussion, and drums, and performs the music called "Tokyo Ska". Basing off the idea that if this Tokyo Ska Paradise Orchestra were to expand into space, what would be needed?

Fig,1, Tokyo Ska Paradise Orchestra members

In this paper, we will clarify the differences in sensation and creativity on Earth and in space, and in environments with different gravity, such as the Moon and Mars, with a particular focus on artists who perform and play on stage using musical instruments, and test hypotheses about how entertainment will change in the future and how it will affect human life in the future. We will test hypotheses about the impact on human life and how entertainment will change in the future. Note that although Japan has Japanese instruments and each country has its own traditional instruments, this paper is based on the assumption that the instruments commonly used in orchestras and rock bands known throughout the world will be played and performed.

Fig.2. The main instruments mentioned in this paper

2. The sensations gained from performing on Earth

First of all, it is common on Earth to set up a "front" on the stage and have the audience in a fixed position in front of you facing the front of the stage. Although there are cases where the audience can change their standing position during the show, such as in the case of standing seats in a live music club, the positional relationship remains the same: facing the front of the stage.

Musical instruments are broadly classified into percussion instruments such as drums and cymbals, stringed instruments such as violins and guitars, and wind instruments such as trumpets and flutes. When played on the ground, each of these instruments can be struck, plucked with a bow or hand, or blown into the instrument to produce sound.

3. Capabilities required for performance in space

To seek performance in space that is similar to that on the ground requires capabilities that are not necessary on the ground. First of all, it is quite difficult to hold one's body in place in a weightless environment. In the case of a percussion instrument, the instrument itself would probably need to be held in place, but as soon as it is struck, the same force would send the percussionist flying in the opposite direction of the direction in which the instrument was struck. To prevent the player from being blown away, it is necessary to fix the instrument and the player's body somewhere, or to develop an instrument that can be played while moving freely. One idea would be to fix the drum to the player's body and strike it as if swinging drumsticks. In Japan, there is drums held by the god of thunder called thunder drums, and one solution would be something similar to that image.

Fig.3. Surrounding the god of thunder is the thunder drums

Also, since marching band drum sets are also worn on the body, it would be possible to play the drum set by adding a waist belt as well, since the drum set would float if it was just hooked to the shoulder.

Fig.4. marching band drum sets

Similarly, reed instruments such as the saxophone and wind instruments such as the trumpet, which is played with a mouthpiece, may have a great deal of force to blow into the instrument as soon as it is breathed into, making it a little more difficult for the players to balance themselves. Incidentally, the recorder or harmonica, which can be played without much effort, can be played without the body shaking from blowing.

When playing a blues harp or recorder using ASTRAX's zero gravity flight service, the force of blowing the instrument did not send the player flying in the direction opposite to the outlet, and the player was able to stay in place or go in the direction they wanted to go.

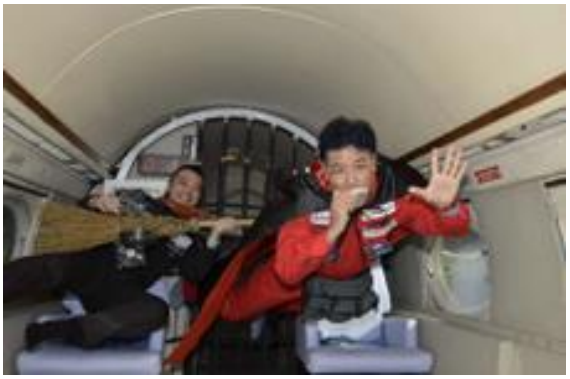

Fig.5. Blues harp playing in zero gravity

Fig.6. Recorder playing in zero gravity

We believe that the violin is the most stable stringed instrument to play, and we had a person who used ASTRAX's zero gravity flight service to play the violin in zero gravity space. The person played the violin firmly with his body in a floating state.

Fig.6. Playing the violin in zero gravity

Others played the Hermann harp and guitar. Each was able to play their instruments while floating in the air, without losing their physical balance as they played.


Fig.7. Playing the Hermann harp in zero gravity


Fig.8. Playing guitar in zero gravity

Please see a separate paper for more information on the instruments played in ASTRAX's zero gravity flight service and other experiments conducted. [79]
Other stringed instruments, such as cellos and double basses, are supported on the stage by endpins, which are rods that transmit the vibrations of the strings to the stage and make them resonate. The wall should be made of wood or something similar with the effect of spreading the resonance.


Fig.9. The metal rod that supports the cello is the end pin

Also, when playing rock guitar, for example, moving around the stage in all directions or violently scratching the strings, the player must control the direction in which the body is moving, or the player may be sent flying in an unintended direction, as is the case with percussion or wind instruments. As for the piano, which can be included in the category of percussion instruments in the sense of hitting or striking the keyboard, but is a string instrument in the sense of striking the strings to produce sound, the mechanism of the piano to produce sound requires the hammers that strike the strings when the keys are pressed to return to their original position after striking the strings, and gravity is involved in this.


Fig.10. Hammer part of piano

The hammer is pulled back to its original position by gravity. In space, where there is no gravity, the hammers cannot return to their original position, making it difficult to play the same note over and over again. It is also difficult to sit in front of a large piano and continue playing. By the way, the keyboard can be played without any problems. A number of astronauts have already played on the International Space Station.


キーボードで音楽を楽しむ宇宙飛行士たち。
宇宙ステーションで。〈提供：NASA〉

Fig.11. Playing the keyboard on the International Space Station

Note that in a spaceship with air or in a zero gravity airplane, the air vibrates and human can hear the sound without any problem using their hearing ability.

4. Sensations obtained from performance in space (hypothesis)

When performing in space, especially in zero gravity, the absolute position of the artist and audience on the ground changes. Unless the artist's position and the audience's seats are fixed, the audience can watch the performance from anywhere, from above or below, 360 degrees to the artist. In addition to a circular stage surrounded by audience seats on the ground, the performance can be viewed from above or below. Also, on Earth, artists are sometimes suspended from above by wires to make them appear to be flying, but without such large-scale equipment, all the artists and the audience can easily fly or float in the sky.

Fig.12. Image of a performance in space presented by SpaceX

5. Sensations obtained from performance on the Moon or Mars (hypothesis)

The Moon and Mars have the same gravity as Earth, so the audience will be positioned facing the front of the stage, just as on Earth. The difference is that the gravity on the Moon and Mars is one-sixth and one-third of that on Earth, respectively. If you are adapted to the gravity of each planet, you will not be able to jump, but if you are adapted to Earth's gravity, you will be able to jump six times and three times more, respectively, than you would on Earth. It is possible to perform using a little height without using large equipment.

6. Possibilities when the space for performance expands into space

When the space in which you perform extends to space, it literally expands the place in which you perform. Performing in the new space of space will also refine the sensitivity of the artists. Mr. Maezawa's project called "DEAR MOON," which takes eight artists on a trip around the moon, is also based on the hope that the artists' sensibilities will be refined and new works of art will be created. Also, the technology required for each location, such as outer space, the moon, and Mars, will be different. It is hoped that the technology developed will be returned to Earth and be useful again.

7. Conclusion (what we need to do to expand our performance in space in the future)

Despite the fact that commercial space travel has been available since 2021, there is still much public perception that space is far away. As of September 2023, Virgin Galactic is conducting monthly commercial space trips. In preparation for a future where more and more people will go to space, we need to prepare instruments that can be played in space now.

ASTRAX will continue to prepare artists to expand their activities into space.

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The Senses and Creativity that can be Achieved by Bringing Entertainment in Space
宇宙空間でエンターテイメントを実現することで得られる感覚と創造性

Taiko Kawakami[a]*, Taichi Yamazaki[b]

[a] *General Manager, ASTRAX, Inc., 1-1-4-301 Mukogaoka, Bunkyo, Tokyo, Japan 113-0023, taiko.kawakami@astrax.space*
[b] *CEO and commercial astronaut, International Space Services, Inc. and ASTRAX, Inc., 2-23-17 Komachi, Kamakura, Kanagawa, Japan 248-0006, taichi.yamazaki@astrax.space*
** Corresponding Author*

アブストラクト

人類の歴史の中で、アーティストの活動の場が広がることで、新しい価値が生まれています。2023年以降に日本の企業家でビリオネアである前澤友作氏は、アーティストを引き連れて月周回旅行に行くことを予定しています。宇宙旅行が一般化すると、アーティストが宇宙で楽器を演奏したり、歌を歌ったり、ダンスを披露するなどのパフォーマンスをする機会も増えてくるでしょう。アーティストが地球上とは異なる重力環境でパフォーマンスを行うためには地球上とは異なる感覚や能力が必要になると同時に、観覧する側も地球上とは違った気づきを得られると考えています。つまり、アーティストの活動範囲が宇宙や月や火星に広がることで、新たな感覚と新たな創造性が生まれてくると考えられます。本稿では、この新しい感覚と創造性が、宇宙での人間の生活にどのような影響を与え、どのように変化していくのかについて、仮説の詳細と検証の経過を紹介します。

Keywords: 宇宙旅行、エンターテイメント、楽器

1. イントロダクション

私たちの生活の中で、エンターテイメントに触れることは基本的な欲求を満たした後、生活を豊かにするための重要な要素です。絵画であれ、音楽であれ、その他のものであれ、エンターテイメントを作り出すアーティストが、今後宇宙に活躍の場を広げていくことは自明のことです。私が応援している、日本のみならず世界各地で30年以上活躍している「東京スカパラダイスオーケストラ」は、メンバーが９人います。それぞれ、トランペット・トロンボーン・テナーサックス・バリトンサックス・ギター・ベース・キーボード・パーカッション・ドラムのパートを担い、「東京スカ」という音楽を奏で、パフォーマンスを行っています。私は、もしこの東京スカパラダイスオーケストラが宇宙に進出するとしたら、何が必要かということを考え、本論文に取り組んでいます。


図１.東京スカパラダイスオーケストラメンバー

本論文では、特に楽器を使ってステージで演奏・パフォーマンスをするアーティストにフォーカスして地球上と宇宙空間、さらには月や火星などの重力の違う環境での感覚や創造性の違いを明確にし、これからの人類の生活への影響とエンターテイメントがどのように変化していくかについて、仮説検証していきます。なお、日本にも和楽器があったり、各国にそれぞれ伝統的な楽器がありますが、本論文では、全世界で知られているオーケストラやロックバンドで

一般的に使われている楽器を演奏・パフォーマンスすることを前提とします。

図2. 本論文で言及する主な楽器

2. 地球上でのパフォーマンスで得られる感覚

まず、地球上ではステージに「前（フロント）」を設定してその前に向かって正面に観客が定位置でいるのが一般的です。ライブハウスのスタンディング席のように観客が自分の立ち位置をライブ中に変えられる場合もありますが、ステージの前に対して向かいあう、という位置関係は変わりません。

演奏する楽器は大きく分けてドラムやシンバルなどの打楽器・バイオリンやギターなどの弦楽器・トランペットやフルートなどの管楽器に分類されます。地上で演奏する際は、それぞれ叩く、弓や手で弦を弾く、楽器に息を吹き込んで音を出すことができます。

3. 宇宙空間でのパフォーマンスで必要な能力

宇宙空間でのパフォーマンスで地上と同様のものを求めようとすると、地上には必要ない能力を要します。まず、無重力状態だった場合、自分の体を定位置に固定する、ということがかなり困難です。打楽器の場合、おそらく楽器自体も固定する必要がありますが、一打叩いた途端に同じ力で楽器を叩いた方角と反対方向に打楽器奏者が飛ばされるでしょう。演奏者が飛ばされないようにどこかに楽器と演奏者の体を固定するか、自由自在に移動しながら演奏できる楽器を開発する必要があります。体に太鼓を固定して、バチを振り回すように叩くというのも一案でしょう。日本では、雷の神様が持っている太鼓を雷鼓というものがありますが、一つの解決策としてはそのイメージに近いものが挙げられるでしょう。

図3. 雷神の周りを囲んでいるのが雷鼓

また、マーチングバンドのドラムセットも体につけて演奏するものなので、ドラムセットを肩に引っかけるだけだとドラムセットが浮いてしまうので、ウエストベルトもつけることで演奏することは可能でしょう。

図4. マーチングバンドのドラムセット

サックスなどのリード楽器やマウスピースを使って吹くトランペットなどの管楽器も同様に、楽器に息を吹き込んだ途端に、吹き込む力が大きくて、少し演奏者が自分の体のバランスを取るのが難しくなるかもしれません。

ちなみに、あまり力を入れなくても吹くことのできるリコーダーやハーモニカは、吹くことで体がブレること演奏することができます。

ASTRAXの無重力飛行サービスを利用してブルースハープやリコーダーを演奏した際、楽器を吹く力で吹き出し口と反対の方向に飛ばされることはなく、その場にとどまることができたり、進みたい方向に進むことができたりしていました。

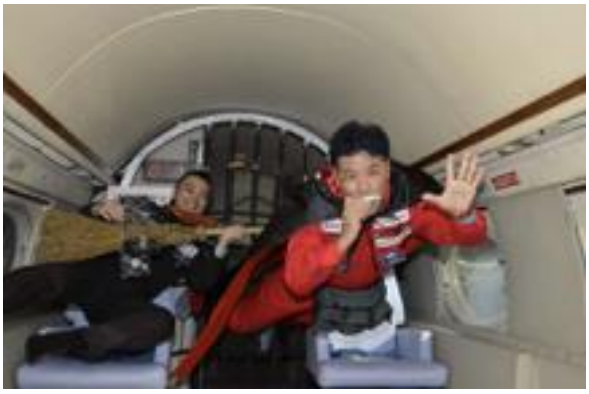

図4. 無重力でブルースハープを吹く様子

図5. 無重力でリコーダーを吹く様子

弦楽器は、バイオリンが一番安定して演奏できると考えています。ASTRAXの無重力飛行サービスを利用して、無重力空間でバイオリンを弾いた方がいらっしゃいました。その方は、体が浮いた状態のまましっかりとバイオリンを演奏していました。

図6. 無重力でバイオリンを弾く様子

その他、ヘルマンハープやギター（子守さん）

を弾いた人もいます。それぞれ、演奏をすることで体のバランスが崩れることはなく、宙に浮いたまま楽器を演奏することができました。


図7. 無重力でヘルマンハープを弾く様子


図8. 無重力でギターを弾く様子

ASTRAXの無重力飛行サービスで演奏された楽器やその他実施された実験の詳細は別論文でご確認ください。[79]
その他の弦楽器、例えばチェロやコントラバスなどは、舞台にエンドピンと呼ばれる楽器を支える棒を接地させて、弦の振動をステージに伝わせて響かせるため、宇宙空間でエンドピンを接地させることが難しく、壁などに当てて演奏するなどの対策が必要になります。壁も木製かそれに似た響きを広げる効果のあるものが望ましいです。


図9. チェロを支える鉄の棒がエンドピン

また、ロックギターなど、縦横無尽にステージ上を動き回ったり、激しく弦を掻き鳴らしながら演奏する場合は、体の移動する方向をコントロールしないと、打楽器や管楽器のように意図していない方向に飛ばされる可能性があります。鍵盤を叩く、打つ、という意味では打楽器に含めてもいいのですが、弦を叩いて音を出すという意味では弦楽器であるピアノについては、ピアノの音を出す仕組みが、鍵盤を押すと弦を叩くハンマーが、弦を叩いた後元の位置に戻る必要があるのですが、それに重力が関係しています。


図10. ピアノハンマー部分

ハンマーを重力で下に引っ張ることで元の位置に戻しているのです。無重力状態になっている宇宙空間では、ハンマーが元の位置に戻ることができず、何度も同じ音を出すことが困難になります。そもそも大きなピアノの前に座って演奏し続けるのも難しいのですが。

ちなみに、キーボードであれば何の問題もなく演奏することができます。既に国際宇宙ステーションでも何人もの宇宙飛行士が演奏しています。

キーボードで音楽を楽しむ宇宙飛行士たち。宇宙ステーションで。〈提供：NASA〉

図11. 国際宇宙ステーションでキーボードを弾く様子

なお、宇宙船や無重力飛行機の中では、機内の空気が振動し、人間は耳の聴力を使って問題なく音を聴くことができます。

4. 宇宙空間でのパフォーマンスで得られる感覚（仮説）

宇宙空間、特に無重力状態でのパフォーマンスの場合、地上では絶対的なアーティストと観客の立ち位置、というのが変化します。アーティストの立ち位置と観客の席を固定しない限り、アーティストに対して360度さらに上からも下からもどこからでも観客がパフォーマンスを観ることが可能になります。地上で円形のステージを観客席が囲んでパフォーマンスが行われることがありますが、それに加えて上からや下からも観ることが可能になるのです。また、地球上では、ワイヤーなどでアーティストを上から吊るして、飛んでいるような演出をすることがありますが、そのような大掛かりな装置を使わなくても、アーティスト全員、そして観客も空を飛んだり浮かんだりすることが簡単にできます。

図12. スペースXが発表した宇宙空間で演奏する様子のイメージ

5. 月や火星でのパフォーマンスで得られる感覚（仮説）

月や火星は、地球と同様重力があるため、地球と同様にステージの正面に向かって観客が定位置で観る事になります。地球上と違う点は、重力が地球と比べてそれぞれ月が6分の1、火星が3分の1になることです。各星の重力に適応してしまうとできなくなりますが、地球の重力に適応していた場合、地球でジャンプするよりそれぞれ6倍、3倍飛ぶことができます。大掛かりな装置を使わないでも、高さを使ったパフォーマンスをすることができます。

6. パフォーマンスをする空間が宇宙に広がった時の可能性

パフォーマンスをする空間が宇宙まで広がった場合、文字通りパフォーマンスをする場所が広がります。宇宙という新しい空間でパフォーマンスをすることで、アーティストの感性も磨かれることでしょう。前澤氏が企画している「DEAR MOON」という月周回旅行にアーティストを8人連れて行くプロジェクトも、アーティストたちの感性が磨かれて新しい作品が生み出されることを期待したものです。また、宇宙空

間・月・火星などそれぞれの場所で必要な技術も違ってくることでしょう。その開発された技術がまた地球上に還元され、役立って行くことが期待されます。

7. 結論（今後宇宙でのパフォーマンスを広げるために必要なこと）

2021年から民間による宇宙旅行が始まっているにもかかわらず、世間ではまだまだ宇宙は遠いものだという認識が多く見られます。2023年9月現在、ヴァージンギャラクティック社は毎月商業宇宙旅行を実施しています。スペースXも毎年1−2回ずつ民間宇宙旅行者を宇宙に運んでいます。ブルーオリジンの宇宙飛行も間も無く再開されるでしょう。また、スターシップのような大型の宇宙船が運航されるようになればさらに多くの人々が宇宙に行く時代がやってくるでしょう。

様々な立場の人たちが宇宙に行く未来がやってくるのに備えて、今から宇宙空間で演奏できる楽器を準備していくことが必要です。ASTRAXでは、引き続きアーティストの活躍の場を宇宙空間に広げるべく、準備を進めていきます。

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【25】Making ASTRAX ACADEMY Online and Multilingual
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【26】Potential Future Plan of Space Izakaya as a Place to Create New Private Space Business
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【40】Maintaining the Health of Pilots and Crew
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【84】Local revitalization project to turn my hometown, Komono Town, into "space town"
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【85】Methods and Practices for Introducing Private Space Education Programs into Japanese Schools
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【86】Development of a "lunar pattern okonomiyaki" baking method to help promote tourism in a lunar city
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【87】Space Education and Nutrition Education Using "Solar Planet Takoyaki
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【88】Application of activities on luxury cruise ships to space tourism vessels
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【89】Astrology in the Space Age: What will happen to the horoscopes of those born on the Moon?
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【90】Exploring the Concept and Potential of Space Museums for Preservation, Education, and Tourism
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【91】Building a Lunar Community for Children: Challenges of Cooperation and Simulating Team Building 子どものための月面コミュニティづくり： 協力への挑戦とチームビルディングの模擬体験