# *Meta Platforms, Inc., Meta Platforms Technologies, LLC, and Twisted Pixel Games, LLC (Petitioners)*
# *v.*
# *Eight kHz, LLC (Patent Owner)*

IPR2023-01019 (US Patent 10,368,179)

IPR2023-01020 (US Patent 10,448,184)

## Petitioners' Demonstratives

September 5, 2024

# Agenda

- Overview
- The Board Should Reject Patent Owner's Results-Driven Claim Constructions
- All Claims Are Unpatentable Over Lyren and Reif
- Clement, Osman, and/or Sauk Render Claims Obvious

# Agenda

## Overview

The Board Should Reject Patent Owner's Results-Driven Claim Constructions

All Claims Are Unpatentable Over Lyren and Reif

Clement, Osman, and/or Sauk Render Claims Obvious

# Each of the Challenged Claims Is Invalid Because It Would Have Been Obvious

## Each of the Challenged Claims is Invalid in View of Lyren and Reif

- **Challenged Claims are not entitled to priority earlier their actual filing dates because the parent '140 Application fails to reasonably convey to possession of:**

1. Warning/alerting by reducing volume and/or altering binaural sound (**how to warn/alert**)
   - *All challenged claims, '179 and '184 patents*
2. Warning/alerting user is leaving [3D virtual] environment/ image in the environment (**when to warn/alert**)
   - *All challenged claims, '179 and '184 patents*
3. Determining/sensing with the WED/HMD, when the user is leaving the [3D virtual] environment
   - *All challenged claims, '179 patent only*

- **If not entitled to earlier priority date, <u>no dispute</u> that Lyren and Reif render the claims obvious**

## Clement, Osman, and/or Sauk Renders Claims 1, 3-4, 6-10, 14-19 Obvious

- **POSA would have been motivated to combine Clement and Osman with Sauk**
- **Even absent Sauk, Clement and Osman render claim 14 of the '179 patent obvious**

# Ground I

# Ground I:
# ’179 Patent, Claim 14

# '179 Patent, Claim 14

| | |
|---|---|
| **[14Pre]** | A method executed by one or more electronic devices, the method comprising: |
| **[14a]** | storing head-related transfer functions (HRTFs) in memory; |
| **[14b]** | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| **[14c]** | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| **[14d]** | determining, with the WED, when the user is leaving the environment; and |
| **[14e]** | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

# '179 Patent, Claim 14

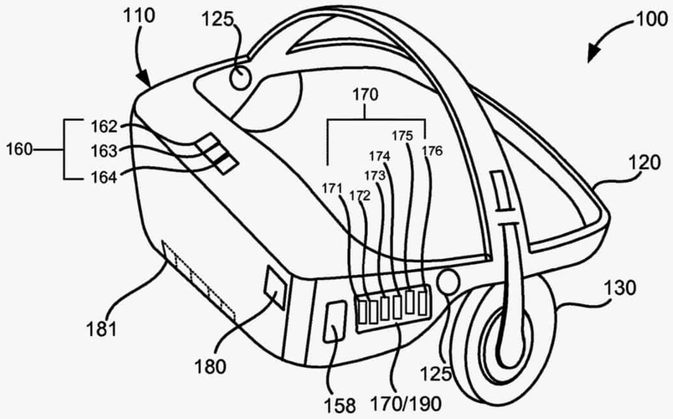
| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
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| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Clement

(57) **ABSTRACT**

A system and method of operating an audio visual system generating a virtual immersive experience may include an electronic user device in communication with a tracking device that may track a user's physical movement in a real world space and translate the tracked physical movement into corresponding movement in the virtual world generated by the user device. The system may detect when a user and the user device are approaching a boundary of a tracking area and automatically initiate a transition out of the virtual world and into the real world. A smooth, or graceful, transition between the virtual world and the real world as the user encounters this boundary may avoid disorientation which may occur as a user continues to move in the real world, while motion appears to have stopped upon reaching the tracking boundary.

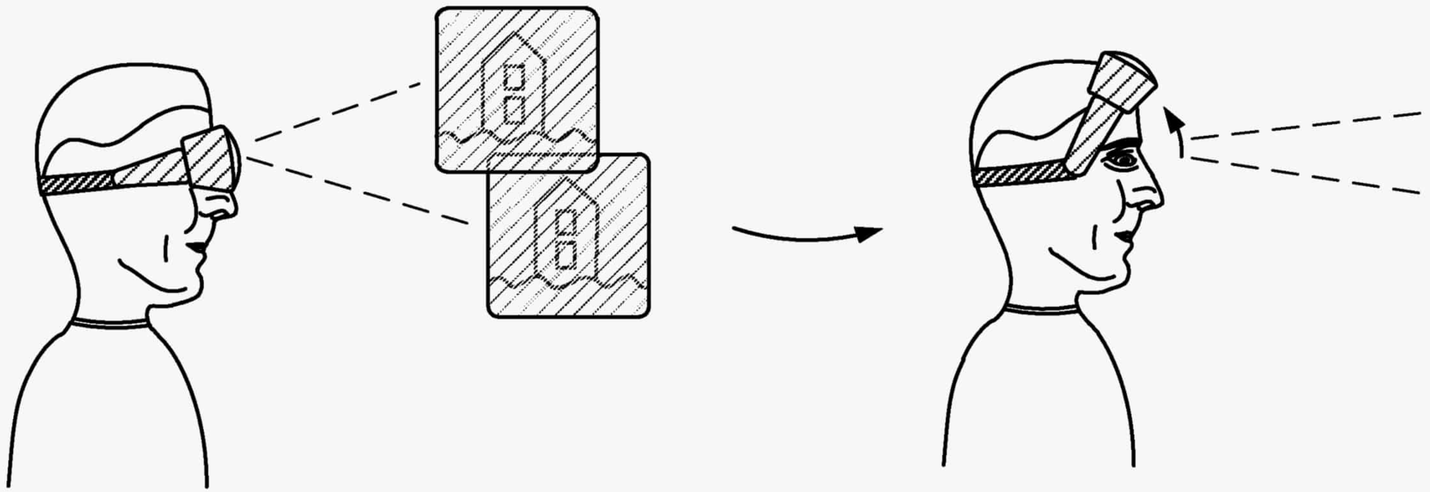
**Ex. 1005 (Clement) at Abstract**




**Ex. 1005 (Clement), Fig. 1A**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| **[14b]** | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |



Ex. 1005 (Clement), Fig. 9

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
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| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
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| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

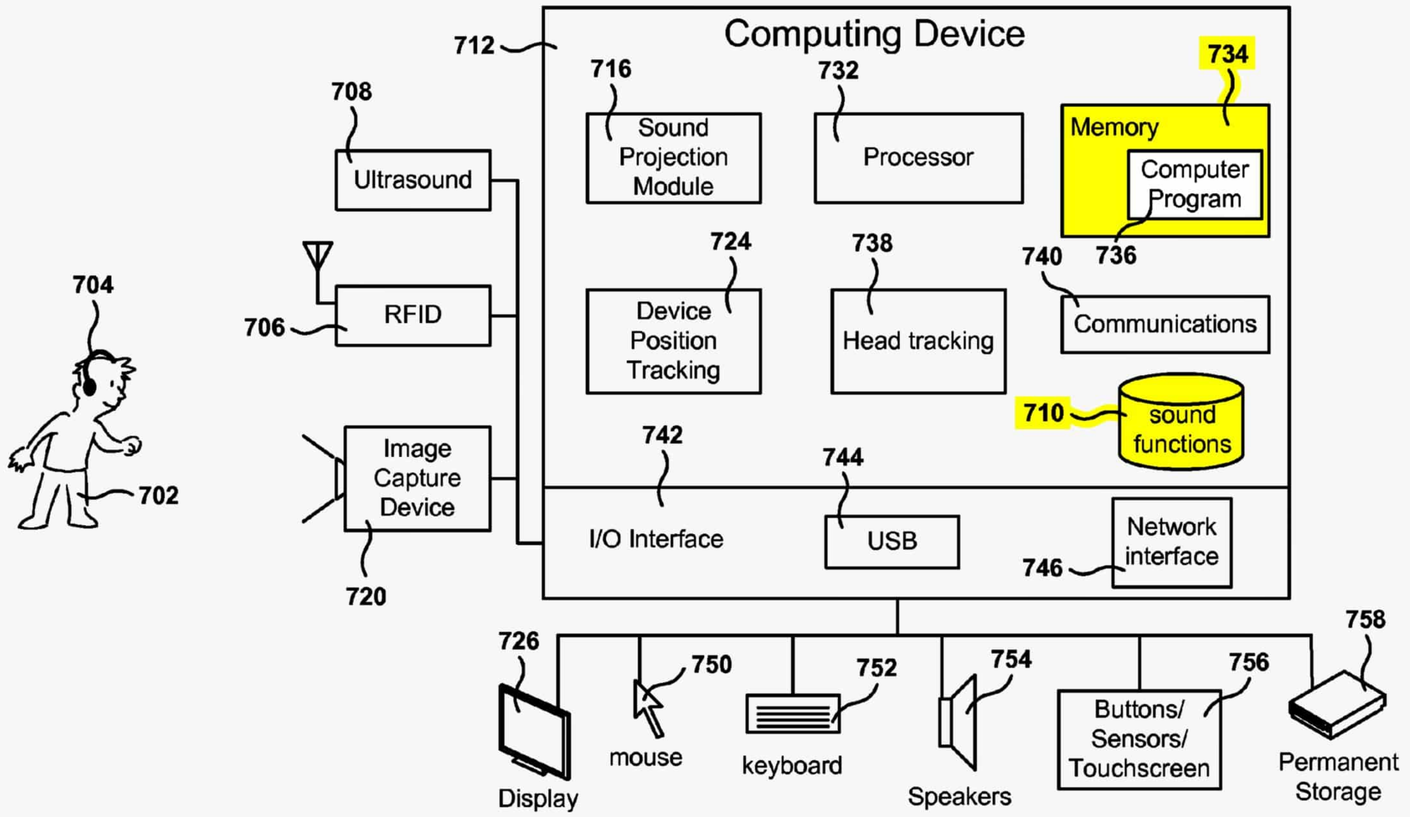
## Osman

Different people have different HRTF's, and the most compelling experience is delivered when that HRTF of the user is utilized. In one embodiment, a standard HRTF is utilized when the HRTF for the user is not available. The standard HRTF takes into account the average characteristics of a human being. Although the HRTF of the user is not utilized, the standard HRTF can still provide a realistic experience for the user. In addition, calibration methods can be utilized to further customize the sound localization experience for the particular user to develop an HRTF for the user.

Ex. 1006 (Osman) at 5:19-28

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |




Ex. 1006 (Osman), Fig. 7 (annotated)

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
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| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
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## Osman

Where s is the sound (e.g., a dog bark), l is the location where the sound is supposed to originate, and ls is the localized sound. One example of a sound localization function is a Head-Related Transfer Function (HRTF), which is a response that characterizes how an ear receives a sound from a point in space. A pair of HRTFs for the ears may be utilized to synthesize a binaural sound that seems to come from a particular point in space. The HRTF can also be described as the modifications to a sound from a direction in free air to the sound arriving at the eardrum. These modifications include the shape of the listener's outer ear, the shape of the listener's head and body, the acoustical characteristics of the space in which the sound is played, and so on. All these characteristics influence how a listener can accurately tell what direction a sound is coming from. Due to the physical differences of each person, each person has a different HRTF. Embodiments of the invention for sound localization are described using HRTF, but any other form of sound localization that accounts for the physical characteristics of a listener can be utilized with embodiments of the invention.

**Ex. 1006 (Osman) at 4:48-67**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

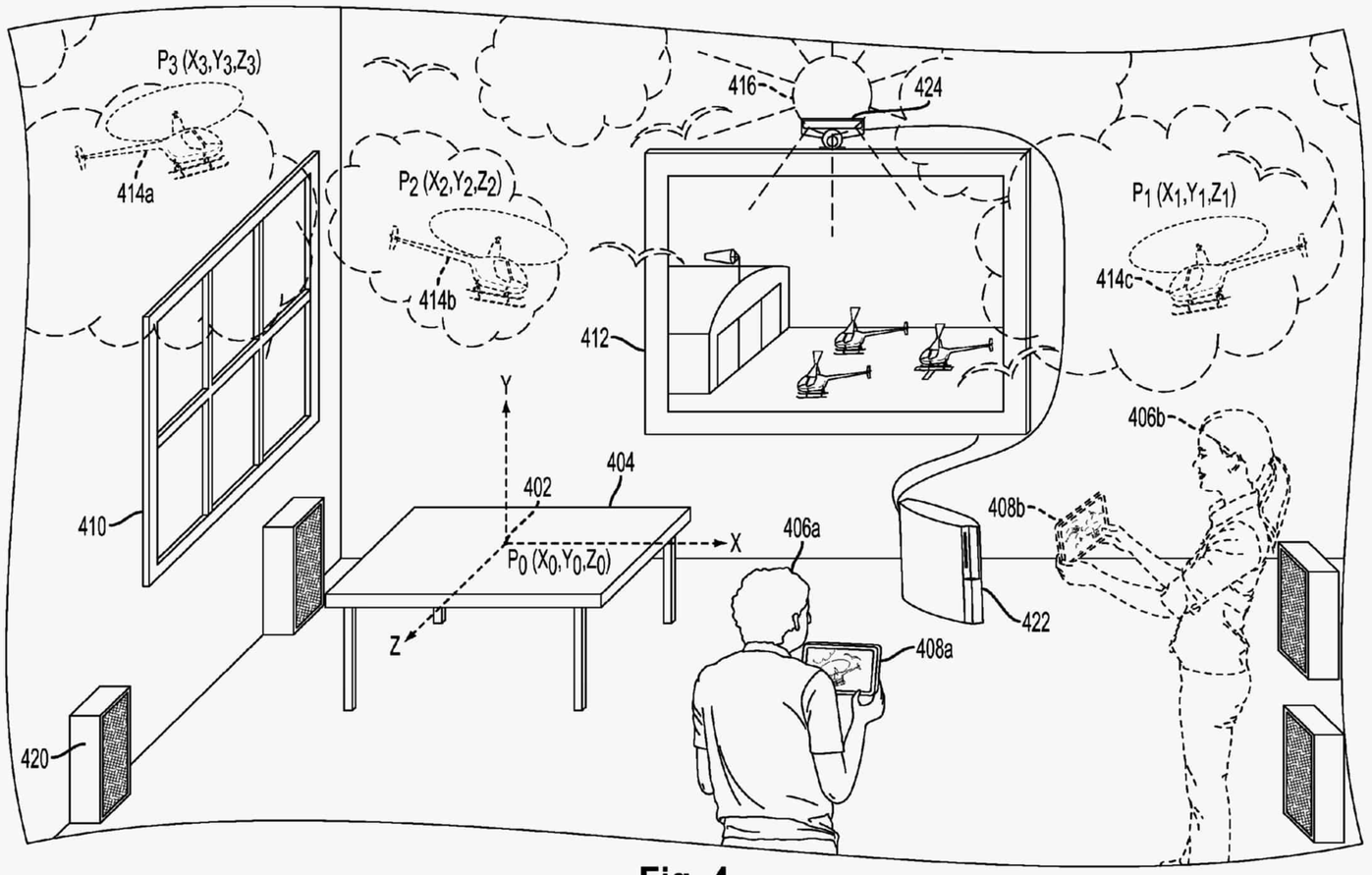



Fig. 4

Ex. 1006 (Osman), Fig. 4

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Declaration Of Dr. Roginska (Petitioner's Expert)

141. A POSA would have been motivated to use a DSP for processing spatialized audio. Using DSPs for this purpose was well-known. For example, a POSA understood that "[w]ithin a virtual reality or multimedia application, 3-D sound processing is almost always best accomplished digitally, using audio DSP chips to manipulate signal sources." Begault (Ex. 1038), 100. Begault describes a

**Ex. 1003 (Roginska Decl.) ¶ 141**

# '179 Patent, Claim 14

[14pre] A method executed by one or more electronic devices, the method comprising

[14a] storing head-related transfer functions (HRTFs) in memory;

[14b] displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

[14c] processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

**[14d]** determining, with the WED, when the user is leaving the environment; and

[14e] alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user.

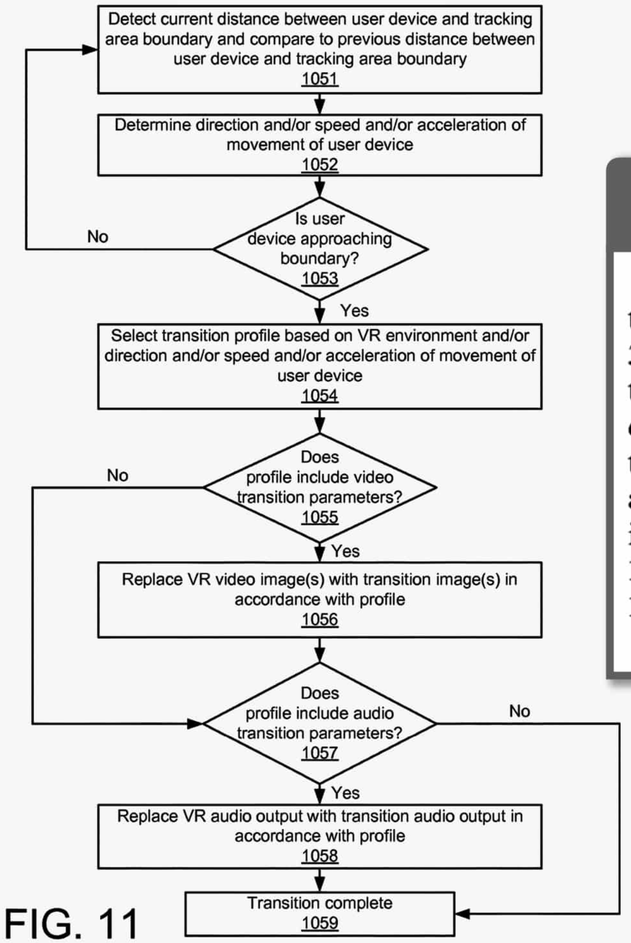



FIG. 11

**Ex. 1005 (Clement), Fig. 11**

## Clement

In the absence of a specific command to transition from the virtual world, the HMD **100** and/or the tracking device **310** may determine a current position of the user in the tracking area **320** at block **1030**, as described above. If it is determined, at block **1040**, that the user is within a set threshold or range of the boundary of the tracking area **320**, at which loss of tracking by the tracking device **310** may be imminent, the transition process may be initiated at block **1050**. The transition process is shown in more detail in FIG. **11**.

**Ex. 1005 (Clement) at 12:20-29**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Clement

In some embodiments, the transition may include a fade of sound content. For example, when transitioning from the virtual world to the real world, audio content associated with the virtual world may fade out, accompanied by a fade in of ambient sound. In some embodiments, the fade out of virtual audio content and the fade in of ambient sound may accompany the fade out of virtual images and the fade in of real world images. In some embodiments, the fade out of virtual audio content and the fade in of ambient sound may be accomplished serially, so that the ambient sound is not superimposed on, or output at the same time as, the virtual audio content.

**Ex. 1005 (Clement) at 9:20-31**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Declaration Of Dr. Roginska (Petitioner's Expert)

166. A POSA would have understood that the transition of Clement is lowering of the volume of the binaural sound, and this would warn the user that the user is leaving the virtual environment. In particular, this transition would have reduced the user's sense of immersion and presence in the environment and thus alert the user that the user is leaving the virtual environment.

**Ex. 1003 (Roginska Decl.) ¶ 166**

# Ground I: ’184 Patent, Claim 14

# '184 Patent, Claim 14

| | |
|---|---|
| [14Pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes to the user at the virtual image in the environment; and |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

# '184 Patent, Claim 14

**[14pre]** A method executed by one or more electronic devices, the method comprising:

**[14a]** storing head-related transfer functions (HRTFs);

**[14b]** displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

**[14c]** processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

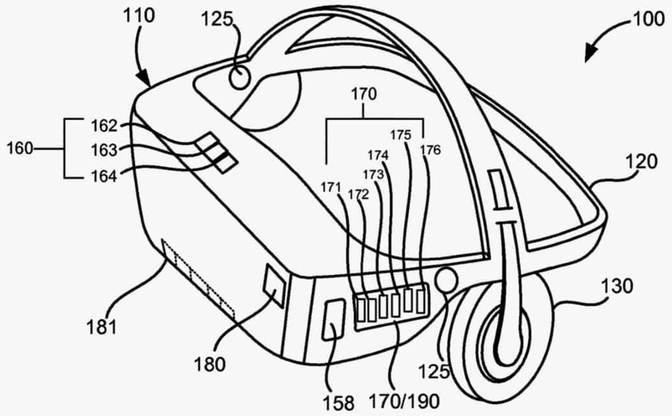
**[14d]** alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image.

## Clement

(57) **ABSTRACT**

A system and method of operating an audio visual system generating a virtual immersive experience may include an electronic user device in communication with a tracking device that may track a user's physical movement in a real world space and translate the tracked physical movement into corresponding movement in the virtual world generated by the user device. The system may detect when a user and the user device are approaching a boundary of a tracking area and automatically initiate a transition out of the virtual world and into the real world. A smooth, or graceful, transition between the virtual world and the real world as the user encounters this boundary may avoid disorientation which may occur as a user continues to move in the real world, while motion appears to have stopped upon reaching the tracking boundary.

**Ex. 1005 (Clement) at Abstract**




**Ex. 1005 (Clement), Fig. 1A**

# '184 Patent, Claim 14

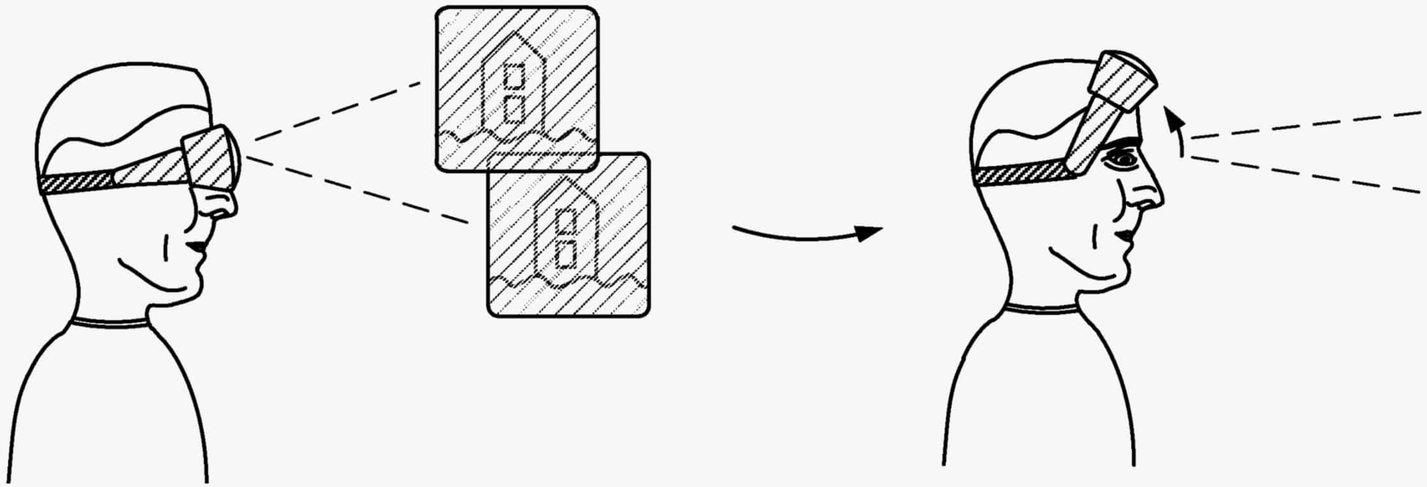
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[14a] storing head-related transfer functions (HRTFs);

**[14b]** displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

[14c] processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

[14d] alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image.



Ex. 1005 (Clement), Fig. 9

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
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| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Osman

Different people have different HRTF's, and the most compelling experience is delivered when that HRTF of the user is utilized. In one embodiment, a standard HRTF is utilized when the HRTF for the user is not available. The standard HRTF takes into account the average characteristics of a human being. Although the HRTF of the user is not utilized, the standard HRTF can still provide a realistic experience for the user. In addition, calibration methods can be utilized to further customize the sound localization experience for the particular user to develop an HRTF for the user.

**Ex. 1006 (Osman) at 5:19-28**

# '184 Patent, Claim 14

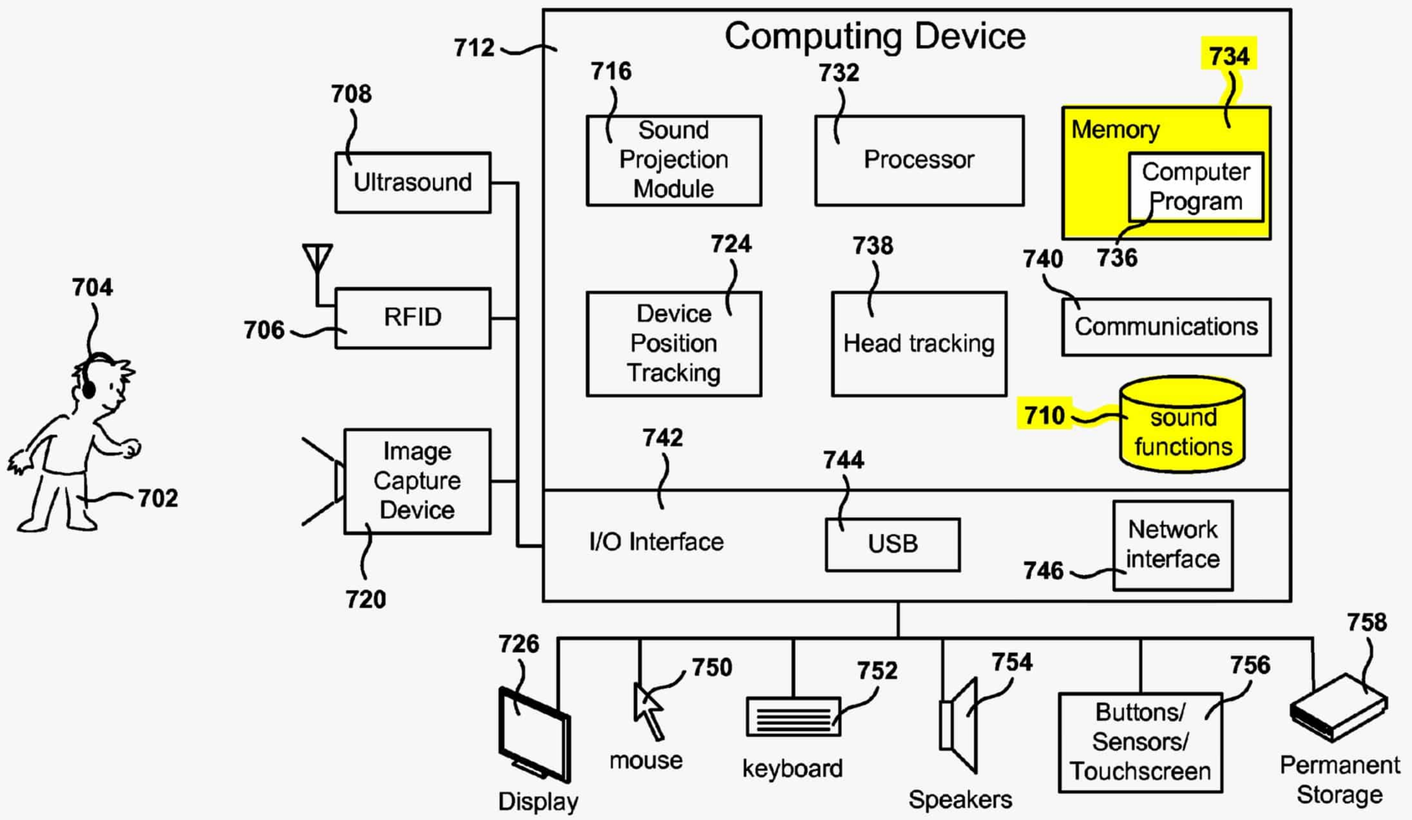
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[14b] displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

[14c] processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

[14d] alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image.




Ex. 1006 (Osman), Fig. 7 (annotated)

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
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## Osman

Where s is the sound (e.g., a dog bark), l is the location where the sound is supposed to originate, and ls is the localized sound. One example of a sound localization function is a Head-Related Transfer Function (HRTF), which is a response that characterizes how an ear receives a sound from a point in space. A pair of HRTFs for the ears may be utilized to synthesize a binaural sound that seems to come from a particular point in space. The HRTF can also be described as the modifications to a sound from a direction in free air to the sound arriving at the eardrum. These modifications include the shape of the listener's outer ear, the shape of the listener's head and body, the acoustical characteristics of the space in which the sound is played, and so on. All these characteristics influence how a listener can accurately tell what direction a sound is coming from. Due to the physical differences of each person, each person has a different HRTF. Embodiments of the invention for sound localization are described using HRTF, but any other form of sound localization that accounts for the physical characteristics of a listener can be utilized with embodiments of the invention.

**Ex. 1006 (Osman) at 4:48-67**

# '184 Patent, Claim 14

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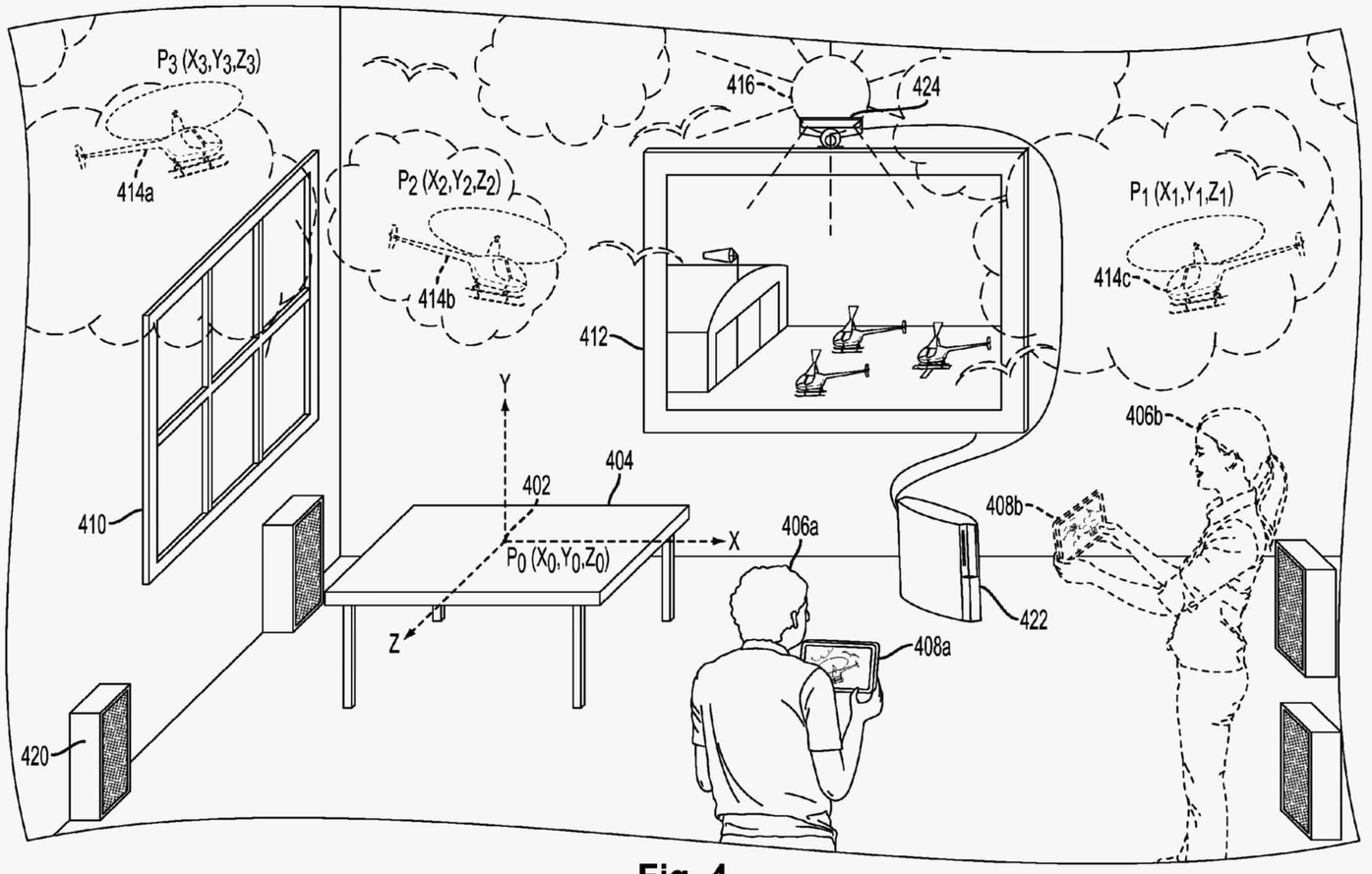



Fig. 4

Ex. 1006 (Osman), Fig. 4

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
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## Declaration Of Dr. Roginska (Petitioner's Expert)

141. A POSA would have been motivated to use a DSP for processing spatialized audio. Using DSPs for this purpose was well-known. For example, a POSA understood that "[w]ithin a virtual reality or multimedia application, 3-D sound processing is almost always best accomplished digitally, using audio DSP chips to manipulate signal sources." Begault (Ex. 1038), 100. Begault describes a

**Ex. 1003 (Roginska Decl.) ¶ 141**

# '184 Patent, Claim 14

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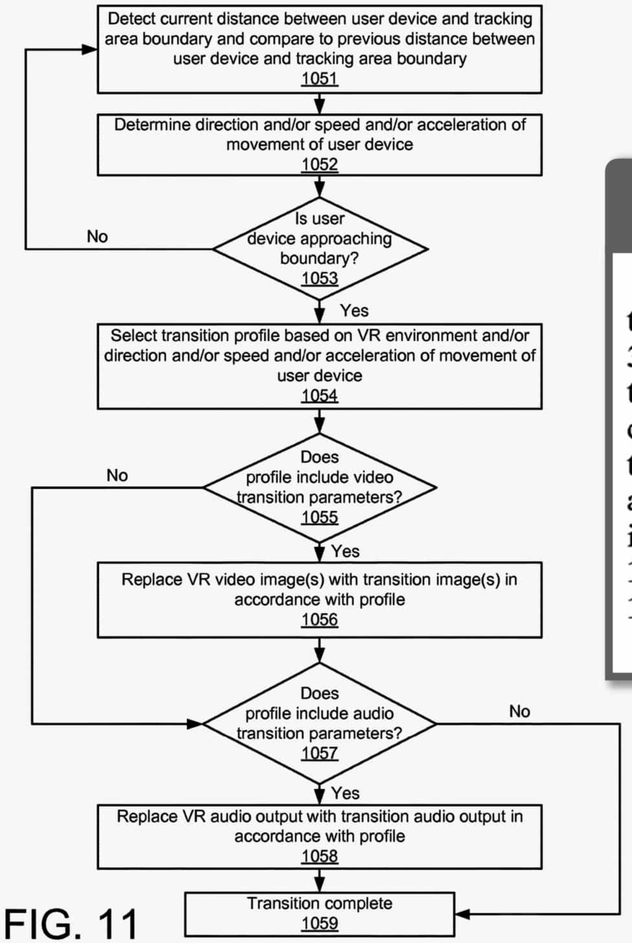



FIG. 11

**Ex. 1005 (Clement), Fig. 11**

## Clement

In the absence of a specific command to transition from the virtual world, the HMD **100** and/or the tracking device **310** may determine a current position of the user in the tracking area **320** at block **1030**, as described above. If it is determined, at block **1040**, that the user is within a set threshold or range of the boundary of the tracking area **320**, at which loss of tracking by the tracking device **310** may be imminent, the transition process may be initiated at block **1050**. The transition process is shown in more detail in FIG. **11**.

**Ex. 1005 (Clement) at 12:20-29**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Clement

In some embodiments, the transition may include a fade of sound content. For example, when transitioning from the virtual world to the real world, audio content associated with the virtual world may fade out, accompanied by a fade in of ambient sound. In some embodiments, the fade out of virtual audio content and the fade in of ambient sound may accompany the fade out of virtual images and the fade in of real world images. In some embodiments, the fade out of virtual audio content and the fade in of ambient sound may be accomplished serially, so that the ambient sound is not superimposed on, or output at the same time as, the virtual audio content.

**Ex. 1005 (Clement) at 9:20-31**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

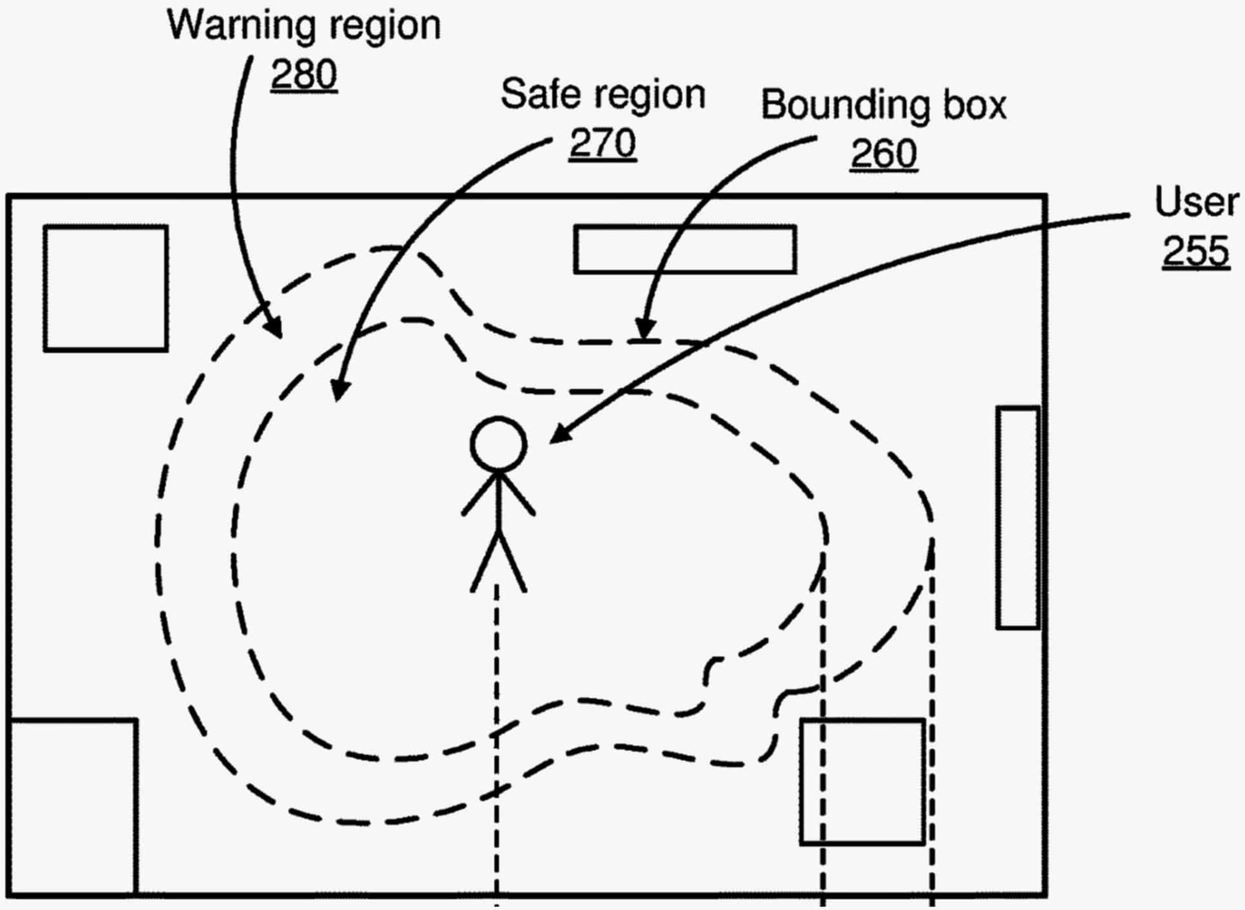
## Declaration Of Dr. Roginska (Petitioner's Expert)

166. A POSA would have understood that the transition of Clement is lowering of the volume of the binaural sound, and this would warn the user that the user is leaving the virtual environment. In particular, this transition would have reduced the user's sense of immersion and presence in the environment and thus alert the user that the user is leaving the virtual environment.

**Ex. 1003 (Roginska Decl.) ¶ 166**

# Ground II

# Motivation to Combine: Lyren and Reif




Ex. 1009 (Reif), Fig. 2C



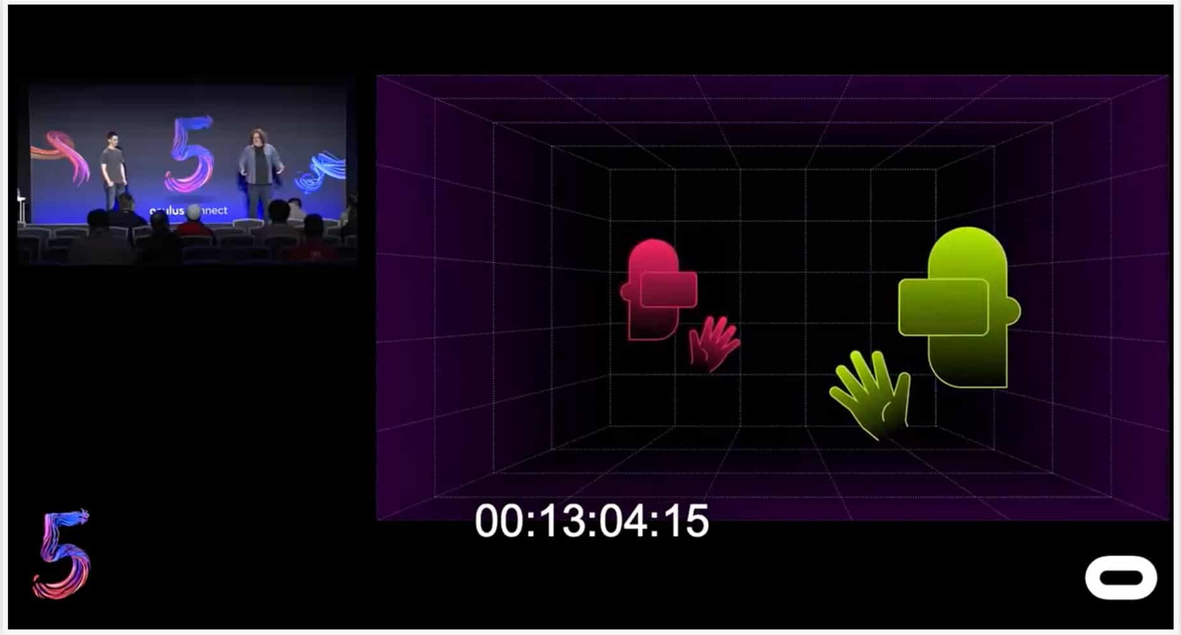
Ex. 1084 at 9

# Motivation to Combine: Lyren and Reif

## Petitioner's Expert, Dr. Roginska, Declaration

Also, there is a Guardian built in, but some experiences are going to have a smaller play space. Bogo had a small play space, so we needed some way to warn the player that you were leaving this play space, so there's loud parts and soft parts in the experience. We were thinking, well, if we put sounds on it, if we put a loud sound on, let's say during the fireworks part, that's sound is going to be way too loud during the soft parts. If we put a soft sound that sits over here, you're not going to hear it in the fireworks part. So we're just like, hmm, you know what we could do, we'll just try the absence of sound. We did a low-pass filter that ramps nice and smooth, so it's not jarring to the player, because you still want to keep everybody immersed, just let them know that they're, you know, about to step out of the play area.

**Ex. 1003 (Roginska Decl.) ¶ 262 (quoting Ex. 1085, 13:00-14:40)**




**Ex. 1085, 13:00-14:40**

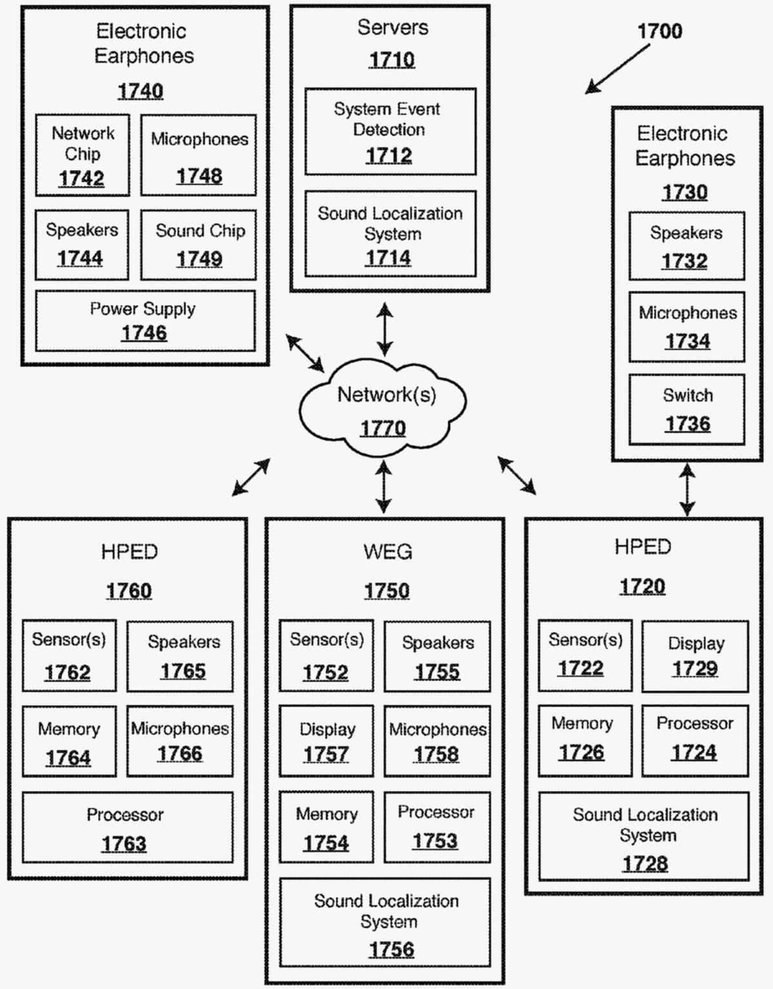
# Ground II:
# ’179 Patent, Claim 14

# '179 Patent, Claim 14

| | |
|---|---|
| [14Pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |




Ex. 1008 (Lyren), Fig. 17

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0077]** A SLP in empty space can include images or video (e.g., images that are part of an augmented or virtual reality). Consider an example in which Alice wears electronic glasses with a see-thru display, OHMD, or a head-mounted display. During a call with Bob, the system localizes a voice of Bob to a SLP in empty space that is proximate to but away from Alice. The electronic glasses or head-mounted display provides or displays an image of Bob that coincides with the SLP in empty space. The image appears to exist in space at the location in empty space with the SLP that is proximate to but away from Alice. Thus, the SLP of Bob's voice and the image of Bob exist in empty space at the same location that is proximate to but away from Alice. To Alice, the voice of Bob appears to emanate from the image of Bob.

**Ex. 1008 (Lyren) at [0077]**

## Lyren Patent Application

**[0164]** Consider an example in which Alice and Bob are both in a 3D visually rendered space talking binaurally face-to-face in full-duplex with each person in a medial plane of the other. Because they can see each other's visual representation, they experience accurate sound localization of each other's voices. Soon Alice turns off her display and is left with only the binaural audial experience of their talk (i.e., Bob's SLP no longer has an accompanying visual image). Due to the lack of a visual cue, Alice cannot accurately locate the SLP of Bob's voice. The system detects that her screen is off, knows Bob's SLP is in her medial plane, and knows she has no head tracking hardware. The system makes a verbal announcement to Alice ("Adjusting localization") and moves Bob's SLP to a predetermined position that Alice has chosen for all communications with no visual image. Alice is familiar with where this location is and looks to Bob's SLP as she continues the conversation with Bob.

**Ex. 1008 (Lyren) at [0164]**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Reif Patent Application

(57) **ABSTRACT**

A virtual reality (VR) system identifies a bounding box including a safe region. The bounding box encloses an area that allows a user wearing a head mounted display (HMD) to safely view content of a virtual world. The VR system identifies the user's location relative to the bounding box and tracks the user's location. When it is determined that the user is located outside the safe region of the bounding box, the VR system can modify what is presented to the user via the HMD, can warn the user, and/or can suggest that the user move back to the safe region.

**Ex. 1009 (Reif) at Abstract**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0256]** Consider the example above in which Alice wears electronic earphones **1730** that wired or wirelessly couple to HPED **1720** while she communicates via a VoIP call with Bob who wears electronic earphones **1740**. Bob's earphones **1740** capture Bob's voices as binaural sound, and the sound chip **1749** converts this sound from analog to digital. The network chip **1742** wirelessly transmits his binaural audio stream to Alice's HPED **1720** via network **1770**. Sound localization system **1728** includes or is in communication with a digital-to-audio converter (DAC), decompressor/decoder, digital signal processor (DSP), and includes hardware and/or software to process and localize sound to a SLP. Memory **1726** and/or dedicated memory in the SLS **1728** stores one or more of Alice's and/or Bob's location, position, head orientation, background noise, environmental conditions, HRTFs, gaze or head tracking offset vectors, access control lists, default listening modes, preferred listening modes, current physical activity, current network state, device hardware and software capabilities, current running processes, availability of resources, and other data. This data can convert Bob's digital stream into localized sound and/or play direct sound that the system has prepared on his behalf that Alice hears at the SLP that is away from but proximate to Alice. Speakers **1732** (located in or near Alice's ear) produce Bob's voice that localizes at the SLP.

**Ex. 1008 (Lyren) at [0256]**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0046]** Another way of changing a sound from being perceived as binaurally captured audio or binaurally manufactured audio to being perceived as non-binaural audio is to render the original source with different spatial parameters or to re-render a sound source with different spatial parameters in order to adjust, degrade, or eliminate certain human audio cues. For example, a SLS renders a source sound using an HRTF to adjust SLPs, renders the sound source to specific alterations per an ITD and/or interaural level difference (ILD), or discontinues rendering or using the HRTF or ITD/ILD calculations while continuing to render other aspects of the audio without pause. As another example, a SLS continues rendering, without pause, and sets the spatial coordinates of any or all SLPs to points within a radius of a head of a listener or to points within a cone of confusion of a listener, in his medial plane, or directly above his head. As another example, the parameters of a rendering process can be set to "zero out" one or more dimension's coordinates input to the rendering algorithm in order to fatten the output by one or more dimensions.

**Ex. 1008 (Lyren) at [0046]**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0256]** Consider the example above in which Alice wears electronic earphones **1730** that wired or wirelessly couple to HPED **1720** while she communicates via a VoIP call with Bob who wears electronic earphones **1740**. Bob's earphones **1740** capture Bob's voices as binaural sound, and the sound chip **1749** converts this sound from analog to digital. The network chip **1742** wirelessly transmits his binaural audio stream to Alice's HPED **1720** via network **1770**. Sound localization system **1728** includes or is in communication with a digital-to-audio converter (DAC), decompressor/decoder, digital signal processor (DSP), and includes hardware and/or software to process and localize sound to a SLP. Memory **1726** and/or dedicated memory in the SLS **1728** stores one or more of Alice's and/or Bob's location, position, head orientation, background noise, environmental conditions, HRTFs, gaze or head tracking offset vectors, access control lists, default listening modes, preferred listening modes, current physical activity, current network state, device hardware and software capabilities, current running processes, availability of resources, and other data. This data can convert Bob's digital stream into localized sound and/or play direct sound that the system has prepared on his behalf that Alice hears at the SLP that is away from but proximate to Alice. Speakers **1732** (located in or near Alice's ear) produce Bob's voice that localizes at the SLP.

**Ex. 1008 (Lyren) at [0256]**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0077]** A SLP in empty space can include images or video (e.g., images that are part of an augmented or virtual reality). Consider an example in which Alice wears electronic glasses with a see-thru display, OHMD, or a head-mounted display. During a call with Bob, the system localizes a voice of Bob to a SLP in empty space that is proximate to but away from Alice. The electronic glasses or head-mounted display provides or displays an image of Bob that coincides with the SLP in empty space. The image appears to exist in space at the location in empty space with the SLP that is proximate to but away from Alice. Thus, the SLP of Bob's voice and the image of Bob exist in empty space at the same location that is proximate to but away from Alice. To Alice, the voice of Bob appears to emanate from the image of Bob.

Ex. 1008 (Lyren) at [0077]

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Reif Patent Application

(57) **ABSTRACT**

A virtual reality (VR) system identifies a bounding box including a safe region. The bounding box encloses an area that allows a user wearing a head mounted display (HMD) to safely view content of a virtual world. The VR system identifies the user's location relative to the bounding box and tracks the user's location. When it is determined that the user is located outside the safe region of the bounding box, the VR system can modify what is presented to the user via the HMD, can warn the user, and/or can suggest that the user move back to the safe region.

Ex. 1009 (Reif) at Abstract

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| **[14d]** | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Reif Patent Application

**[0017]** In some implementations, the bounding box can encompass or include another set of one or more boundaries that define an exterior border of a warning region. This other set of one or more boundaries defining the exterior border of the warning region can be larger than or outside of the former set of one or more boundaries defining the safe region. The warning region, as used herein, can refer to a portion inside the other set of one or more boundaries, but outside the former set of one or more boundaries defining the safe region. In some cases, when the VR system **300** determines that the location of the user wearing the HMD **150** is within the warning region, the VR system **300** can modify what is displayed to the user such that the user is presented with a combination or mixture of the virtual scene and the real-world scene. For instance, as the user initially

Ex. 1009 (Reif) at [0017]

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Reif Patent Application

**[0033]** Moreover, the location module **330** can be configured to facilitate determining a location of a user of the VR system **300**. In some cases, the determined location of the user can be relative to a virtual environment provided to the user by the VR system **300**. For instance, the location of the user can be relative to the bounding box within the virtual environment. In some embodiments, the location module **330** can utilize location data provided via the HMD **150** to determine the location of the user. In one example, the HMD **150** can transmit real-time location data to (the location module **330** of) the VR system **300** such that the user's location can be determined based on the real-time location data. In this example, the HMD **150** can transmit infrared data, Wi-Fi data, gyroscopic data, accelerometer data, Bluetooth data, and/or other wireless or wired signals, etc., to the VR system **300** in order to facilitate determining the location of the HMD **150**, which can correspond to the location of the user wearing the HMD **150**. Furthermore, in some implementations, the location module **330** can determine the location of the user based on acquiring information from at least one input component **120**. In one instance, a camera installed at the HMD **150** can capture image data representing the real-world environment. Based on such image data representing the real-world environment, the location module **330** can calculate the location of the user relative to the real-world environment, and thus can calculate the location of the user relative to the bounding box. In another instance, one or more cameras not installed at the HMD **150** but present in the real-world environment can capture image data that includes a representation of at least a portion of the user. Based on such image data including the representation of at least the portion of the user, the location module **330** can calculate the location of the user relative to the real-world environment (e.g., background) and/or relative to the bounding box. Again, many variations are possible.

**Ex. 1009 (Reif) at [0033]**

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Reif Patent Application

**[0039]** Furthermore, in some embodiments, when the location module **330** determines that the location of the user is outside at least the first set of one or more boundaries for the safe region, the notification module **350** can generate and/or provide an indication to the user that the location of the user is outside at least the first set of one or more boundaries for the safe region. For example, the notification module **350** can generate a notification to be displayed via the HMD **150** in attempt to inform the user about his/her current location. In some cases, the indication provided by the notification module **350** can include at least one of a visual indication, an audio indication, or a haptic indication. For example, the visual indication can correspond to a text message or a visual animation, the audio indication can include a warning beep or a voice message, and the haptic indication can include a vibration. Again, it should be appreciated that many variations are possible.

Ex. 1009 (Reif) at [0039]

# '179 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising |
| [14a] | storing head-related transfer functions (HRTFs) in memory; |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | determining, with the WED, when the user is leaving the environment; and |
| [14e] | alerting the user that the user is leaving the environment by reducing a volume of the binaural sound that localizes from the virtual image and that is being provided to the user. |

## Lyren Patent Application

**[0103]** In FIGS. **4-16**, example actions include, but are not limited to, one or more of switch the sound from binaural sound to stereo sound, switch the sound from binaural sound to mono sound, switch the sound from stereo sound to binaural sound, switch the sound from mono sound to binaural sound, maintain binaural sound but alter the binaural sound, stop binaural sound, discontinue playing sound, mute the sound, lower a volume of the sound, raise a volume of the sound, "cancel-out" or quiet a sound or part of a sound by processing it with Active Noise Control (ANC), provide a sound or audio alert, provide a visual alert, move one or more SLPs, adjust or alter a SLP, cancel a SLP, replace a

Ex. 1008 (Lyren) at [0103]

# Ground II:
# ’184 Patent, Claim 14

# '184 Patent, Claim 14

| | |
|---|---|
| [14Pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes to the user at the virtual image in the environment; and |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

# '184 Patent, Claim 14

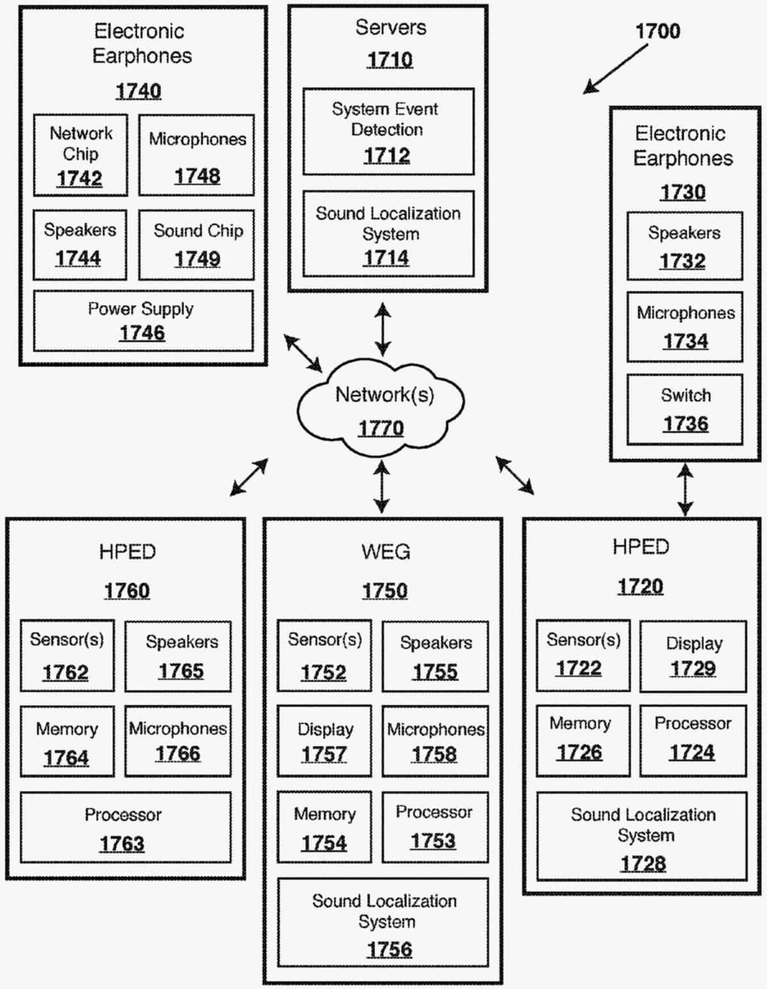
**[14pre]** A method executed by one or more electronic devices, the method comprising:

**[14a]** storing head-related transfer functions (HRTFs);

**[14b]** displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

**[14c]** processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

**[14d]** alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image.




**Ex. 1008 (Lyren), Fig. 17**

# '184 Patent, Claim 14

[14pre] A method executed by one or more electronic devices, the method comprising:

[14a] storing head-related transfer functions (HRTFs);

[14b] displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

[14c] processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment;

[14d] alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image.

## Lyren Patent Application

**[0077]** A SLP in empty space can include images or video (e.g., images that are part of an augmented or virtual reality). Consider an example in which Alice wears electronic glasses with a see-thru display, OHMD, or a head-mounted display. During a call with Bob, the system localizes a voice of Bob to a SLP in empty space that is proximate to but away from Alice. The electronic glasses or head-mounted display provides or displays an image of Bob that coincides with the SLP in empty space. The image appears to exist in space at the location in empty space with the SLP that is proximate to but away from Alice. Thus, the SLP of Bob's voice and the image of Bob exist in empty space at the same location that is proximate to but away from Alice. To Alice, the voice of Bob appears to emanate from the image of Bob.

**Ex. 1008 (Lyren) at [0077]**

## Lyren Patent Application

**[0164]** Consider an example in which Alice and Bob are both in a 3D visually rendered space talking binaurally face-to-face in full-duplex with each person in a medial plane of the other. Because they can see each other's visual representation, they experience accurate sound localization of each other's voices. Soon Alice turns off her display and is left with only the binaural audial experience of their talk (i.e., Bob's SLP no longer has an accompanying visual image). Due to the lack of a visual cue, Alice cannot accurately locate the SLP of Bob's voice. The system detects that her screen is off, knows Bob's SLP is in her medial plane, and knows she has no head tracking hardware. The system makes a verbal announcement to Alice ("Adjusting localization") and moves Bob's SLP to a predetermined position that Alice has chosen for all communications with no visual image. Alice is familiar with where this location is and looks to Bob's SLP as she continues the conversation with Bob.

**Ex. 1008 (Lyren) at [0164]**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Reif Patent Application

(57) **ABSTRACT**

A virtual reality (VR) system identifies a bounding box including a safe region. The bounding box encloses an area that allows a user wearing a head mounted display (HMD) to safely view content of a virtual world. The VR system identifies the user's location relative to the bounding box and tracks the user's location. When it is determined that the user is located outside the safe region of the bounding box, the VR system can modify what is presented to the user via the HMD, can warn the user, and/or can suggest that the user move back to the safe region.

**Ex. 1009 (Reif) at Abstract**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Lyren Patent Application

**[0256]** Consider the example above in which Alice wears electronic earphones **1730** that wired or wirelessly couple to HPED **1720** while she communicates via a VoIP call with Bob who wears electronic earphones **1740**. Bob's earphones **1740** capture Bob's voices as binaural sound, and the sound chip **1749** converts this sound from analog to digital. The network chip **1742** wirelessly transmits his binaural audio stream to Alice's HPED **1720** via network **1770**. Sound localization system **1728** includes or is in communication with a digital-to-audio converter (DAC), decompressor/decoder, digital signal processor (DSP), and includes hardware and/or software to process and localize sound to a SLP. Memory **1726** and/or dedicated memory in the SLS **1728** stores one or more of Alice's and/or Bob's location, position, head orientation, background noise, environmental conditions, HRTFs, gaze or head tracking offset vectors, access control lists, default listening modes, preferred listening modes, current physical activity, current network state, device hardware and software capabilities, current running processes, availability of resources, and other data. This data can convert Bob's digital stream into localized sound and/or play direct sound that the system has prepared on his behalf that Alice hears at the SLP that is away from but proximate to Alice. Speakers **1732** (located in or near Alice's ear) produce Bob's voice that localizes at the SLP.

**Ex. 1008 (Lyren) at [0256]**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Lyren Patent Application

**[0046]** Another way of changing a sound from being perceived as binaurally captured audio or binaurally manufactured audio to being perceived as non-binaural audio is to render the original source with different spatial parameters or to re-render a sound source with different spatial parameters in order to adjust, degrade, or eliminate certain human audio cues. For example, a SLS renders a source sound using an HRTF to adjust SLPs, renders the sound source to specific alterations per an ITD and/or interaural level difference (ILD), or discontinues rendering or using the HRTF or ITD/ILD calculations while continuing to render other aspects of the audio without pause. As another example, a SLS continues rendering, without pause, and sets the spatial coordinates of any or all SLPs to points within a radius of a head of a listener or to points within a cone of confusion of a listener, in his medial plane, or directly above his head. As another example, the parameters of a rendering process can be set to "zero out" one or more dimension's coordinates input to the rendering algorithm in order to fatten the output by one or more dimensions.

**Ex. 1008 (Lyren) at [0046]**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Lyren Patent Application

**[0256]** Consider the example above in which Alice wears electronic earphones **1730** that wired or wirelessly couple to HPED **1720** while she communicates via a VoIP call with Bob who wears electronic earphones **1740**. Bob's earphones **1740** capture Bob's voices as binaural sound, and the sound chip **1749** converts this sound from analog to digital. The network chip **1742** wirelessly transmits his binaural audio stream to Alice's HPED **1720** via network **1770**. Sound localization system **1728** includes or is in communication with a digital-to-audio converter (DAC), decompressor/decoder, digital signal processor (DSP), and includes hardware and/or software to process and localize sound to a SLP. Memory **1726** and/or dedicated memory in the SLS **1728** stores one or more of Alice's and/or Bob's location, position, head orientation, background noise, environmental conditions, HRTFs, gaze or head tracking offset vectors, access control lists, default listening modes, preferred listening modes, current physical activity, current network state, device hardware and software capabilities, current running processes, availability of resources, and other data. This data can convert Bob's digital stream into localized sound and/or play direct sound that the system has prepared on his behalf that Alice hears at the SLP that is away from but proximate to Alice. Speakers **1732** (located in or near Alice's ear) produce Bob's voice that localizes at the SLP.

**Ex. 1008 (Lyren) at [0256]**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Lyren Patent Application

**[0077]** A SLP in empty space can include images or video (e.g., images that are part of an augmented or virtual reality). Consider an example in which Alice wears electronic glasses with a see-thru display, OHMD, or a head-mounted display. During a call with Bob, the system localizes a voice of Bob to a SLP in empty space that is proximate to but away from Alice. The electronic glasses or head-mounted display provides or displays an image of Bob that coincides with the SLP in empty space. The image appears to exist in space at the location in empty space with the SLP that is proximate to but away from Alice. Thus, the SLP of Bob's voice and the image of Bob exist in empty space at the same location that is proximate to but away from Alice. To Alice, the voice of Bob appears to emanate from the image of Bob.

**Ex. 1008 (Lyren) at [0077]**

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Lyren Patent Application

**[0103]** In FIGS. **4-16**, example actions include, but are not limited to, one or more of switch the sound from binaural sound to stereo sound, switch the sound from binaural sound to mono sound, switch the sound from stereo sound to binaural sound, switch the sound from mono sound to binaural sound, maintain binaural sound but alter the binaural sound, stop binaural sound, discontinue playing sound, mute the sound, lower a volume of the sound, raise a volume of the sound, "cancel-out" or quiet a sound or part of a sound by processing it with Active Noise Control (ANC), provide a sound or audio alert, provide a visual alert, move one or more SLPs, adjust or alter a SLP, cancel a SLP, replace a

Ex. 1008 (Lyren) at [0103]

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Reif Patent Application

(57) **ABSTRACT**

A virtual reality (VR) system identifies a bounding box including a safe region. The bounding box encloses an area that allows a user wearing a head mounted display (HMD) to safely view content of a virtual world. The VR system identifies the user's location relative to the bounding box and tracks the user's location. When it is determined that the user is located outside the safe region of the bounding box, the VR system can modify what is presented to the user via the HMD, can warn the user, and/or can suggest that the user move back to the safe region.

Ex. 1009 (Reif) at Abstract

# '184 Patent, Claim 14

| | |
|---|---|
| [14pre] | A method executed by one or more electronic devices, the method comprising: |
| [14a] | storing head-related transfer functions (HRTFs); |
| [14b] | displaying, with a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment; |
| [14c] | processing, by a digital signal processor (DSP), sound with the HRTFs to generate binaural sound that externally localizes in empty space from the virtual image in the environment; |
| [14d] | alerting the user that the user is leaving the virtual image in the environment by altering processing of the binaural sound by the DSP and reducing a volume of the binaural sound that localizes to the user at the virtual image. |

## Reif Patent Application

**[0039]** Furthermore, in some embodiments, when the location module **330** determines that the location of the user is outside at least the first set of one or more boundaries for the safe region, the notification module **350** can generate and/or provide an indication to the user that the location of the user is outside at least the first set of one or more boundaries for the safe region. For example, the notification module **350** can generate a notification to be displayed via the HMD **150** in attempt to inform the user about his/her current location. In some cases, the indication provided by the notification module **350** can include at least one of a visual indication, an audio indication, or a haptic indication. For example, the visual indication can correspond to a text message or a visual animation, the audio indication can include a warning beep or a voice message, and the haptic indication can include a vibration. Again, it should be appreciated that many variations are possible.

Ex. 1009 (Reif) at [0039]

# Agenda

Overview

**The Board Should Reject Patent Owner's Results-Driven Claim Constructions**

- **"Environment" is Not Limited to a Physical Environment**
- **"3D Virtual Environment" Cannot Be Sound-Only**
- **"Determining, With the WED, When the User is Leaving the Environment" Does Not Require Independently Determining**

All Claims Are Unpatentable Over Lyren and Reif

Clement, Osman, and/or Sauk Render Claims Obvious

# The Board Should Reject Patent Owner's Results-Oriented Constructions

| Claim Term | Patent Owner's Proposed Construction | Claims |
|---|---|---|
| environment | "physical surroundings in which a user operates" | '179 patent: cls. 7-20<br>'184 patent: cls. 7-20 |
| 3D virtual environment | "three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound" | '179 patent: cls. 1-6<br>'184 patent: cls. 1-6 |
| determining, with the WED, when the user is leaving the environment | "determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment" | '179 patent: cls. 1-20 |

# The Board Should Reject Patent Owner's Results-Oriented Constructions

1 "Environment" is Not Limited to a Physical Environment

2 "3D Virtual Environment" Cannot Be Sound-Only

3 "Determining, With the WED, When the User is Leaving the Environment" Does Not Require Independently Determining

# Specification Makes Clear "Environment" Can Be Physical or Virtual

## Patent Owner Response

**A. "Environment"**

The term "environment" in independent claims 7 and 14 and associated dependent claims should be construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, to mean "physical surroundings in which a user operates."

**IPR2023-01019, POR at 8; *see also* IPR2023-01020, POR at 6**

## '179 Patent

Among other things, events can be triggered by changes in a user's or a remote user's network conditions, system resources, hardware, software, operating system notifications, the passage of time, the granting or denial of various resource and/or file permissions, a change in the ability to detect motion and/or object location and/or orientation and/or position in a physical or a virtual environment, or a change in the ability to detect an environment, its shape, acoustic properties, or noise level. Events are also triggered according to one or more audio cues detected in a user's or a remote user's physical or virtual environment such as cues indicating a location, position, or orientation, or a change in them, cues indicating a reference frame of a user or a remote user, a lateral or vertical motion, a change in distance, a change in a physical or a virtual environment such as its shape, acoustic properties, noise level, or placement of objects or structures in the environment. Events can also be triggered by a change in the spatial or positional congruency between shapes or things within multiple physical or virtual environments, or by a request from a user or a remote user or their application software, operating system, or hardware.

**Ex. 1001 ('179 Patent) at 28:9-30;**
***see also* Ex. 1001 ('184 Patent) at 28:9-30**

# Claim Language Makes Clear "Environment" Can Be Physical or Virtual

## Patent Owner Response

**A. "Environment"**

The term "environment" in independent claims 7 and 14 and associated dependent claims should be construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, to mean "physical surroundings in which a user operates."

**IPR2023-01019, POR at 8; *see also* IPR2023-01020, POR at 6**

## '179 Patent, Claim 7

7. A method executed by one or more electronic devices, the method comprising:

storing head-related transfer functions (HRTFs) in memory;

displaying, by a display of a wearable electronic device (WED) worn on a head of a user, a virtual image in an environment;

processing, by a digital signal processor (DSP), sounds with the HRTFs to generate binaural sound in empty space that is provided to the user and that externally localizes to the empty space and to the virtual image in the environment; and

determining, with the WED, when the user is leaving the environment; and

alerting the user that the user is leaving the environment by altering processing of the binaural sound to degrade audio cues in order to prevent the user from experiencing external localization of the binaural sound.

**Ex. 1001 ('179 Patent), Claim 7; *see also id.*, Claim 14;**
**Ex. 1001 ('184 Patent), Claims 7, 14**

# Patent Owner's Expert Agrees That an "Environment" Can Be Physical or Virtual

## Patent Owner's Expert, Dr. Begault, Declaration

13. In my opinion, a PHOSITA would recognize that the stated "environment", a "3D virtual environment", or a "virtual image in the environment" in the subject claims all to refer to the same type of immersive virtual world context that the user interacts within. In this context, virtual sound sources are perceived to be externalized to the user at different sound localization points relative to the listener. *See* Figure 1 below, left (the violin and bell sound sources are heard outside of the head).

IPR2023-01019, -01020, Ex. 1147 (Begault Dep.) at 119:20-120:15 (objection omitted)

# Patent Owner's Expert Agrees That an "Environment" Can Be Physical or Virtual

## Patent Owner's Expert, Dr. Begault, Deposition

Q. Okay. Just to be clear, it sounds like your response to me was emphasizing that environment is not necessarily limited to either virtual or physical. It could be a virtual or physical environment and could be other types of environments as well; is that correct?

**A. Well, outside of the scope of this patent discussion and outside of the scope of my deposition, I gave you a hypothetical because I was trying to imagine other ways that there could be an environment. So I went to the concept of an imaginary environment or a dreamed environment. So, I don't think that falls in either category. But I believe what I was talking about here, in the deposition, was real, virtual, or both, simultaneously, types of environments of things that surround us.**

IPR2023-01019, -01020, Ex. 1147 (Begault Dep.) at 119:20-120:15 (objection omitted)

# The Board Should Reject Patent Owner's Results-Oriented Constructions

| Claim Term | Patent Owner's Proposed Construction | Claims |
|---|---|---|
| environment | "physical surroundings in which a user operates" | '179 patent: cls. 7-20<br>'184 patent: cls. 7-20 |
| 3D virtual environment | "three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound" | '179 patent: cls. 1-6<br>'184 patent: cls. 1-6 |
| determining, with the WED, when the user is leaving the environment | "determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment" | '179 patent: cls. 1-20 |

# The Board Should Reject Patent Owner's Results-Oriented Constructions

1 "Environment" is Not Limited to a Physical Environment

**2 "3D Virtual Environment" Cannot Be Sound-Only**

3 "Determining, With the WED, When the User is Leaving the Environment" Does Not Require Independently Determining

# "3D Virtual Environment" Cannot Be Sound-Only

## Patent Owner Response

The term "3D virtual environment" in independent claim 1 and associated dependent claims should be construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, to mean "three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound."

**IPR2023-01019, POR at 10; *see also* IPR2023-01020, POR at 8**

## '179 Patent

**1**. A method comprising:

storing head-related transfer functions (HRTFs) in memory of a head mounted display (HMD) worn on a head of a user;

displaying, with a display of the HMD worn on the head of the user, a three-dimensional (3D) virtual environment that includes a virtual image;

processing, by a digital signal processor (DSP) in the HMD, sounds with the HRTFs to generate binaural sound that is provided to the user and that externally localizes in empty space to the virtual image in the 3D virtual environment;

sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment that includes the virtual image; and

warning the user that the user is leaving the 3D virtual environment by filtering, by the DSP, the binaural sound to alter audio cues to prevent the user from experiencing external localization of the sounds and by lowering a volume of the sounds being provided to the user.

**Ex. 1001 ('179 Patent), Claim 1;**
***see also* Ex. 1001 ('184 Patent), Claim 1**

# 3D Virtual Environment Is Displayed by the Display of an HMD

## '179 Patent

1. A method comprising:
storing head-related transfer functions (HRTFs) in memory of a head mounted display (HMD) worn on a head of a user;
displaying, with a display of the HMD worn on the head of the user, a three-dimensional (3D) virtual environment that includes a virtual image;
processing, by a digital signal processor (DSP) in the HMD, sounds with the HRTFs to generate binaural sound that is provided to the user and that externally localizes in empty space to the virtual image in the 3D virtual environment;
sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment that includes the virtual image; and
warning the user that the user is leaving the 3D virtual environment by filtering, by the DSP, the binaural sound to alter audio cues to prevent the user from experiencing external localization of the sounds and by lowering a volume of the sounds being provided to the user.

**Ex. 1001 ('179 Patent), Claim 1;**
***see also* Ex. 1001 ('184 Patent), Claim 1**

## '179 Patent

is situated on his desk. An image of the friend appears on a display of the laptop while the SLP **126** appears above the laptop. As shown in the transition from box **128**A to box

**Ex. 1001 ('179 Patent) at 6:20-22;**
***see also* Ex. 1001 ('184 Patent) at 6:20-22**

nying SLP). As such, the sound localization points **154-157** coincide with visual displays or images of people with whom the user **150** talks. As shown in the transition from

**Ex. 1001 ('179 Patent) at 6:65-67;**
***see also* Ex. 1001 ('184 Patent) at 6:65-67**

Alice. The electronic glasses or head-mounted display provides or displays an image of Bob that coincides with the SLP in empty space. The image appears to exist in space at the location in empty space with the SLP that is proximate to but away from Alice. Thus, the SLP of Bob's voice and

**Ex. 1001 ('179 Patent) at 11:10-15;**
***see also* Ex. 1001 ('184 Patent) at 11:10-15**

# 3D Virtual Environment Is Displayed by the Display of an HMD

## Patent Owner Sur-Reply

inclusion of a virtual image. Instead, PO's construction acknowledges that the 3D virtual aspects of the environment may be a 3D binaural audio soundscape, as described in the specification and acknowledged by Petitioner's expert. '179 Patent,

**IPR2023-01019, POSR at 2; *see also* IPR2023-01020, POR at 3**

## '179 Patent

By way of introduction, sound localization (i.e., the act of relating attributes of the sound being heard by the listener to the location of an auditory event) provides the listener with a three-dimensional (3D) soundscape or 3D sound environment where sounds can be localized to points around the listener. Binaural sound and some forms of stereo sound provide a listener with the ability to localize sound, though binaural sound generally provides a listener with a superior ability to localize sounds in the 3D environment.

**Ex. 1001 ('179 Patent) at 2:38-46;**
***see also* Ex. 1001 ('184 Patent) at 2:38-46**

## '179 Patent

1. A method comprising:
storing head-related transfer functions (HRTFs) in memory of a head mounted display (HMD) worn on a head of a user;
displaying, with a display of the HMD worn on the head of the user, a three-dimensional (3D) virtual environment that includes a virtual image;
processing, by a digital signal processor (DSP) in the HMD, sounds with the HRTFs to generate binaural sound that is provided to the user and that externally localizes in empty space to the virtual image in the 3D virtual environment;
sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment that includes the virtual image; and
warning the user that the user is leaving the 3D virtual environment by filtering, by the DSP, the binaural sound to alter audio cues to prevent the user from experiencing external localization of the sounds and by lowering a volume of the sounds being provided to the user.

**Ex. 1001 ('179 Patent), Claim 1;**
***see also* Ex. 1001 ('184 Patent), Claim 1**

# "3D Virtual Environment" Cannot Be Sound-Only

## Patent Owner Response

points). Notably, this disclosure in the specification shows that a 3D virtual environment does not require 3D visual immersion, or a "3D virtual world," as suggested by the Board. Decision, 30. To the contrary, the specification provides

**IPR2023-01019, POR at 11; *see also* IPR2023-01020, POR at 9**

## Patent Owner's Expert, Dr. Begault, Declaration

13. In my opinion, a PHOSITA would recognize that the stated "environment", a "3D virtual environment", or a "virtual image in the environment" in the subject claims all to refer to the same type of immersive virtual world context that the user interacts within. In this context, virtual sound sources are perceived to be externalized to the user at different sound localization points relative to the listener. *See* Figure 1 below, left (the violin and bell sound sources are heard outside of the head).

**IPR2023-01019, -01020, Ex. 2006 ¶ 13**

# The Board Should Reject Patent Owner's Results-Driven Constructions

| Claim Term | Patent Owner's Proposed Construction | Claims |
|---|---|---|
| environment | "physical surroundings in which a user operates" | '179 patent: cls. 7-20<br>'184 patent: cls. 7-20 |
| 3D virtual environment | "three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound" | '179 patent: cls. 1-6<br>'184 patent: cls. 1-6 |
| determining, with the WED, when the user is leaving the environment | "determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment" | '179 patent: cls. 1-20 |

# The Board Should Reject Patent Owner's Results-Oriented Constructions

1 "Environment" is Not Limited to a Physical Environment

2 "3D Virtual Environment" Cannot Be Sound-Only

**3 "Determining, With the WED, When the User is Leaving the Environment" Does Not Require Independently Determining**

# "Determining, with the WED, When the User Is Leaving The Environment" Does Not Require Independently Determining

## Patent Owner Response

The phrase, "determining, with the WED, when the user is leaving the environment" in claim 14, when construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, means "determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment."

**IPR2023-01019, POR at 12**

## Patent Owner Sur-Reply

leaving the environment." Petitioner's citation to the specification, which supports the WED "*can* be used to determine whether a user is leaving the environment," (Reply.6), actually supports PO's position. The specification never mentions the use of external devices to determine when the user is leaving the environment. Thus,

**IPR2023-01019, POSR at 3**

## '179 Patent

By way of example, electronic devices include, but are not limited to, a computer, handheld portable electronic devices (HPEDs), wearable electronic glasses, watches, wearable electronic devices, portable electronic devices, computing devices, electronic devices with cellular or mobile phone capabilities, digital cameras, desktop computers, servers, portable computers (such as tablet and notebook computers), electronic and computer game consoles, home entertainment systems, handheld audio playing devices (example, handheld devices for downloading and playing music and videos), appliances (including home appliances), personal digital assistants (PDAs), electronics and electronic systems in automobiles (including automobile control systems), combinations of these devices, devices with a processor or processing unit and a memory, and other portable and non-portable electronic devices and systems.

**Ex. 1001 ('179 Patent) at 39:9-24**

# "Determining, with the WED, When the User Is Leaving The Environment" Does Not Require Independently Determining

## Patent Owner Response

*also* Figure 20. These components are all contained within the WED and can be used to determine when a user is leaving the environment. Thus, the specification clearly discloses that the WED determines a location of a user and when the user is leaving an environment and makes this determination independent of a stationary tracking device.

**IPR2023-01019, POR at 13**

## '179 Patent

Electronic device **2002** includes one or more components of computer readable medium (CRM) or memory **2020**, one or more displays **2022**, a processor or processing unit **2024**, one or more interfaces **2026** (such as a network interface, a graphical user interface, a natural language user interface, a natural user interface, a reality user interface, a kinetic user interface, touchless user interface, an augmented reality user interface, and/or an interface that combines reality and VR), a camera **2028**, one or more sensors **2030** (such as micro-electro-mechanical systems sensor, an activity tracker, a pedometer, a piezoelectric sensor, a biometric sensor, an optical sensor, radio-frequency identification sensor, a global positioning satellite (GPS) sensor, a solid state compass, gyroscope, magnetometer, and/or an accelerometer), a location or motion tracker **2032**, one or more speakers **2034**, head related transfer functions or HRTFs **2036**, a sound localization system **2038** (such as a system that localizes sound, adjusts sound, moves sound, predicts or extrapolates characteristics of sound, manages SLPs, predicts SLPs, and/or executes one or more methods discussed herein), one or more microphones **2040**, a predictor **2042**, a user agent **2044** (such as an intelligent user agent), a user profile **2046** (including public and private information about a user), and a user profile builder **2048**.

**Ex. 1001 ('179 Patent) at 39:25-48**

# Patent Owner's Construction is Designed to Avoid the Prior Art

## Clement

In some embodiments, the tracking device **310** may detect the user's proximity to a boundary of the tracking area **320**, or that the user is within a threshold distance of a boundary of the tracking area **320**. In some embodiments, the HMD **100** may include a sensor that detects that the user user's proximity to a boundary of the tracking area **320**, or that the user is within a threshold distance of a boundary of the tracking area **320**. For example, one of the sensors of the sensing system **160** (such as, for example a proximity sensor **163**) and/or the camera **180** of the HMD **100** may detect this proximity to the boundary, and the control system **170**/ processor **190** may initiate the transition process as described above.

**Ex. 1005 (Clement) at 7:4-16**

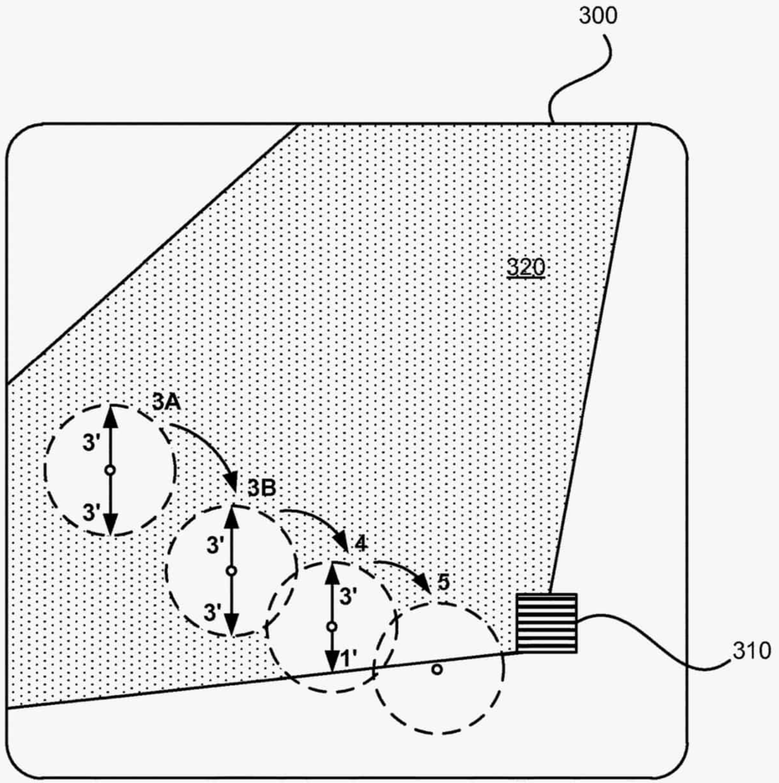



FIG. 3C

**Ex. 1005 (Clement), Fig. 3C**

# Expert Testimony Confirms Determining Step Does Not Require Independently Determining

## Dr. Roginska, Supplemental Declaration

32. This phrase does not require the WED to make the determination independently of a stationary tracking device. The claim language does not support such a construction. For example, the claims are open-ended by reciting that the method "compris[es]" the recited steps. In other words, the claims to not preclude the possibility of other unclaimed steps in a method, including steps performed by a stationary tracking device. Nor does the phrase "with the WED" mean that the WED cannot use information from another device such as a stationary tracking device. To the contrary, the claim language simply means the WED performs the claimed determination without regard for *how* it does it, including whether the determination is performed with the help of any other device.

33. The specification also does not limit the claimed determining step. Although a WED includes various components that can potentially be used independently from a stationary tracking device to make the claimed determination (*see, e.g.*, Figure 20), nothing in the specification defines the "determining" step to be performed independently of any other device. *See* '179 patent, 40:7-15.

**Ex. 1146 (Roginska Suppl. Decl.) ¶¶ 32-33**

# Expert Testimony Confirms Determining Step Does Not Require Independently Determining

## Patent Owner's Expert, Dr. Begault, Deposition

Q. Would the WED determine when the user is leaving the environment if it's using external sensors?

**A. It could. So I guess that's one possibility.**

Q. What about if the WED is using external reference points?

**A. Maybe.**

IPR2023-01019, -01020, Ex. 1147 (Begault Dep.) at 157:14-158:1

Q. So you don't know how this would work? You don't know how you would use a WED to determine when a user is leaving an environment?

**A. There are many possibilities for how that might work.**

Q. Is one of them using a camera, an external camera?

**A. One of many possibilities.**

Q. Is one of them using an external tracking device?

**A. It could possibly be.**

IPR2023-01019, -01020, Ex. 1147 (Begault Dep.) at 159:19-160:12 (objections omitted)

# The Board Should Reject Patent Owner's Results-Driven Constructions

| Claim Term | Patent Owner's Proposed Construction | Claims |
|---|---|---|
| environment | "physical surroundings in which a user operates" | '179 patent: cls. 7-20<br>'184 patent: cls. 7-20 |
| 3D virtual environment | "three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound" | '179 patent: cls. 1-6<br>'184 patent: cls. 1-6 |
| determining, with the WED, when the user is leaving the environment | "determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment" | '179 patent: cls. 1-20 |