



# VRND CAPSTONE - ROBO REPLACEMENTS

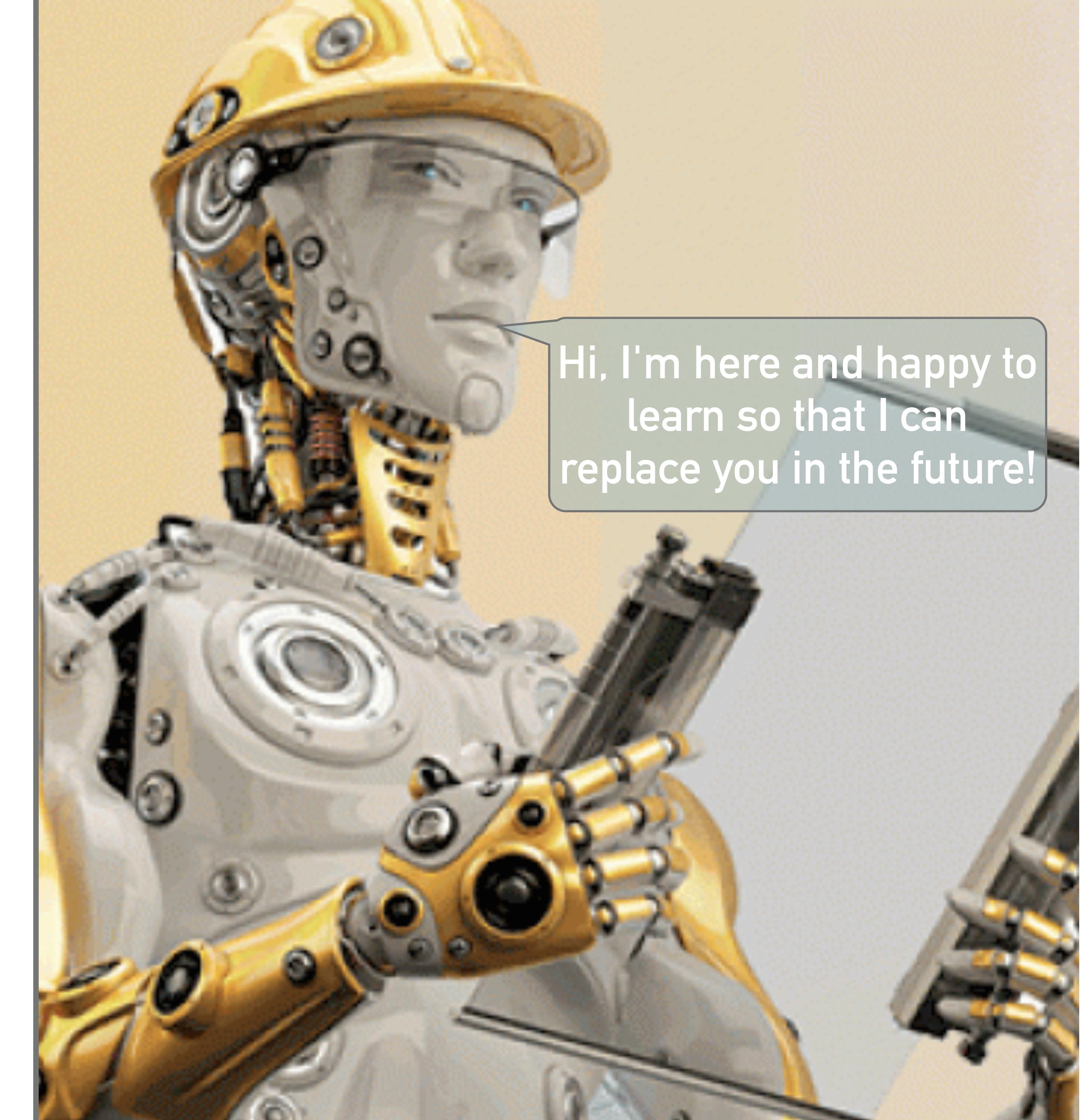
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*Eric Zavesky - May-June 2018 - Game Planning*

# DESCRIPTION

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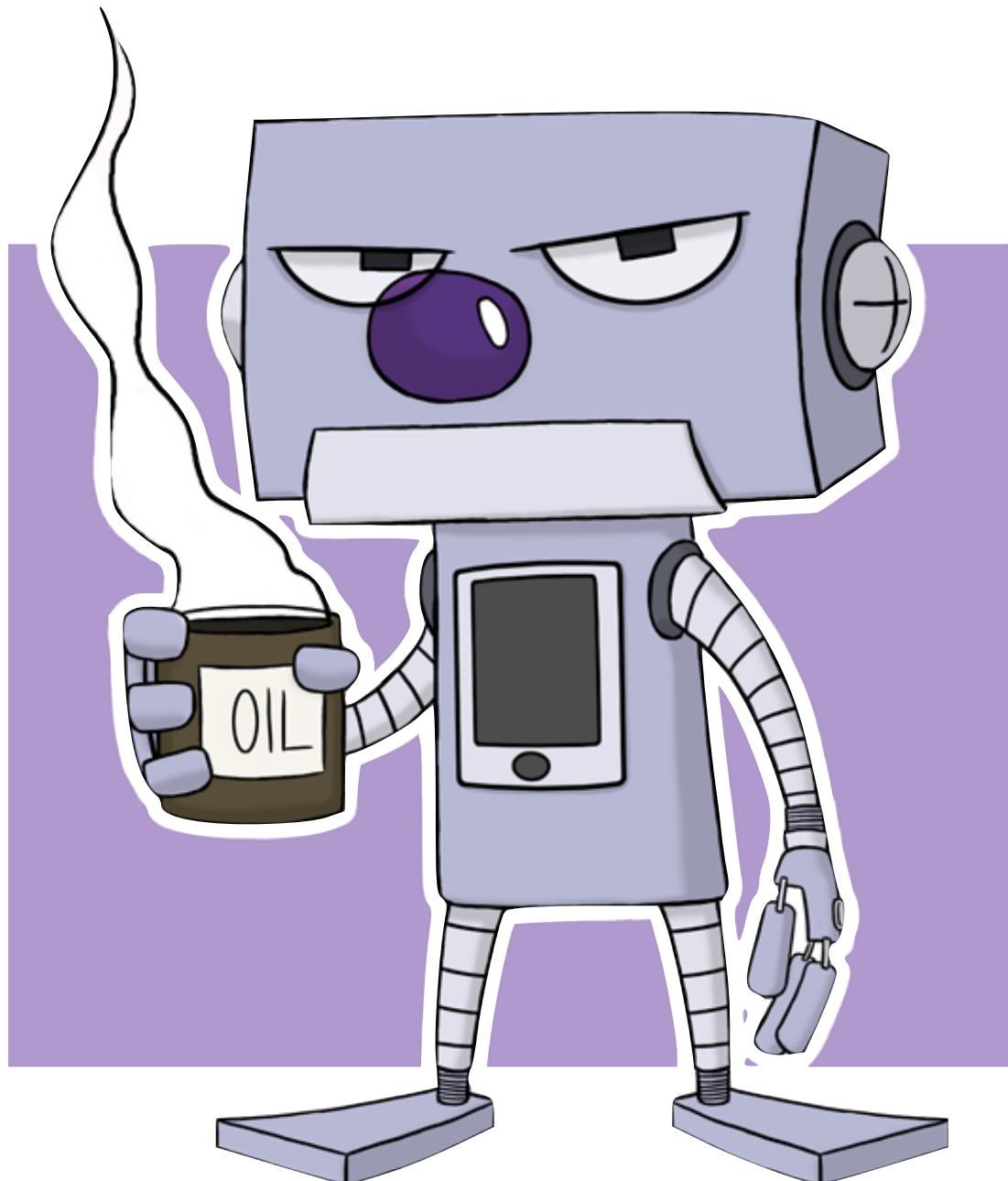
- This capstone will explore the emotive side of robotic automation -- mostly focused on humor, curiosity, and surprise!
- The player's task will be to teach a robot (upper half of a robot avatar) how to accomplish a few simple tasks by demonstration and vocal commands.
- Doing/Listening, Seeing, Speaking
- The focus of this application will be the gameplay and robot interaction, as opposed to extensive graphical interactions.



# GAMEPLAY

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- Task Review
  - Doing/Listening, Seeing, Speaking
  - Robot interjects satirical, comical commentary, a la dialog from games like "The Lab" or "RoboRecall"

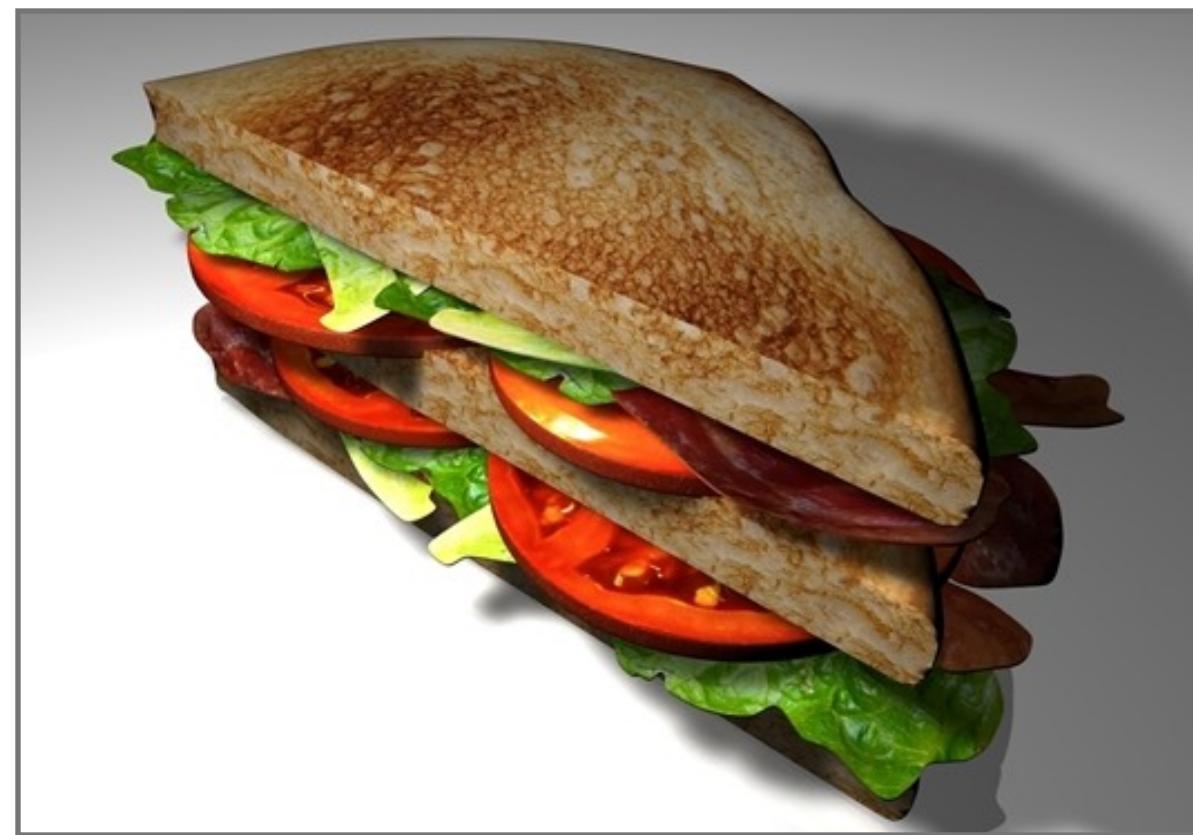
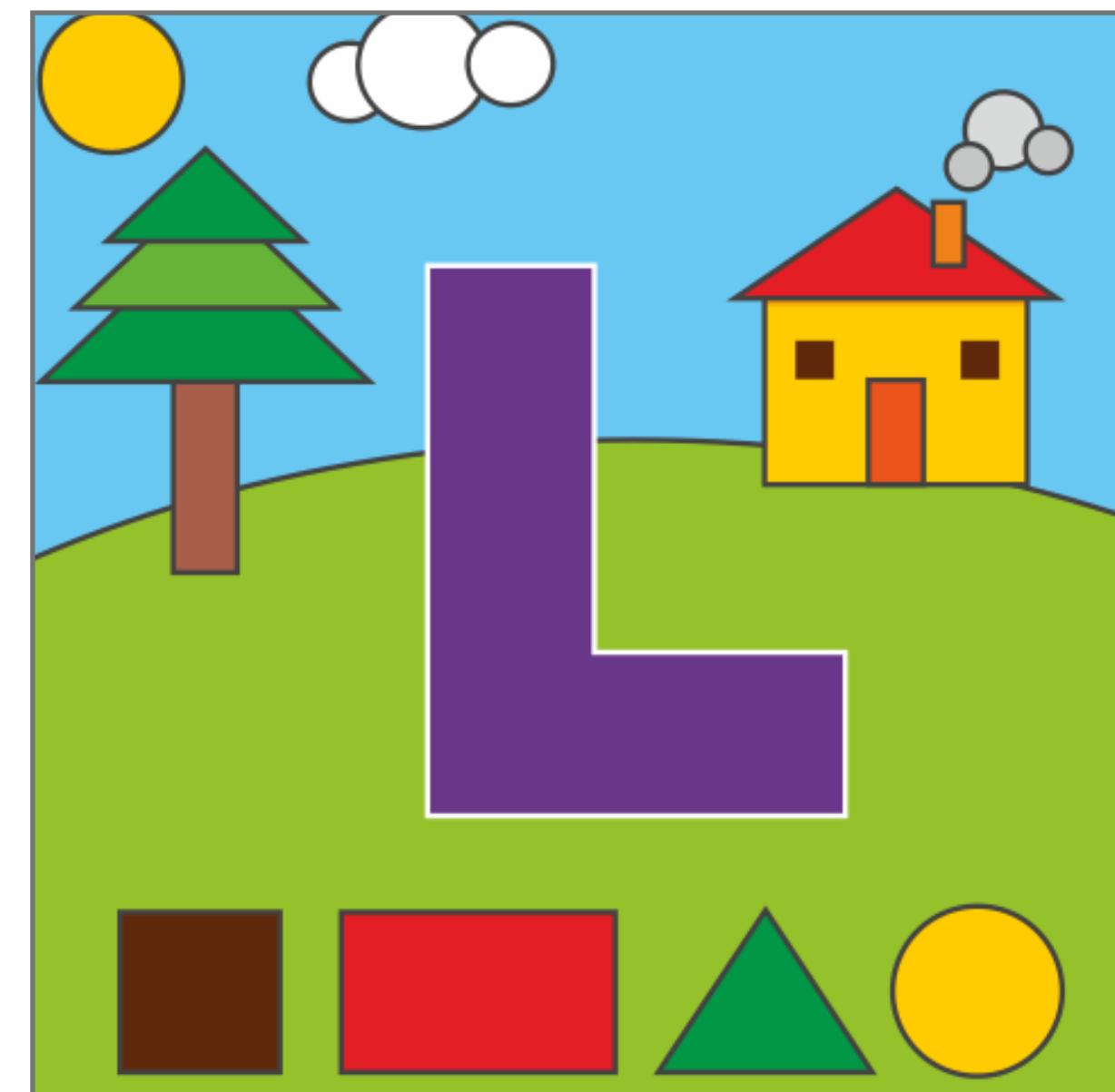


- Doing Task
  - goal: using simple interaction mechanics, move to make a sandwich
  - Robot copies user movements
  - User orders task
- Seeing Task
  - goal: teach the robot how to see different items (house, car, flower)
  - user places item on table, robot classifies them online (AI/ML component)
- Listening/Speaking Task
  - goal: user helps robot with speech recognition to complete a "MadLib"
  - ideally pre-programmed animations will bring in media that adjusts according to a few options presented to the user

# FEATURES AND DEPENDENCIES: MODELS & ANIMATIONS

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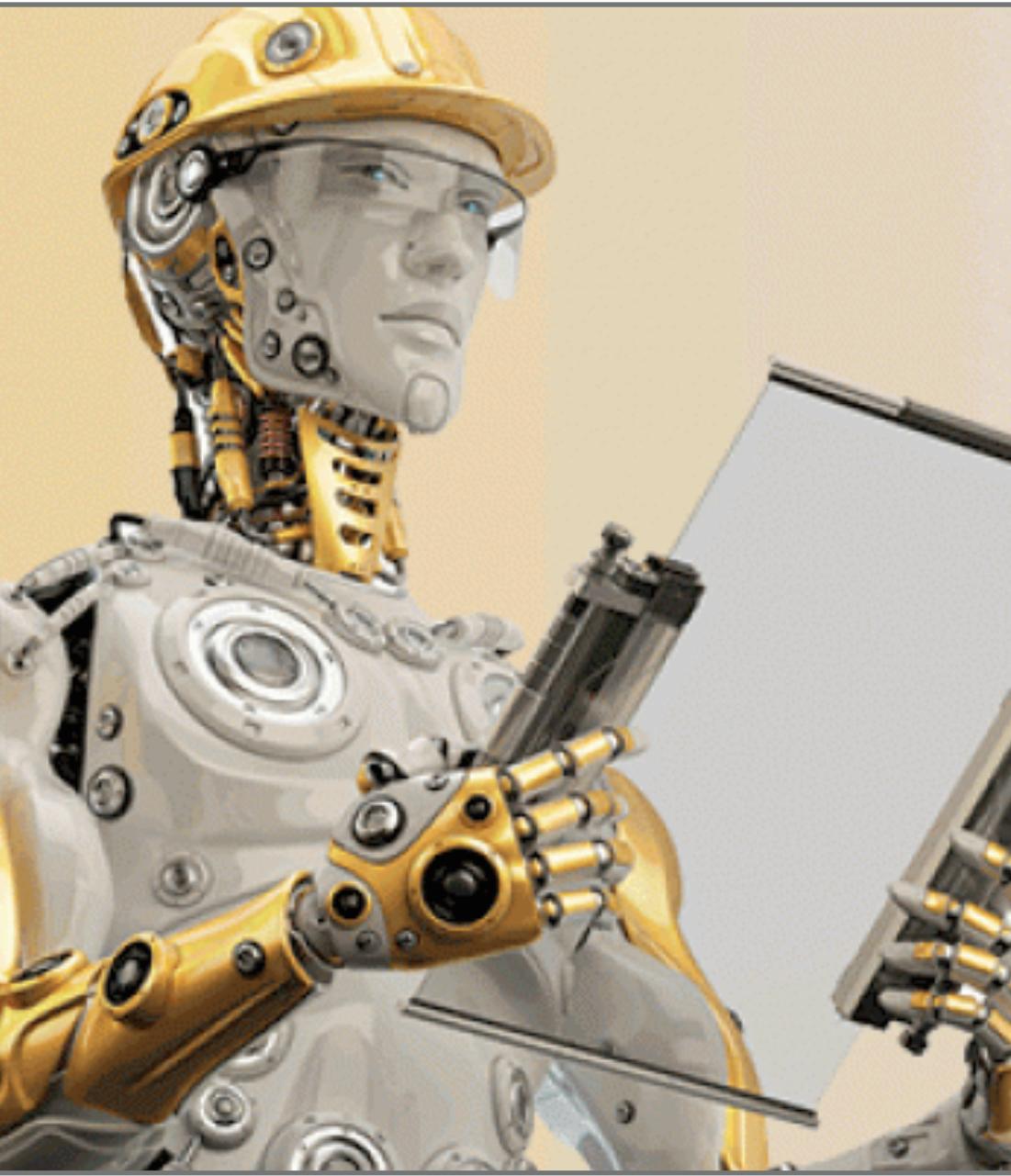
- Robotic avatar
- Doing task
  - food models: bread, jelly, butter
  - tool models: plate, knife
- Simple kitchen environment
  - possibly reusing models from Udacity early models and starter kits
- Seeing task
  - simple shapes created in Unity
  - simple camera or simple office setting
- Listening task
  - news desk + image/video assets
  - animations for a few tasks to present objects

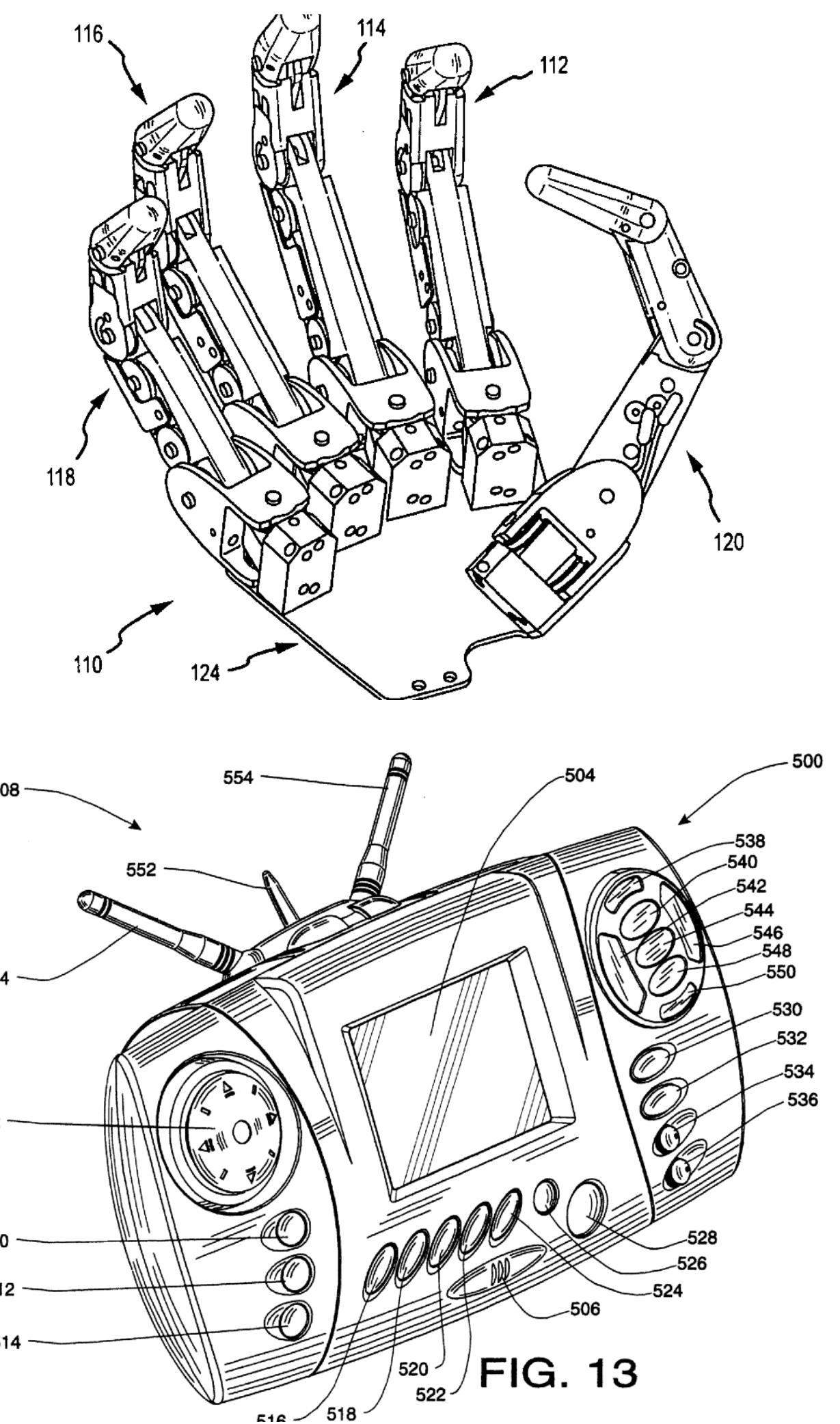
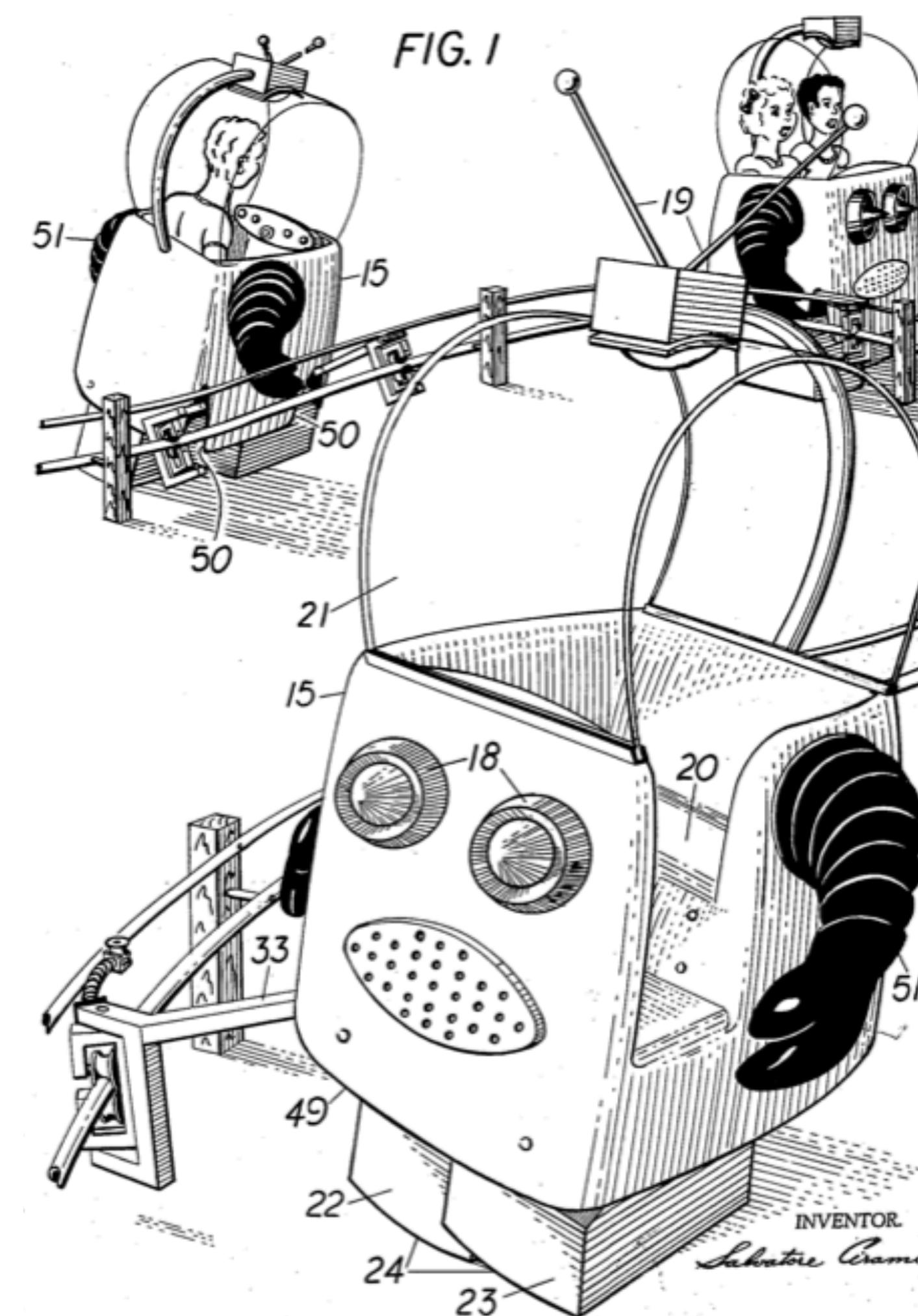
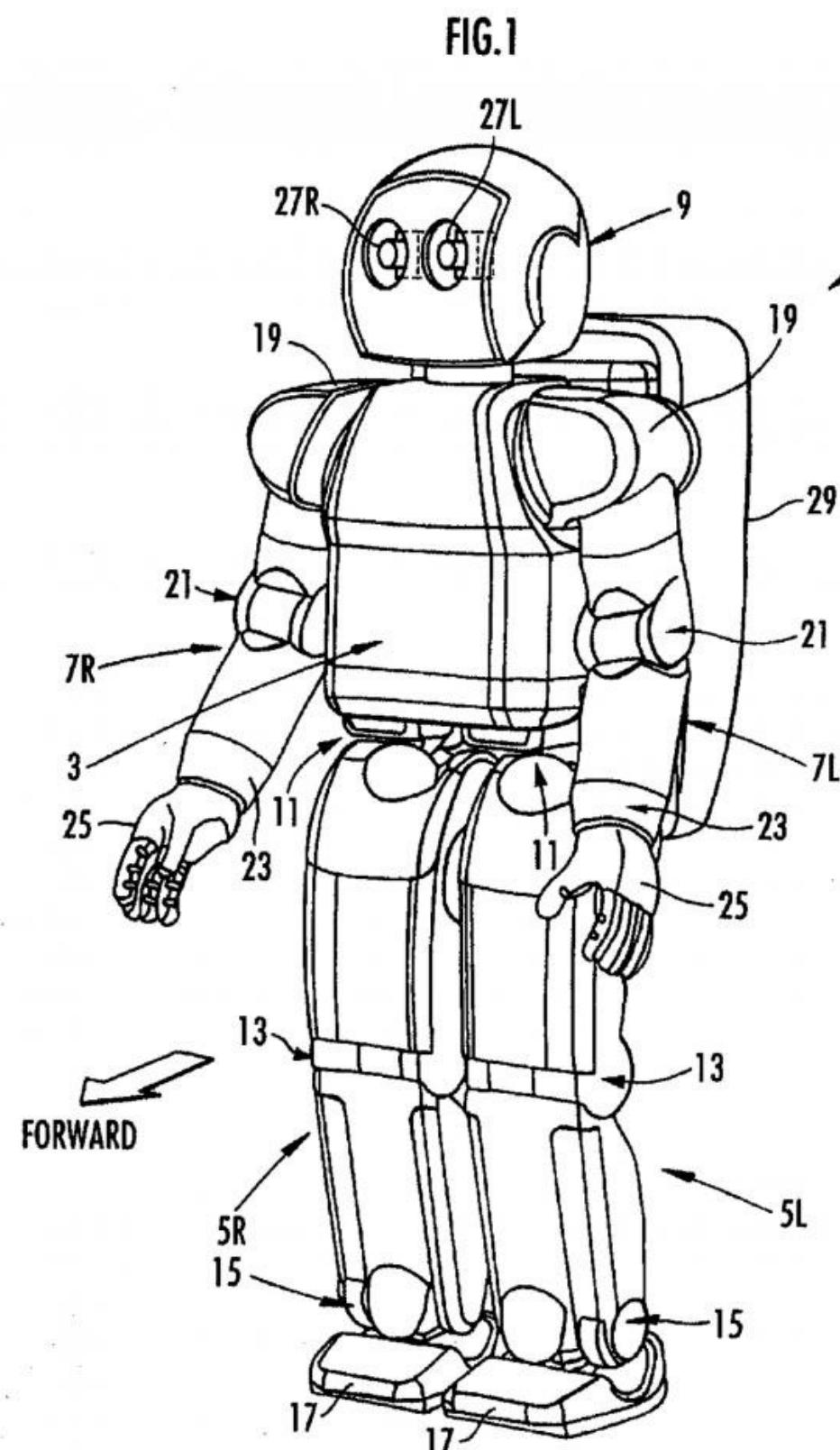


# FEATURES AND DEPENDENCIES: SOFTWARE & PROGRAMMING

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- Text to speech with funny robot voice
- Doing
  - Link kinematics between robot hand and human hand for testing
  - Simple memory/copier for task
  - Ordering process for task
- Seeing
  - Capability to create shapes and placement
  - Simple nearest neighbor for placement using shape and pallets placement
- Listening/Speaking
  - Create a few words
  - Create recognition model constrained to a few words
- Compose text as output





# SOFTWARE & INTERACTIONS

## FEATURES AND DEPENDENCIES: TEXT TO SPEECH

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- Priority: Text Bubbles in OSD
- Achievable: Recorded voice + audio FX with funny robot voice
- Stretch: an automated TTS generation with personality
  
- <http://www.acapela-group.com/>
  - would require removal of background
- <https://www.cepstral.com/en/demos>
  - simple demo, apply dizzy droid or other audio effect for robot sound
- Mac "speak" tool plus a visual effect
  - [https://www.youtube.com/watch?v=j\\_FvFAdlbwo](https://www.youtube.com/watch?v=j_FvFAdlbwo)
  - <http://www.asktoby.com/#killerringer>
- <https://assetstore.unity.com/packages/tools/audio/speech-auto-detector-86008>
- <https://forum.unity.com/threads/rt-voice-run-time-text-to-speech-solution.340046/>

# FEATURES AND DEPENDENCIES: SPEECH RECOGNITION

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- Priority: Just using buttons for input
- Stretch: Full speech recognition through Google or Watson
  
- <https://bitbucket.org/Unity-Technologies/speech-to-text>
  - <https://stackoverflow.com/questions/39611728/how-to-add-speech-recognition-to-unity-project#39613264>
- <https://assetstore.unity.com/packages/templates/tutorials/vr-watson-speech-sandbox-114015>
- <https://assetstore.unity.com/packages/tools/ai/ibm-watson-sdk-for-unity-108831>
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# FEATURES AND DEPENDENCIES: MACHINE LEARNING

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- Priority: Simple shape + KNN classification
- Stretch: (this is a fun requirement and will only be skipped under duress)
  
- <https://github.com/nvnhcmus/kNN> - knn method
- <https://github.com/pavl0v/RandomForest> - simple random forest method
- [http://accord-framework.net/docs/html/R\\_Project\\_Accord\\_NET.htm](http://accord-framework.net/docs/html/R_Project_Accord_NET.htm)
- <http://accord-framework.net/>

# FEATURES AND DEPENDENCIES: DOING TASK IK SOFTWARE

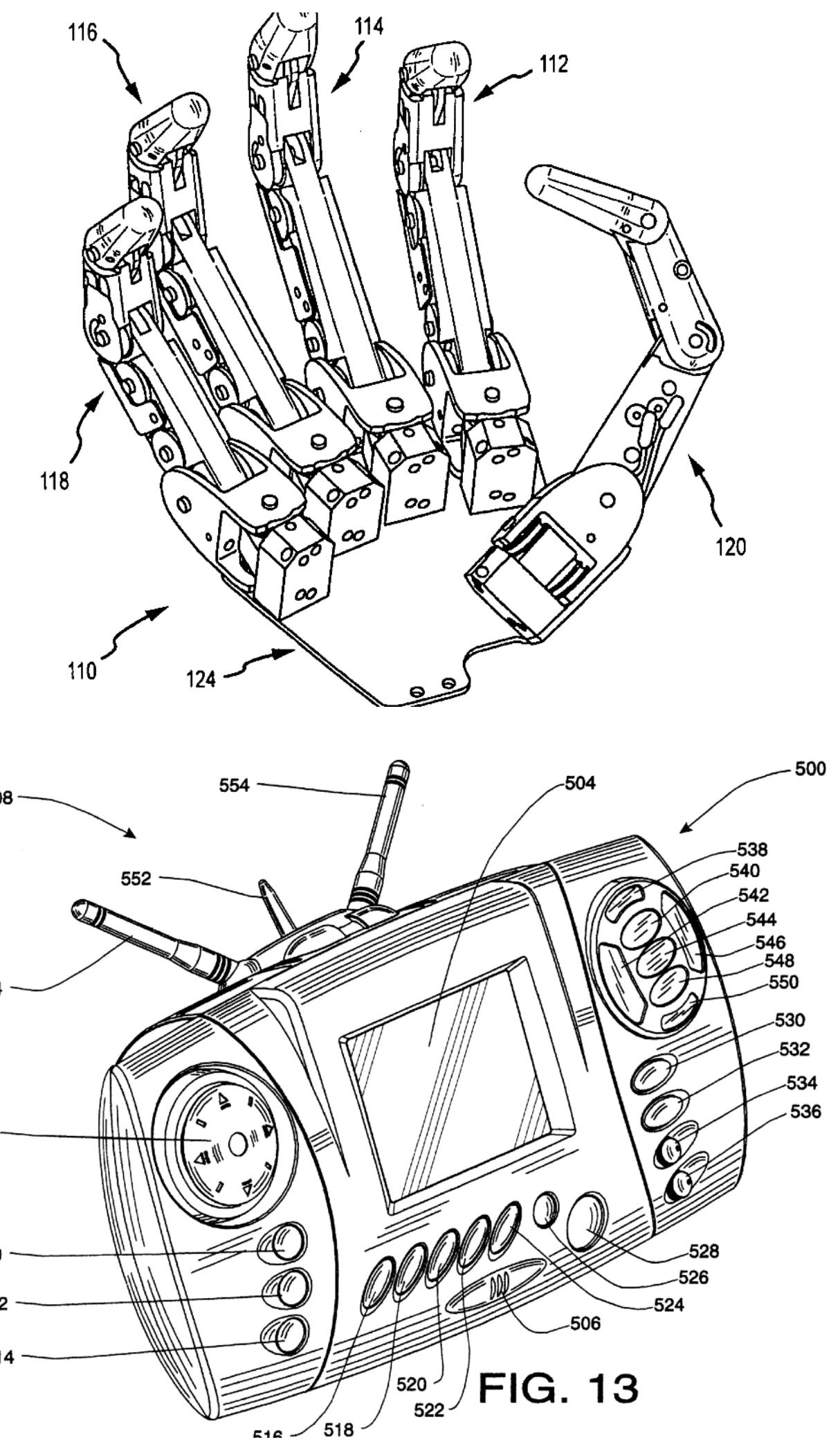
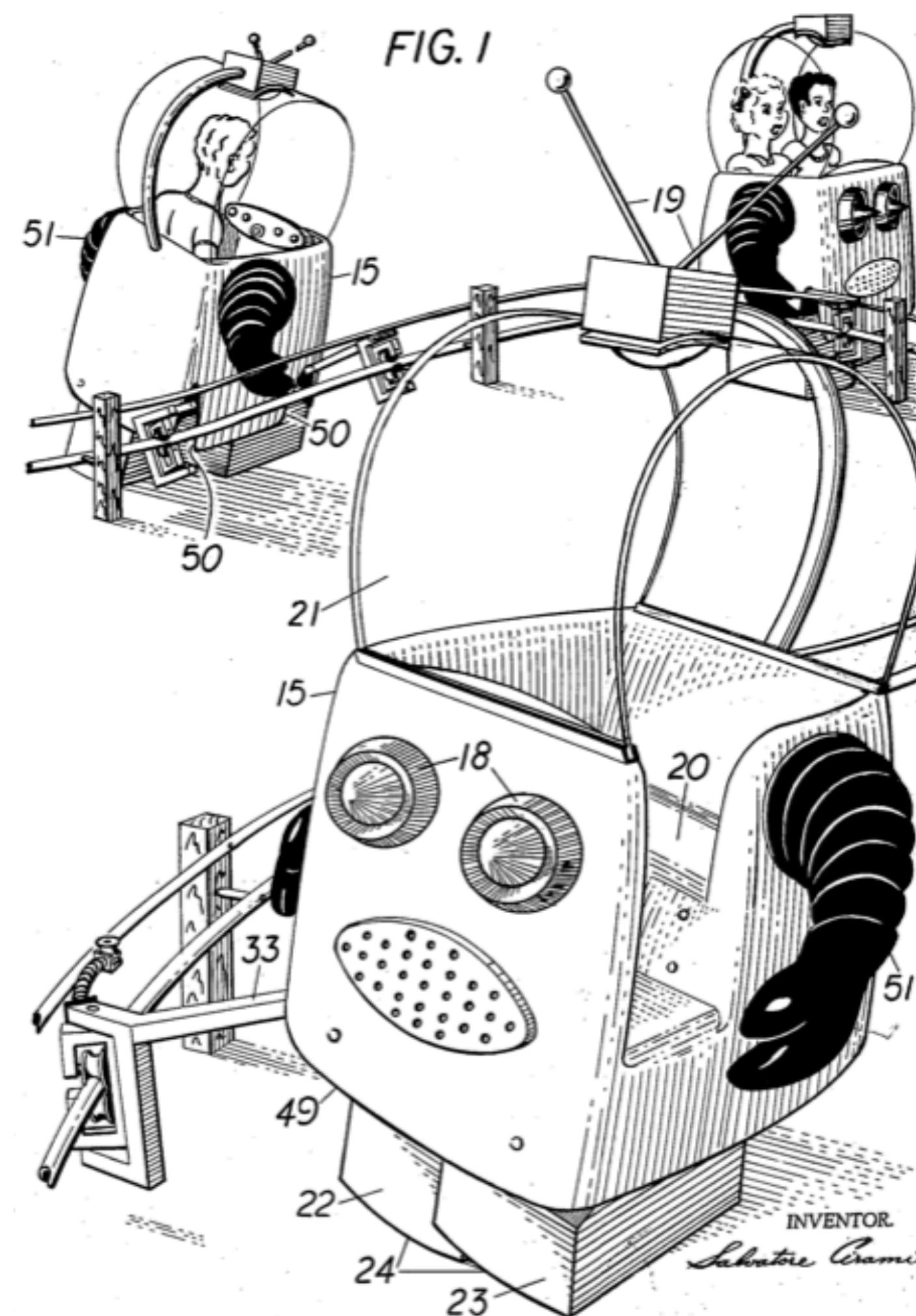
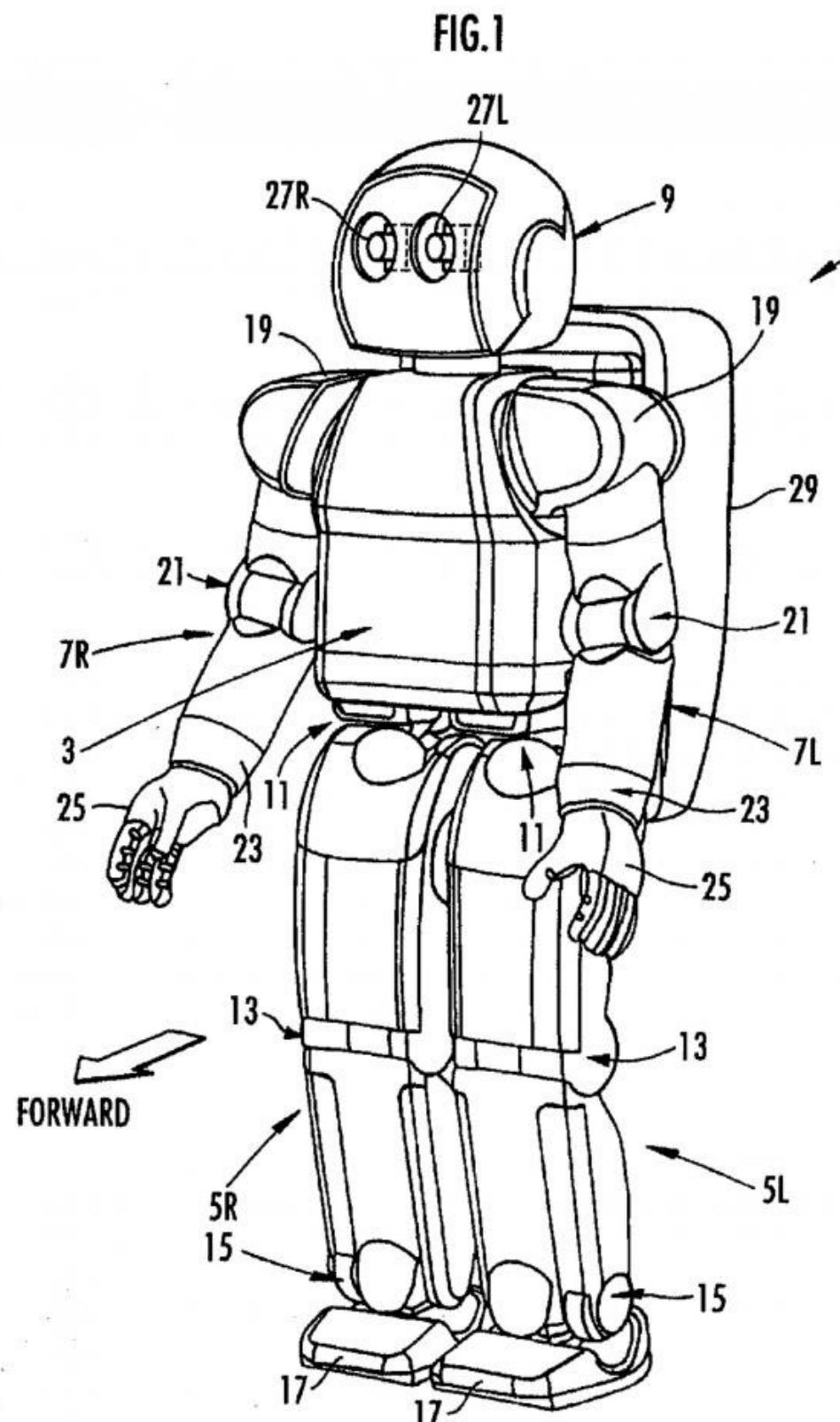
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- Priority: Simple IK following of user and objects
- Stretch: Tasks out of order, different sizes, etc; also more complicated ordering requirements  
(instead of linearly asking for user help)
  
- Discovery of bound avatar with desired actions (e.g. full IK+bones)
- Create method for "doing" task
  - Robot will follow user object with head when something is held
  - Backend script tracks which object is grabbed
    - ~~Backend script captures position in update as driver for robot behavior~~
    - Robot follows own grabbed object when manipulating
  - Display will update with task, allowing user to go back or forth with grips
  - ~~Push button between tasks to record them as done or restart~~
  - ~~Push button when task is completed~~
  - Realtime computation of similarity based on object position differences

# FEATURES AND DEPENDENCIES: LISTENING AND READING

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- Priority: OSD for story and text prompts, buttons
- Stretch: Spoken prompts, speech recognition for constrained reply
  
- Propose the use of animations to accomplish much of robot animation
  - <https://assetstore.unity.com/packages/3d/animations/everyday-motion-free-115067>
  - CMU motion capture -> FBX (search first, then find which one it is)
    - <http://mocap.cs.cmu.edu/search.php>
    - <https://assetstore.unity.com/packages/3d/animations/huge-fbx-mocap-library-part-2-20282>

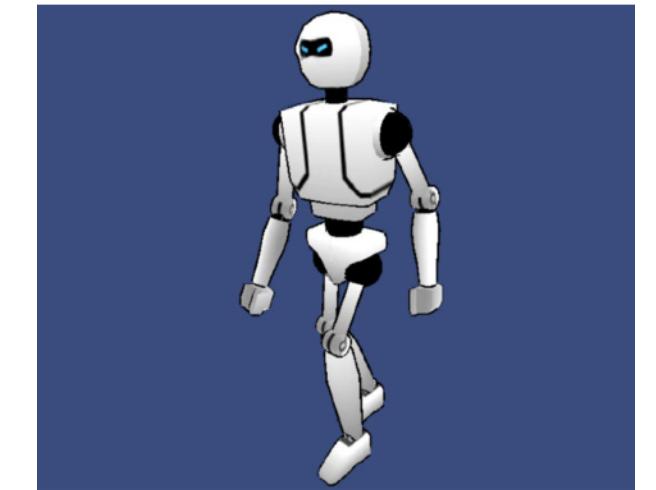


# MODELING

# FEATURES AND DEPENDENCIES: KINEMATIC ROBOT

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- <https://assetstore.unity.com/packages/3d/characters/robots/space-robot-kyle-4696>
  - simple kinematic robot
- <https://assetstore.unity.com/packages/3d/characters/robots/robot-1-65726>
  - larger kinematic robot, may be too scary
- <https://assetstore.unity.com/packages/3d/characters/robots/cyber-soldier-52064>
- <https://assetstore.unity.com/packages/3d/characters/robots/sleek-toon-bot-free-34490>
- <https://assetstore.unity.com/packages/3d/characters/robots/dummy-animation-64322>
- Software IK



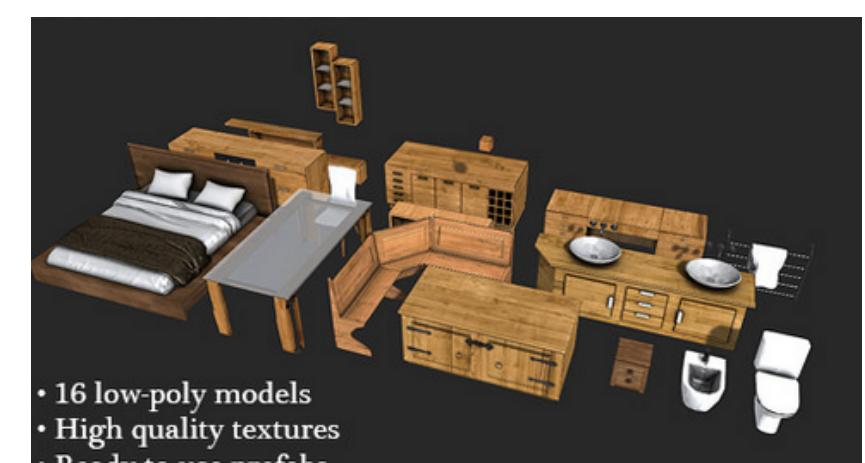
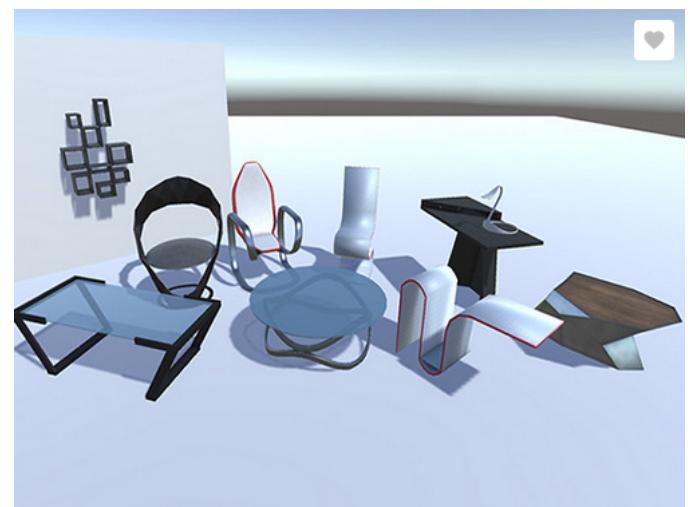
# FEATURES AND DEPENDENCIES: ENVIRONMENT MODELS

- <https://assetstore.unity.com/packages/3d/environments/sci-fi/sci-fi-styled-modular-pack-82913>
  - comprehensive space outpost package
- <https://assetstore.unity.com/packages/3d/props/furniture/big-furniture-pack-7717>
  - some beds, couches, etc
- <https://www.turbosquid.com/3d-models/virtual-tv-studio-news-dxf-free/991615>
  - <https://assetstore.unity.com/packages/3d/environments/virtual-news-studio-91126>
  - example of news studio (no model, inspiration)
- <https://assetstore.unity.com/packages/templates/tutorials/the-great-fleece-110186>
  - museum example
- <https://assetstore.unity.com/packages/3d/characters/cozy-cabinet-117482>
  - interior "study" room
- Udacity apartment/kitchen model example
- <https://assetstore.unity.com/packages/audio/music/absolutely-free-music-4883>
  - music!?



# FEATURES AND DEPENDENCIES: OBJECT MODELS

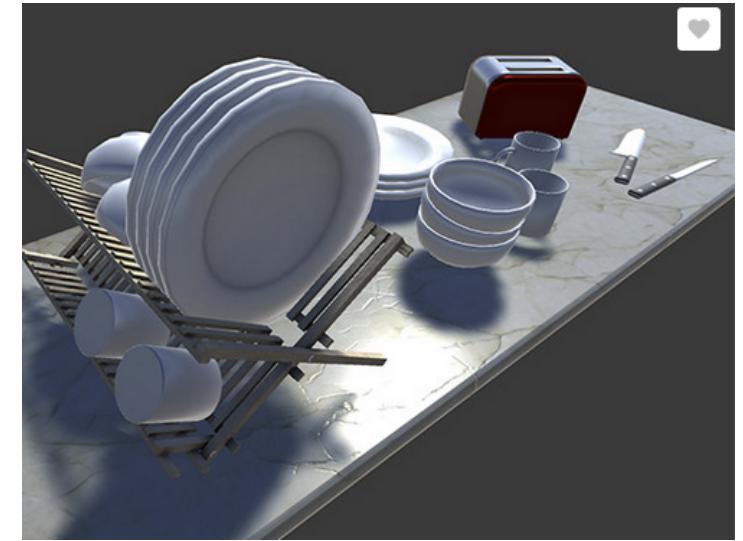
- <https://assetstore.unity.com/packages/3d/props/tools/carpenter-tools-118471>
  - joking tools for cooking
- <https://assetstore.unity.com/packages/3d/props/furniture/modern-furniture-pieces-pack-81417>
  - additional furniture pieces
- <https://assetstore.unity.com/packages/3d/props/furniture/gray-furniture-pack-40580>
  - gray furniture
- <https://assetstore.unity.com/packages/3d/props/furniture/chalet-style-furniture-31966>
  - chalet dark wood furniture
- TV from museum example

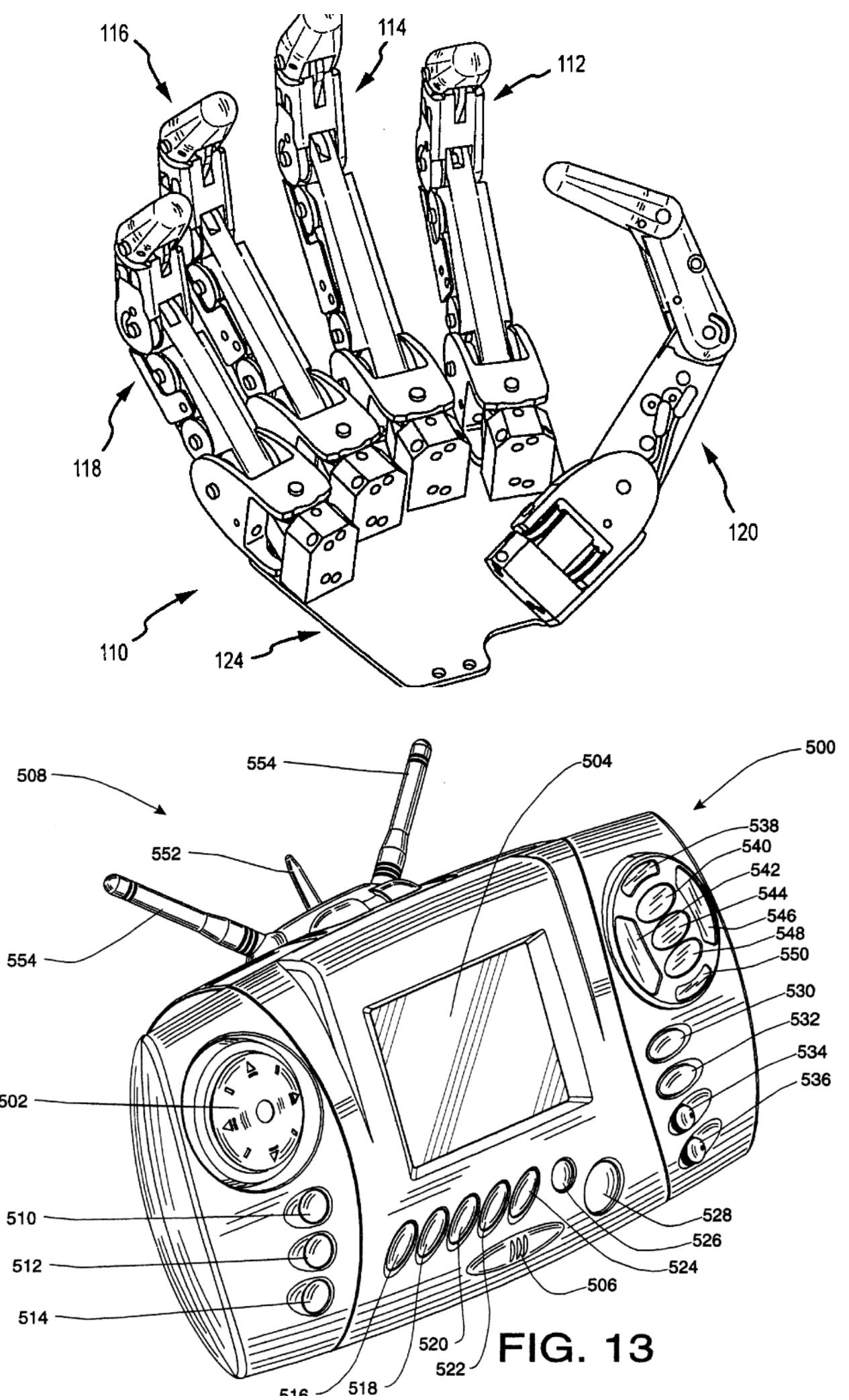
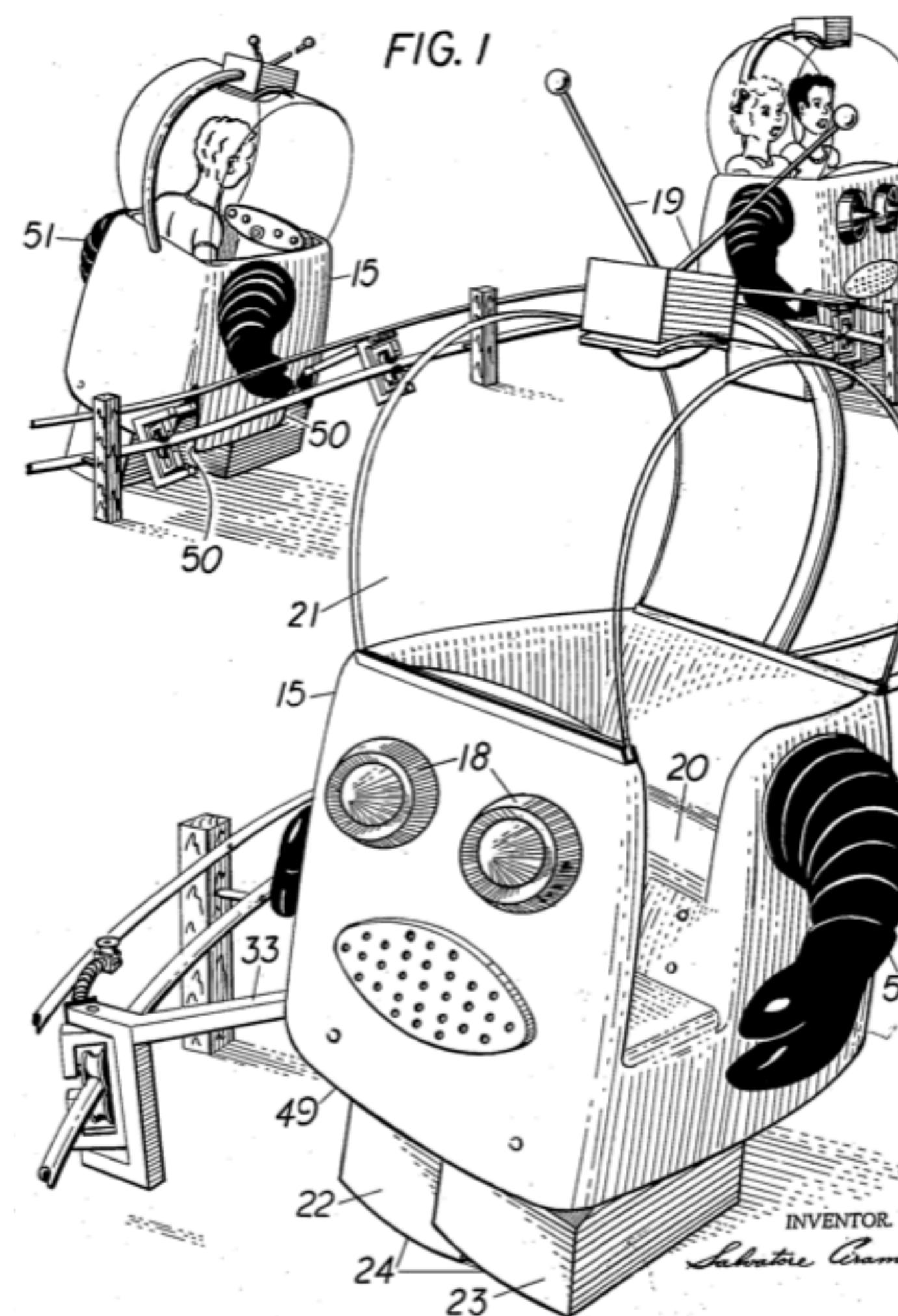
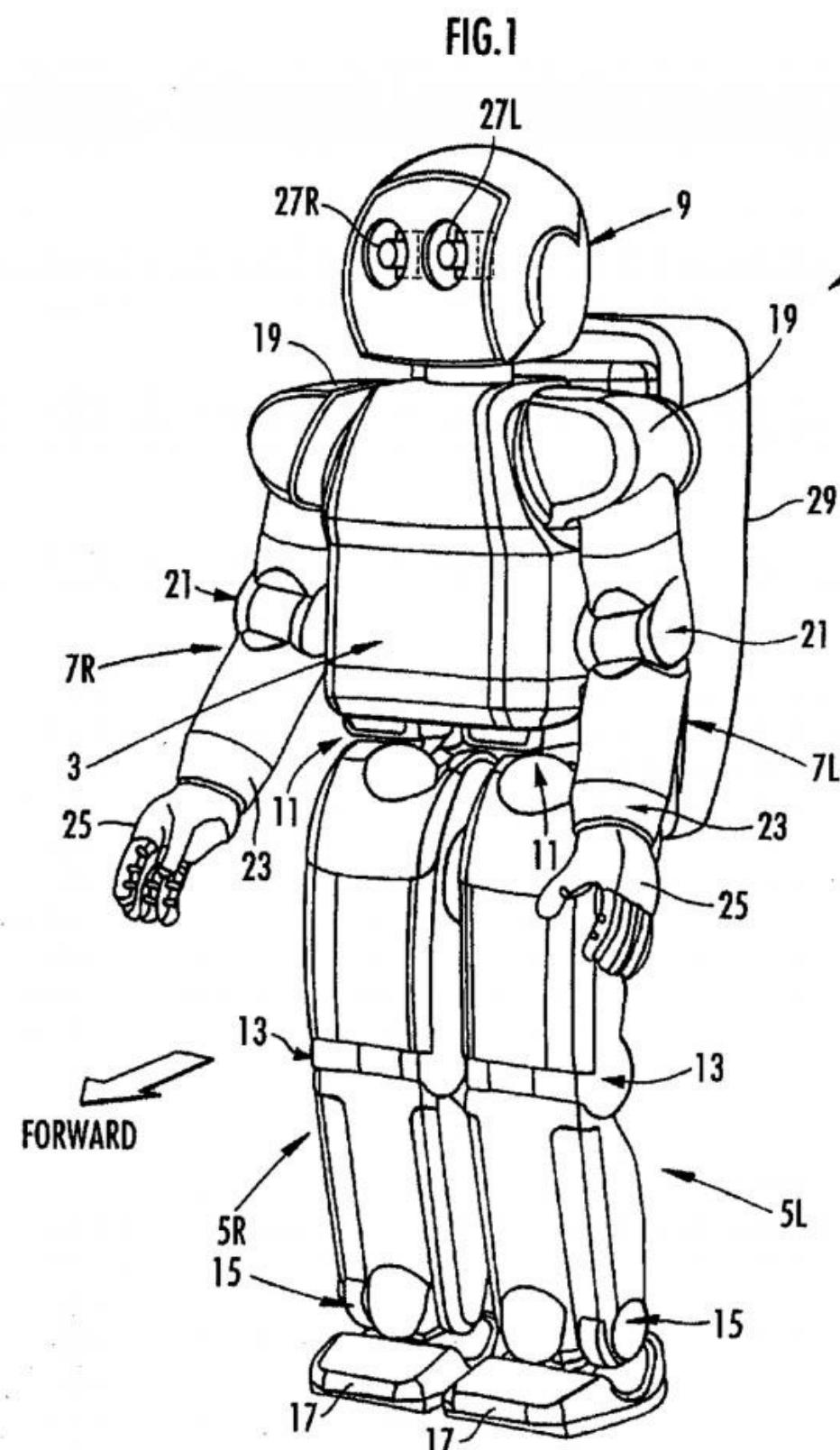


# FEATURES AND DEPENDENCIES: OBJECT MODELS

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- <https://assetstore.unity.com/packages/3d/props/interior/ygs-mugs-96665>
  - coffee mugs
- <https://assetstore.unity.com/packages/3d/props/interior/kitchen-props-free-80208>
  - mugs, plates, toaster
- <https://assetstore.unity.com/packages/3d/environments/fantasy/pirate-tavern-113463>
  - mugs, plates, etc
- <https://assetstore.unity.com/packages/3d/props/interior/props-for-the-classroom-5977>
  - classroom objects



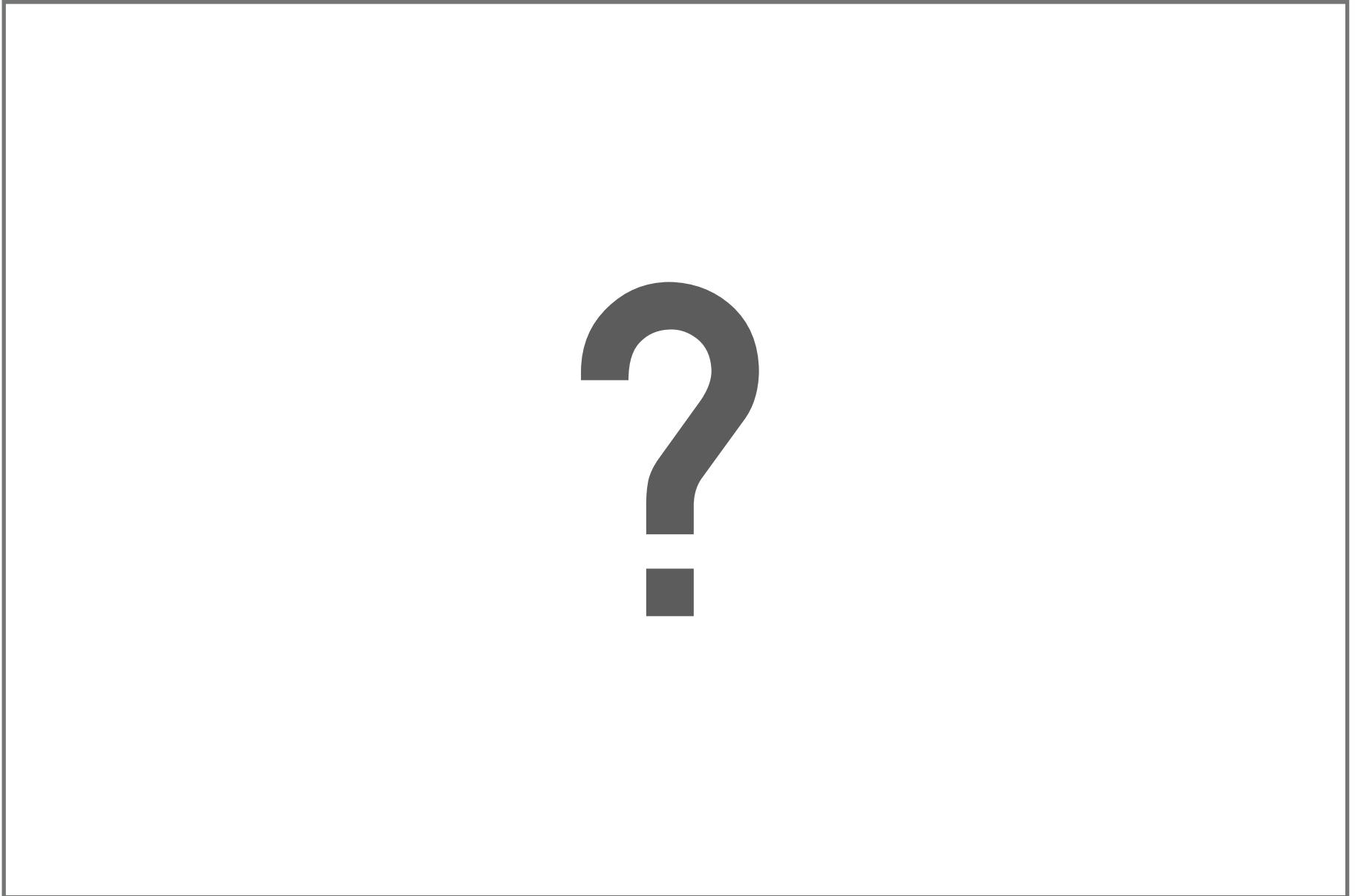


# USER TESTING AND FEEDBACK

# USER PERSONA AND NEEDS

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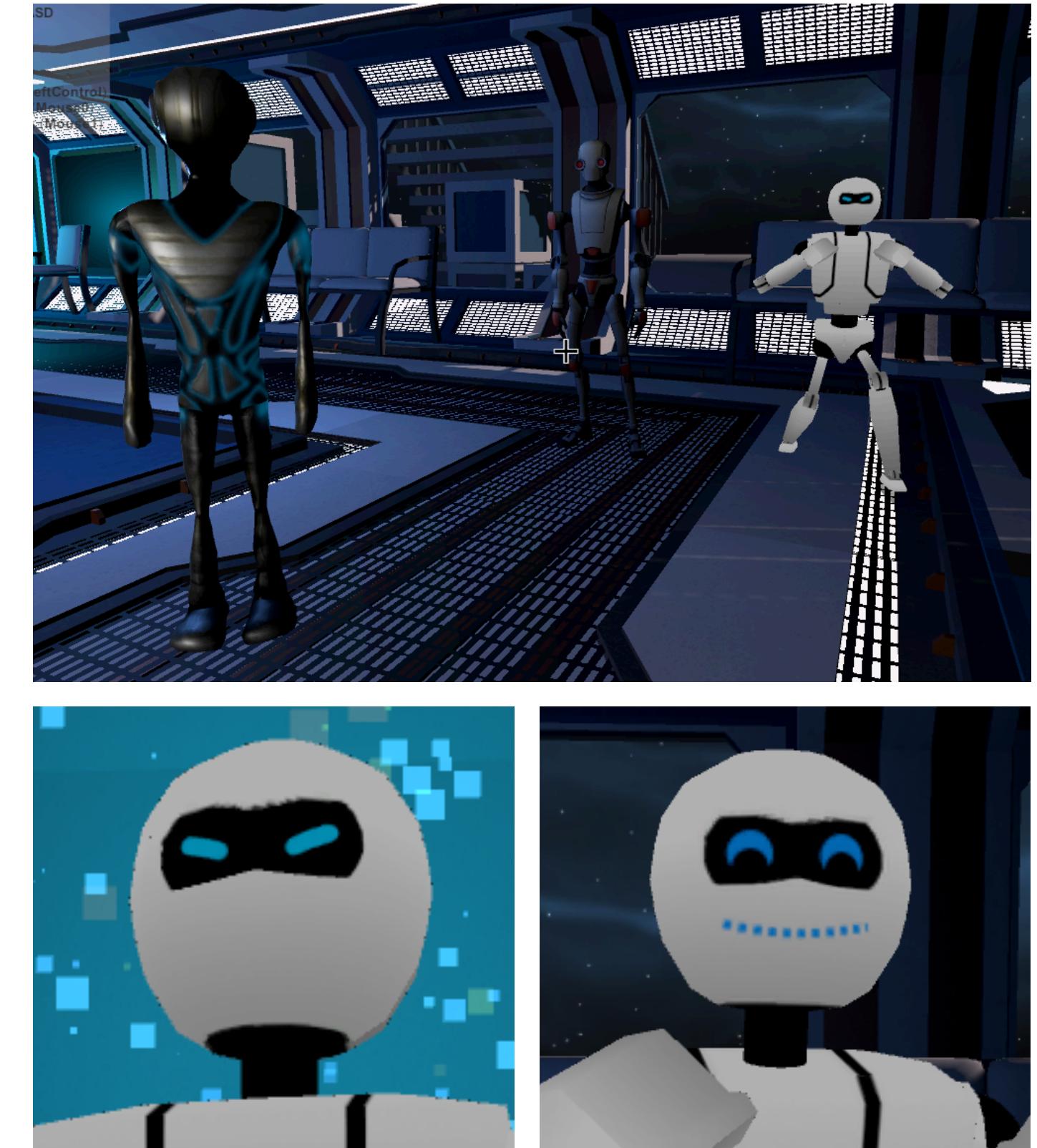
- (child) - ~7 yr old
  - Goals: have fun, learn a little
  - Experience: very little
  - Requirements:
    - Visually interesting for short-attention span
    - Possibly, ability to read prompts
  
- (adult) - ~30-40 yr old
  - Goals: laugh, quick in+out for game
  - Experience: moderate to high
  - Requirements:
    - Comical
    - Simple but entertaining game play



# USER TESTING RESULTS (RECORDED IN TIME ORDER)

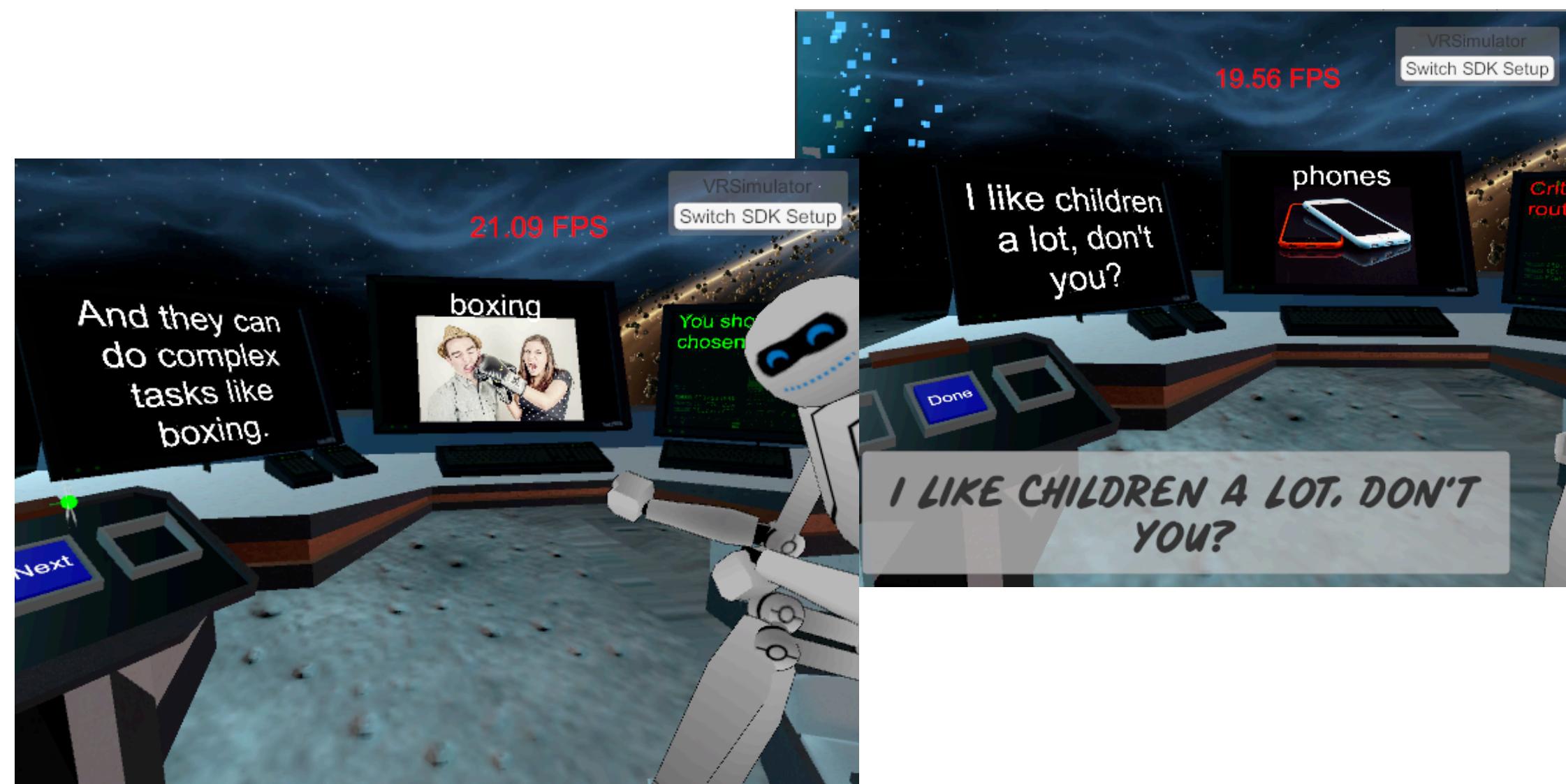
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- 7/6 - Child was tested with several robot appearances. She choose the white "toon" robot for primary use.
- Child user preferred "happy" toon face, so minor material updates were made to source robot.
- Child wanted to let each robot have a different name. This modification can be evaluated as a canvas on the robots, but will likely get scoped out due to time.



# USER TESTING RESULTS (RECORDED IN TIME ORDER)

- 7/8 - Adult play tested with dialog and initial comical sense of robots in different scenarios
  - results were very positive and encouraging
  - font and mild sarcasm was appreciated
  - additionally, "cartoon" nature of robot was appreciated and did not detract from the game
- 7/10 - Developed with a child, the reading/listening game should be fun for most
  - based on simple stories with silly substitution parts
  - simple textual and visual responses should make it easy to appreciate



# USER TESTING RESULTS (RECORDED IN TIME ORDER)

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# DELIVERABLE SCOPING (FULL LOG)

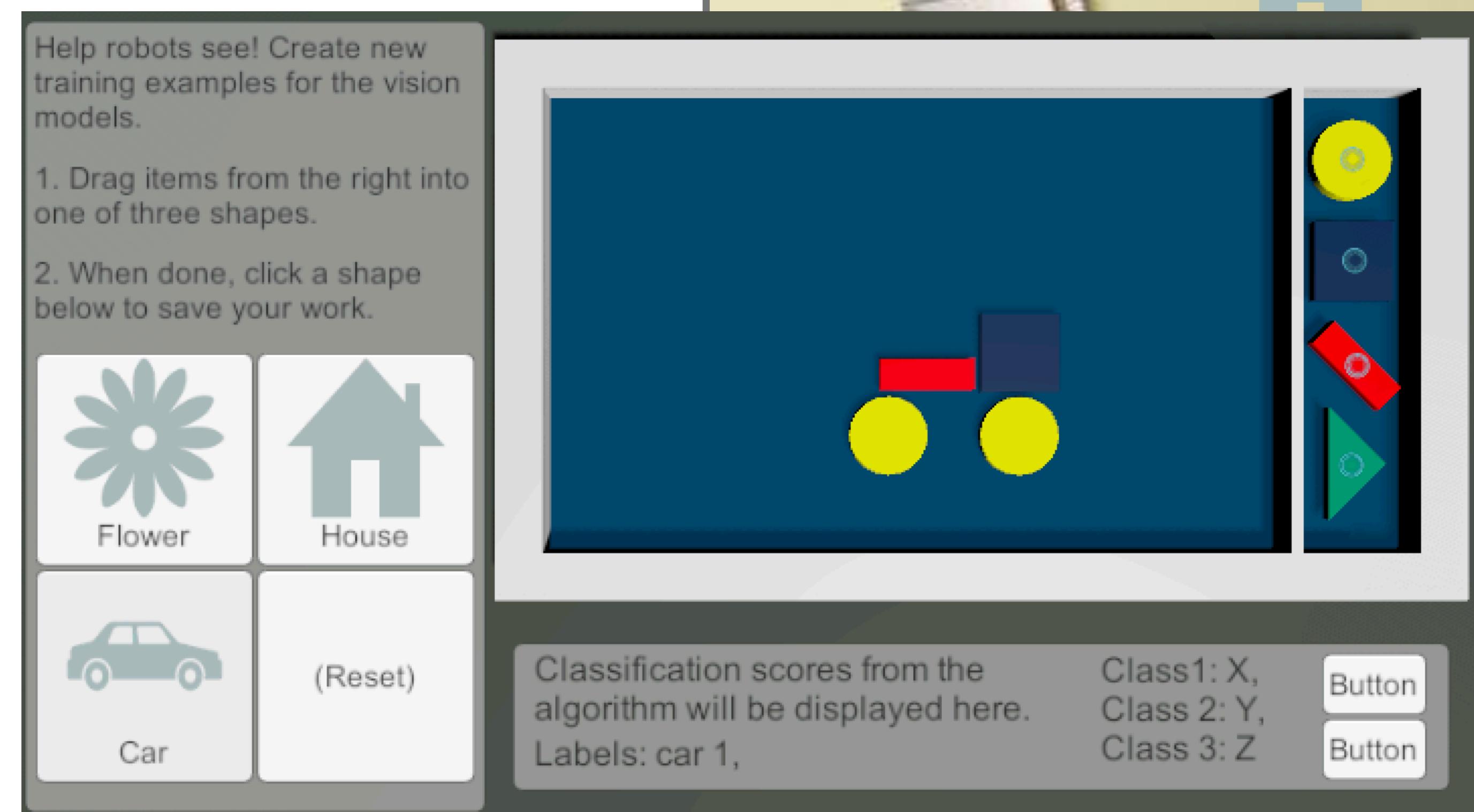
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- 7/5 - Created design docs (this log) and scoping
- 7/6 - Scene and environment scoping, after discovery of the stylized sci-fi module, it appears that environment creation time can be reduced.
- 7/6 - Kinematics for robotic actions
  - Kinematics for robot more challenging than suspected, a "follow IK" script is good example
  - Deferred: Initially kinematics for repeated actions will loop on one task, but eventually they should be programmatically conditioned
- Text-to-Speech and audio generation for robot speech will be deferred until almost the last point in the game; instead text captions will be used.
  - `AudioClip clip2 = Resources.Load<AudioClip>("Sounds/cube_up");`
- 7/8 - The dialog system appears to work well for showing robot conversations with triggers.



# DELIVERABLE SCOPING (FULL LOG)

- 7/8 - inspired by 2D drag+drop tutorial, created 2D tool to seed training and evaluation of seeing (primitive object task, below)
  - serialize to data that can be used for training
  - quick evaluation of interaction schemes with VR tools
- 7/10 - listening/reading was completed with simple button interaction as first pass
  - two stories currently included
- 7/10 - move to simplified IK task
  - make robot mirror person
  - goal is to create an object with robot instead of human alone
  - reduced scope of record+playback



# DELIVERABLE SCOPING (FULL LOG)

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- 7/11 - 2 stories for reading/listening is sufficient
- 7/11 - doing task has one food building right now, need to work on sync with robot IK interaction



# RUNNING TODO (FOR TRACKING)

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- Mirror capability for doing (track an object)
  - link created objects to IK iteration
  - fix floating objects
  - fix created objects
- Primitives for seeing track
  - basic shapes, snapping deposit location
  - display of status via GUI on adjacent screen
  - creation of buttons to submit and reset (trash?)
  - mode to "REPLAY" shapes for a database
  - stretch: mode to upload/retrieve shapes from online database
- Add some gaming capability (like stars in OSD, etc) for accomplishments and time to completion.
- Add intro panels and welcome package at beginning of game
- Stretch goal: enhanced dialog state system
- (possible) Improve story telling task - add 1-2 more stories
- Stretch goal: add speech recognition for listening task

