CLAIMS:

1. A theme park attraction system comprising:

~~1.~~ a user interaction system comprising:

a camera configured to capture imagery of a reference element of a handheld object on a two-dimensional plane; and

an output device configured to output a user interactive experience;

a projected location determination system communicatively coupled to the user interaction system, wherein the projected location determination system comprises~~:~~

~~translation logic configured to~~ a controller having one or more processors and a memory, the memory storing machine-readable instructions configured to cause the one or more processors to: determine one or more translation factors representative of a difference in location between a calibration location and an initial location of the reference element on the two-dimensional plane captured in the imagery;

~~scaling logic configured to~~ determine one or more scaling factors correlative to a user arm length based on the imagery; ~~and~~

~~a controller having a processor and a memory, the memory storing machine readable instructions configured to cause the processor to:~~

determine a current location of the reference element on the two-dimensional plane captured in the imagery;

determine a projected target location of the handheld object based on the current location of the reference element, the one or more translation factors, and the one or more scaling factors; and

instruct the output device to output the user interactive experience in response to determining that the projected target location corresponds to a target location.

~~2.~~

2. The theme park attraction system of claim 1, wherein the ~~translation logic~~

~~is~~machine-readable instructions are configured to cause the one or more processors to determine the one or more translation factors and the one or more scaling factors based on a first image of the imagery.

~~3.~~

3. The theme park attraction system of claim 2, wherein the machine-readable instructions are configured to cause the ~~processor~~ one or more processors to determine the current location of the reference element based on a second image of the imagery.

~~4.~~

4. The theme park attraction system of claim 1, wherein the one or more translation factors ~~are configured to~~ compensate for a difference between a user perception ~~as to~~of where the handheld object is pointing in three-dimensional space and a corresponding location of the reference element in the two-dimensional plane.

~~5.~~

5. The theme park attraction system of claim 1, wherein the one or more scaling factors ~~are configured to~~ compensate for differences in user arm lengths.

~~6.~~

6. The theme park attraction system of claim 1, wherein the ~~scaling logic is configured~~machine-readable instructions are configured to cause the one or more processors to determine the one or more scaling factors based on the location of the reference element on the two-dimensional plane.

~~8.~~

7. The theme park attraction system of claim 1, wherein the ~~scaling logic is~~machine-readable instructions are configured to~~:~~

cause the one or more processors to: determine a user height based on the location

of the reference element on the two-dimensional plane; and

determine the user arm length based on the user height.

9.

8. The theme park attraction system of claim 1, comprising arc distortion compensation logicwherein the machine-readable instructions are configured to:

cause the one or more processors to: determine one or more offsets based on the projected target location and one or more polynomial equations; and

apply the one or more offsets to the projected target location, wherein the machine-readable instructions are configured to cause the processor to; and instruct the output device to output the user interactive experience in response to determining that the

projected target location corresponds to a target location on the two-dimensional plane after applying the one or more offsets to the projected target location.

~~10.~~

9. The theme park attraction system of claim ~~9~~8, wherein the one or more offsets ~~are configured~~ to compensate for a difference in shape between an arcuate nature of an arm movement of a user and the two-dimensional plane.

10. The theme park attraction system of claim 8, wherein at least one of the one or more polynomial equations is of a third order.

11. A system comprising:

~~11. The theme park attraction system of claim 9, wherein one or more polynomial equations are of a third order.~~

~~12. A target tracking system for an interactive experience, the target tracking system comprising:~~

~~translation logic~~one or more processors; and

a memory storing machine-readable instructions configured to cause the one or more processors to:

determine one or more translation factors representative of a difference in location between a calibration location ~~displayed~~ on a two-dimensional plane and an initial location of a reference element of a handheld object in a first image ~~when pointing to the calibration location~~ on the two-dimensional plane;

~~scaling logic configured to~~ determine one or more scaling factors correlative to a user arm length based on the first image; ~~and~~

~~a controller having a processor and a memory storing machine readable instructions, wherein the machine readable instructions are configured to cause the~~

~~processor to:~~

determine a current location of the reference element in a second image on the two-dimensional plane;

determine a projected target location of the handheld object based on the current location of the reference element, the one or more translation factors, and the one or more scaling factors; and

output a user interactive experience in response to determining that the projected target location corresponds to a target location.

~~13.~~

12. The ~~target tracking~~ system of claim ~~12~~11, wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine a transformation matrix comprising the one or more translation factors and the one or more scaling factors.

~~14.~~

13. The ~~target tracking~~ system of claim ~~13~~12, wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine the projected target location of the handheld object by applying the transformation matrix to the current location of the reference element.

~~15.~~

14. The ~~target tracking~~ system of claim ~~12~~11, wherein the one or more translation factors comprise a horizontal component, and wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine the horizontal component based on a horizontal difference between the calibration location and the initial location of the reference element.

~~16.~~

15. The ~~target tracking~~ system of claim ~~15~~14, wherein the one or more translation factors comprise a vertical component, and wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine the vertical component based on a vertical difference between the calibration location and the initial location of the reference element.

~~17.~~

16. The ~~target tracking~~ system of claim ~~12~~11, wherein the one or more scaling factors comprise a horizontal component, and wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine the horizontal component based on the user arm length.

~~18.~~

17. The ~~target tracking~~ system of claim ~~17~~16, wherein the one or more scaling factors comprise a vertical component, and wherein the machine-readable instructions are configured to cause the ~~processor~~one or more processors to determine the vertical component based on the user arm length.

18. A method comprising: receiving a calibration location on a two-dimensional plane;

~~19. A method of providing an interactive experience comprising:~~

~~receiving a calibration location on a two-dimensional plane;~~

receiving an initial location of a reference element of a handheld object on the two-dimensional plane captured in imagery;

determining one or more translation factors based on the calibration location and the initial location of the reference element;

determining one or more scaling factors based on the initial location of the reference element;

~~determine a~~determining a current location of the reference element on the two-dimensional plane captured in the imagery;

determining a projected target location of the handheld object based on the current location of the reference element, the one or more translation factors, and the one or more scaling factors; and

outputting a user interactive experience in response to determining that the projected target location corresponds to a target location.

~~20.~~

19. The method of ~~providing an interactive experience of~~ claim ~~19~~18, wherein determining the one or more translation factors is based on a difference between the calibration location and the initial location of the reference element on the two-dimensional plane.

~~21.~~

20. The method of ~~providing an interactive experience of~~ claim ~~19~~18, comprising determining a user height based on the initial location of the reference element.

~~22.~~

21. The method of ~~providing an interactive experience of~~ claim ~~21~~20, comprising determining a user arm length based on the user height.

~~23.~~

22. The method of ~~providing an interactive experience of~~ claim ~~22~~20, wherein

determining the one or more scaling factors is based on the user height.

23. The method of claim 21, wherein determining the one or more scaling factors is based on the user arm length.