Technical English
Chapter Four

Augmented and Virtual Realities

In this chapter you will study

- ✓ Read about augmented and virtual realities
- ✓ Review vocabulary related to AR and VR
- ✓ Learn about making instructions about a process
- ✓ Listen to a talk about the application VR in education
- ✓ Learn to write paragraphs to describe a natural or man-made process
- ✓ Translate a text about AR

I. Tuning-in

Images below feature different technologies and tools in the fields of augmented reality (AR) and virtual reality (VR). Try to match each term from the box with the appropriate picture.

HUD eyeglasses
3D plura-view stereoscopic monitors
holographic display
VR HMD Virtual reality

1 ……4……

2. ……3……

3. ……1……

4. ……2……

II. Reading Selection
Augmented and Virtual Realities

- **Introduction**
- Advances in digital and computer technologies, over the past two decades, have significantly contributed to the design and development of tools and spaces specialized to perform tasks which were hard to be accomplished without IT. For instance, *simulating* flights in pilot training courses, 3D interior design, or different product promotion projects would have not been possible without the technologies that visualize virtual spaces (i.e., virtual reality) or enhance the physical world by adding virtual elements to it (i.e., augmented reality). Unlike augmented reality (AR), virtual reality (VR) *immerses* users into the virtual content enabling a really *vivid* experience. This, in effect, can cognitively engage users with such an experience. The more these realities get *entwined* in our everyday occupational, educational, and entertainment experiences, the more their relevant industries grow.

- Augmented and virtual reality system design and development can be appealing for software developers, system designers, computer experts, and programmers with a coding background, UX/UI design knowledge, and *ample* knowledge of programming languages for developing interactive experiences. In addition to sophisticated skills belonging to the field of computer engineering, developers need some knowledge of linear algebra and geometry. Generating VR/AR products, mainly 3D environments, usually involves two platforms: Unity and Unreal. The former usually requires C# and the latter needs C++ coding languages. It is important to note that engineers should differentiate between AR and VR systems they want to design prior to *embarking on* a strategy or development path. The remaining part of this chapter is dedicated to a discussion of the concepts of augmented and virtual realities and related hardware/software.

Augmented Reality

- Augmented reality refers to the enhancement of the elements that reside in the physical world by digital computer-based perceptual data to create an interactive experience that alters users' uptake of the real-world rather than completely replacing it with a simulated perception. Drawing on multiple sensory systems (i.e., *olfactory*, visual, auditory, and *haptic*), AR provides opportunities for partially *supplemented* experiences and blends real-time interaction and physical world with highly precise 3D virtual elements. Early generation of AR systems was primarily applied for military purposes and was later extended into the realms of entertainment, business, archeology, urban planning, architecture and design, language education, STEM education, industrial design and manufacturing, history, literature, medicine and healthcare planning, industrial design, commerce, and visual arts. Technically speaking, augmented reality is more than a mere overlay of information, it also encompasses "registration and tracking between the *superimposed* perceptions, sensations, information, data, and images and some portion of the real world" (emphasis added).

- In line with the advances in smartphone technologies, AR cameras and object recognition tools are integrated into portable devices enabling them to digitally *manipulate* and process data about different locations and spaces. The core components of any AR system (i.e., sensors, input devices, a processor, and displays) are integrated in today's smartphones and tablets. In addition to AR components integrated into the design of smart tools and technologies, there are standalone wearable and handheld tools and hardware for *rendering* supplemented reality such as head-up display (HUDs) eyeglasses or systems for car windscreens. Head-up display systems are *transparent* systems that render information at users' viewpoints without the need for looking away from the point they are looking at in the real world.

- For effective integration of real-world augmentations, AR devices need to be capable of image registration which is the ability to derive coordinates from the physical world without drawing on the camera. Built on video registration, an image which is known as an augogram is generated by the computer and applied to create the augmentation. Another essential requirement in AR is motion tracking which can be markerless or based on markers. In markerless tracking, physical world environments, elements, and their intersects are precisely detected by means of sensors. In the tracking strategy that relies on markers, visual cues are used as markers to trigger illustration of the virtual objects.

Virtual Reality

- Decades ago, virtual reality (VR) was more of a fantasy depicted in sci-fi movies and stories which largely formed *mainstream perceptions* about the virtual worlds. What was *foreshadowed* in these works is a *prominent* technology today and gets *hyped for* by means of *cutting-edge* widgets and software. It is generally believed that Palmer Luckey's of a VR headset *prototype* initiated the VR age in 2010s and *sparked* interests in VR technologies. Over the past decade, VR has significantly *evolved* parallel with a growing number of high-tech companies joining the *bandwagon* introducing toolkits ranging from smartphone-powered headsets to highly *sophisticated* gaming and video-generation equipment such as PlayStation VR.

The most crucial hardware *component* of many VR projects is a head- or helmet-mounted display (HMD). It is a headset similar to a very big pairs of *goggles* which is designed *consistent* with motion *tracking* technologies and gyroscopes developed primarily for smartphones. These include computer processors (essentially fast and lightweight), motion sensors, and HD screens (usually small) to display in a *stereoscopic* manner.

However, thanks to the virtual reality modeling language (VRML) introduced in 1994, not all VR are dependent on headsets. Building on VRML as the main framework, Web3D consortium, founded in 1997, proposed industry standards for 3D and X3D graphics to effectively distribute VR content on the Web known as WebVR that supports different types of VR kits (e.g., Oculus Rift) available in the market many of which are accessible to ordinary users for affordable prices. Google Cardboard, for example, enables users to experience VR through their smartphones. There is no doubt that VR technologies such as flight simulators have positively contributed to the development of different fields (e.g., aviation industry). Virtual reality should be distinguished from 360° reality which mainly refers to panoramic pictures and videos. In 360°, viewers do not have free movement to experience a real virtual world.

The Challenges and Threats

The Challenges and Threats

Studies suggests that playing *Pokémon Go* while driving has resulted in a disproportionate growth in the number of vehicular fatalities and crashes across the US. It has been observed that pedestrian's wearing HUD eyeglasses usually change *customize* and modify their surroundings to their preferences by erasing traffic signs or lines increasing the likelihood of having car crashes while walking on the streets. In addition to the threat associated with reality modification, privacy is a main concern in AR. Compared to augmented reality, VR entails more challenges specifically when users are underage and very young. In addition to the high risk of media violence, as suggested in different studies, feelings of deep immersion into the virtual world may result in young users "simultaneously holding the idea of the virtual world in mind while experiencing the physical world" (Wikipedia). In other words, there is a high risk of long engagement with a real world replicate, particularly using VR headset, compromising user's capacity to maintain reality.

II. Exercises

Reading Comprehension

A. Decide if the following statements are True, False, or Not Mentioned.

1. AR and VR design and development solely require specialized knowledge of coding and programming languages.	False
2. Virtual reality cameras can be used to create VR photography using 360° panorama videos.	Not mentioned
3. The use of VR is essentially entwined with head- or helmet-mounted displays.	False
4. In AR, the physical world is enhanced by adding virtual elements to the space.	True
5. Image registration stands for the act of generating augograms or coordinates from the physical world to create augmentation.	True

B. Answer the following questions based on the text.

1. Augmented reality refers to .....

a

a. the use of perceptual data to create an experience that completely supplements real-world.

b. the application of multi-sensory data to augment physical world with precise 3D elements.

c. transparent display systems which are used for manipulating and processing real-world data.

d. tracking physical world environments, elements, and their intersects by means of visual cues.

2. Which option is **TRUE** about virtual reality?

d

a) Palmer Luckey's of a VR headset prototype was the first attempt to conceptualize virtual reality.

b) In VR, information is overlayed through superimposing perceptions, sensations, information, data, and images.

c) VR visualizes highly sophisticated 360° panoramic pictures and videos for users.

d) VR content can be effectively distributed on the Web as well as head-mounted display devices.

3. The most serious challenges confronting VR include all of the following options **EXCEPT** .....

a. compromising users' reality maintainance

b. media violence

c. reallity modification

d. deep immersion in a real world replicate

4. İt can be inferred from the text that transparent HUD displays in cars render information at drivers' viewpoints to .....

a. decrease the likelihood of distraction while driving and possible accidents

b. enable them to customize the surrondings to their preferences

c. facilitate tracking and registration of virtual objects for them

d. simulate a more user-friendly driving experience

5. Which of the following options are **NOT** amongst the required knowledge areas for designing AR/VR products?

a. language programming

b. geometry

c. user interface design

d. contrastive pragmatics

C. Classify the following as linked in the passage to:

VR	AR	Both	Neither

1. Augography ..... AR .....
2. motion tracking ..... both .....
3. image registration ..... AR .....
4. C# and C++ coding languages ..... both .....
5. Flight simulation ..... VR .....

Vocabulary Practice

A. Match the words in the right columns with relevant equivalents on the left.

1. simulate ……d……
2. superimposed ……j……
3. entwine ……f……
4. relay ……h……
5. haptic ……i……
6. vivid ……g……
7. olfactory ……b……
8. perceptual ……c……
9. disproportionate ……e……
10. coordinate ……a……

a. transmitting and understanding information through touch
b. the sense of smell
c. related to the noticing ability
d. to create conditions or processes similar to something that exists
e. too large or too small in comparison to something else
f. twist together or around something
g. very clear, powerful, and detailed
h. to repeat something you have heard, or to broadcast a signal, message, or program on television or radio
i. articles designed to be used together and to attain their effect through pleasing contrast (as of color, material, or texture)
j. to put especially a picture, words, etc. on top of something else, especially another picture, words, etc., so that what is in the lower position can still be seen, heard, etc.

B. Fill in the blanks with the appropriate items. Make changes in words when necessary.

ample	render	compromise	realm	immerse
supplement	embark	integrated	consistent	hype

1. Unfortunately, what he is does is not ...consistent..... with what is says.
2. Only one year after the kickstarter business was highly ...hyped..... for in the media and newspapers, now sales are failing to match those heady expectations.
3. As stated in Cambridge English Corpus: "Vision is a mode of de-distancing that brings things that are not at hand nearer from their remoteness, and ..renders.. beings accessible even from afar."
4. There is ...ample..... evidence that economic prosperity highly promote satisfaction of people.

B. Fill in the blanks with the appropriate items. Make changes in words when necessary.

ample	render	compromise	realm	immerse
supplement	embark	integrated	consistent	hype

5. She was so ....deeply immersed... in writing her research paper that she did not understood how the time passed.
6. Vegetarians need to ...fill supplement..... their daily diets with iron and other nutrients.
7. Software systems that combine the most commonly used functions of different productivity software programs into one app are widely referred to as ...integrated..... software.
8. This gripping documentary investigates whether the company's determination to expand ....compromised.. safety and quality and dealt a hammer blow to its reputation

III. Language Focus: Instructions about a Process

- Knowing how to give instructions for different procedures and process is definitely a key skill for any computer engineers, scientist, system designer, and programmer. Instructions indicate how the audience need to perform a process. As processes are always integral parts of engineering, you need to know how to offer instructions on how to perform a machine or design software. Such instructions vary in form from individual phrases to longer language chunks. Regardless of their focus, comprehensive instructions about a process usually entail the following features:

- Transition words indicating steps and orders (e.g., first, second, then, afterwards)
- Imperative mode and in some cases statements
- Use of modals

Language Focus Exercises

Read the following sentences about earthquake formation process and arrange them into correct order using relevant transition words. Use transitions when needed.

- the seismic waves shake the earth as they get from the core of the earth to the surface
- the energy level grows up and causes tension in the tectonic plates
- the energy within the earth core builds up due to various moves in the earth crust
- that is when the earthquake takes place
- the pressure radiates outwards by moving the plates from each other

1. .....
2. .....
3. .....
4. .....
5. .....

Disassembling means parting different components of a computer from the system unit. Here are some beginning steps. Put these scrambled sentences into order. Use appropriate transition words.

a) Take out the side panels.

b) Wear an anti-static wrist strap to protect components by earthing your static electricity.

c) Take out the motherboard tray.

d) Turn off the computer and unplug all wires and cables connected to the tower.

e) Take out the screws on the back of the power.

f) Just like the side panels, the top panel slides off.

g) We have to unplug the fan from the motherboard, unscrew it from outside.

h) If there is a power switch on the back, switch it OFF.

1. ..d.. 2. ..h.. 3. ..e.. 4. ..a.. 5. ..f.. 6. ..b.. 7 ..g..

IV. Follow-Up Section

A. Complementary Reading

Read the following passage about the differences between augmented and virtual realities and fill in the blanks with relevant items.

~~overlay~~	associated	projects	~~scenarios~~	replicate
simulated	immerses	alternate	self-guided	supplements

Unlike VR that (1) ..immerses.. users into real-world (2) ..replicates.. or look-alike experiences, AR (3) ..projects.. non-real virtual elements into physical world. The interactive nature of these experiences makes them highly appealing for users. The reality in VR is mainly generated and (4) ..simulated.. by computer technology and is largely adopted in the movie and gaming industries as well as education and training such as in aviation, military, engineering, healthcare, and business. For instance, VR technologies provide opportunities for soldiers to be trained for different battle (5) ....scenarios

overlay	**associated**	**projects**	**scenarios**	**replicate**
simulated	**immerses**	**alternate**	**self-guided**	**supplements**

Augmented reality, similarly, moves beyond mere entertainment. Rather than placing the user in a completely virtual world, AR (6) ..supplements.. the physical world with virtual objects. Retailers, for instance, help their customers to easily visualize the product they are planning to buy using specific applications. These apps (7) ..overlay..... 3D images of the product (e.g., a wardrobe) they want to purchase onto customers' desired space (e.g., a bedroom). In addition to business, education, and entertainment, AR has been largely influential in tourism industry. Different historic sites offer applications that enable tourists to experience (8) self-guided walking tours as they gain information about the design, history, and architecture of the site.

- **B. Listening**

Scan the following QR codes and watch a TEDTalk lecture by Jessica Ochoa Hendrix talks about the potential of VR for helping middle school students to see themselves as scientists. Try to comprehend the lecture without activating the subtitles. Answer the questions based on the information you obtained. To check your answers, activate the English subtitles and watch the video again.

1. What Jessica's point in quoting Edelman's statement i.e., "you can't be what you can't see"? ……People……choose……their…job……without…knowing…anything…about them
2. What does the term "extended reality" refer to? …Combination…of…virtual…reality…and…physical world
3. Why one of the student's feedback really excited Jessica? ….they…seem…themselves…as scientist
4. What has been the main drive behind Jessica's conducting this project? ……
5. Academic research has shown that VR may lead to increases in ……learning…retention
6. How can the term "underrepresented in science" be defined based on this lecture? ……
7. In this extend reality program, Jessica and her teammates worked with teachers to ensure the program fits …seamlessly into the existing …curriculum
8. What are the main toolkits the students need to participate in the expedition? ……
9. Through digital journals, students .construct models based on hypothes: data.
10. Because of the importance of …repeated…exposu BioDive was constructed to ……5…class…period:
11. Student feedback gave Jessica's team ..concrete.. items ..build…in… to be sure that they were including student voices.
12. What are Jessica's suggestions for supporting students in exploring all of their desires with these eye-opening experiences? VR with inexpensive headsets

C. Presentation Project

- Augmented reality applications are of three types: pattern-based, location-based, and gesture-based. *Which one of these application types are more intricate and costly when it comes to software design?*

- Answer the above question from the lens of a computer scientist or engineer in one of the following ways and email the output to your instructor:

- An audio-narrated PowerPoint Presentation
- An audio-narrated screencast

- **D. Writing**

Computer scientists as well as hardware/software engineers are widely engaged in system design and development projects. As a part of these projects, design team members are required to write relevant and adequate descriptions of system procedures and functional processes. In other words, the ability to effectively describe a process is an essential writing skill for a software designer, system scientist, programmer, and/or engineer. Considering its importance, process description is one of the commonly used task type in Academic IELTS Writing Task 1.

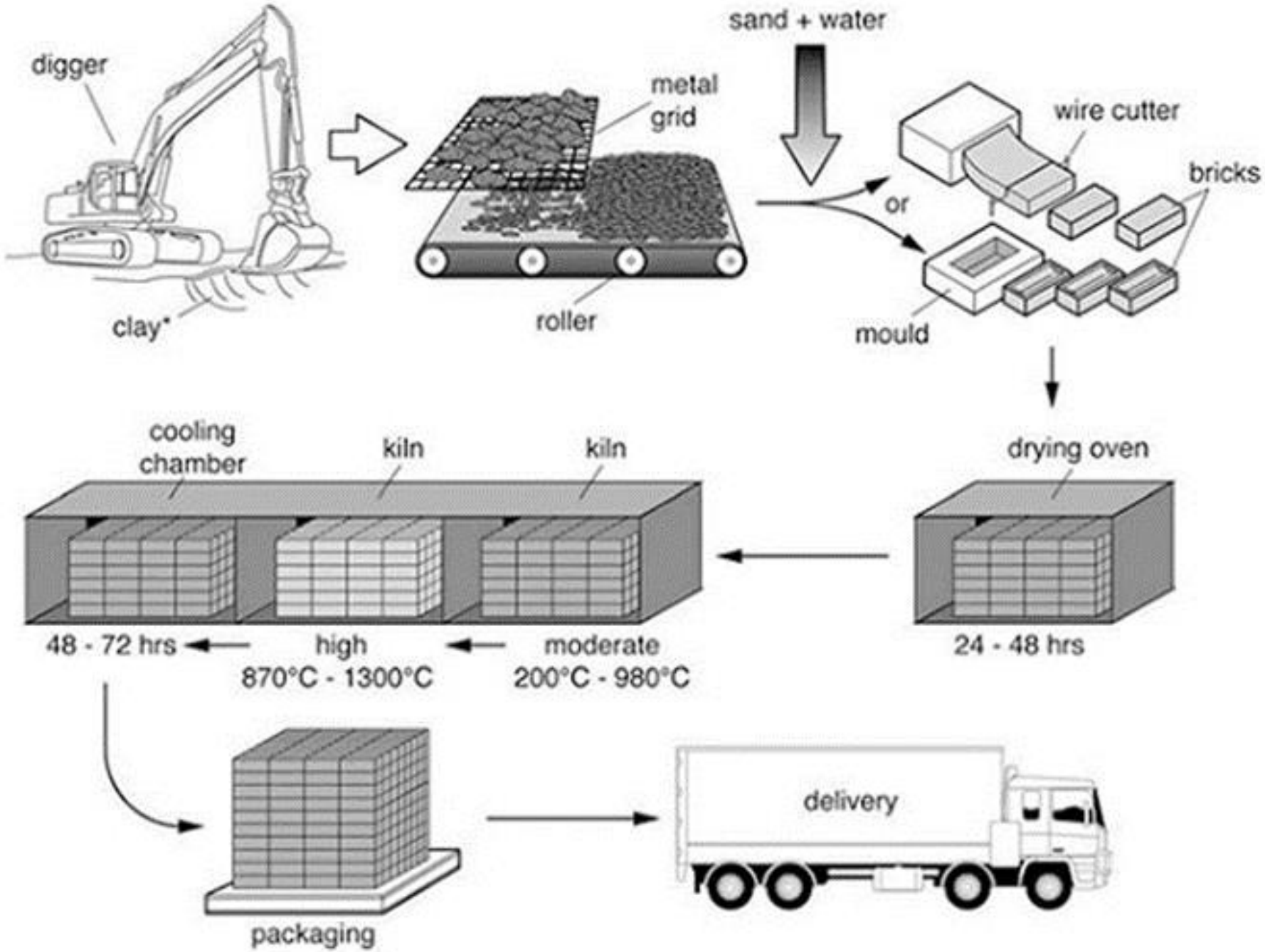
Writing

Processes can be natural or man-made. Describing either type requires similar writing skills. To effectively describe a process in writing, you need to follow the following steps:

1. First, make sure you completely understand the process and what it is all about. For this to happen, you need to find the beginning and the end of the process and learn about the stages involved. It is also important to understand how each stage is related to the preceding and following stages.
2. Second, you need to understand what are you expected to write. For this to happen, you need to analyze and paraphrase the question. Such questions usually contain two sentences: the first part describes the visual illustration and the second one highlights what the writer is expected to do, for example: The diagram shows the process by which honey is produced. Summarize the information by selecting and reporting the main features.
3. Write two general sentences that can be expanded into two paragraphs.

- Look at the following image from a **sample academic IELTS Task 1** about brick manufacturing process. Read the instruction and write a passage of at least 150 words. Once completed compare your writing with a sample answer on the next page.

- *The diagram illustrates the process that is used to manufacture bricks for the building industry. Summarize the information by selecting and reporting the main features and make comparisons where relevant.*


digger
clay*
metal grid
roller
sand + water
or
wire cutter
bricks
mould
drying oven
24 - 48 hrs
cooling chamber
kiln
kiln
48 - 72 hrs
high
870°C - 1300°C
moderate
200°C - 980°C
packaging
delivery

- **V. Translation**

- **Translate the following paragraph in fluent Persian.**
- Construct3D is based on the Studierstube system recently described by Schmalstieg et al. Studierstube uses augmented reality to allow multiple users to share a virtual space. We use see-through HMDs capable of overlaying computer-generated images onto the real world, thereby achieving a combination of virtual and real world, allowing natural communication among users. The latest version of Studierstube allows the mix and match of heterogeneous output devices such as personal HMD, virtual workbench, conventional monitors, and input through a variety of tracking devices. All these devices appear to act as interfaces to a single distributed system. The current version of Construct3D offers a basic set of functions for the construction of primitives such as points, lines, planes, cubes, spheres, cylinders and cones. Construction functions include intersections, normal lines and planes, symmetry operations, and taking measurements… Construct3D promotes and supports exploratory behavior through dynamic geometry, i.e. all geometric entities can be continuously modified by the user