

MotionBeam

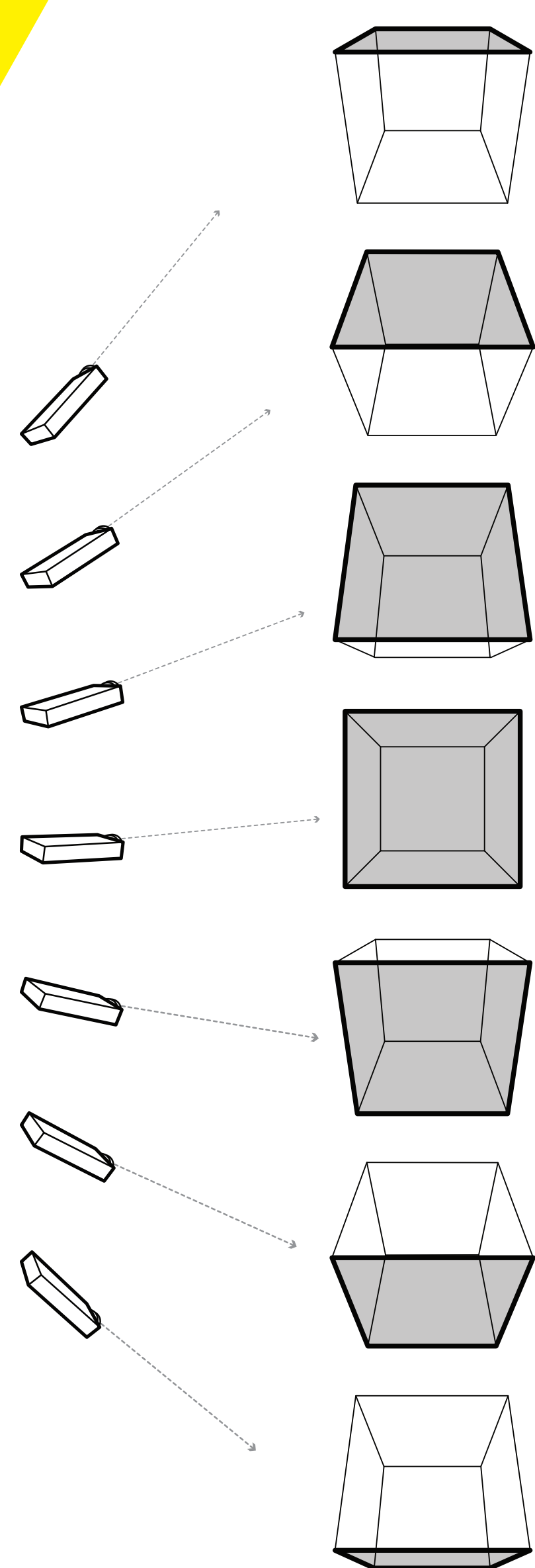
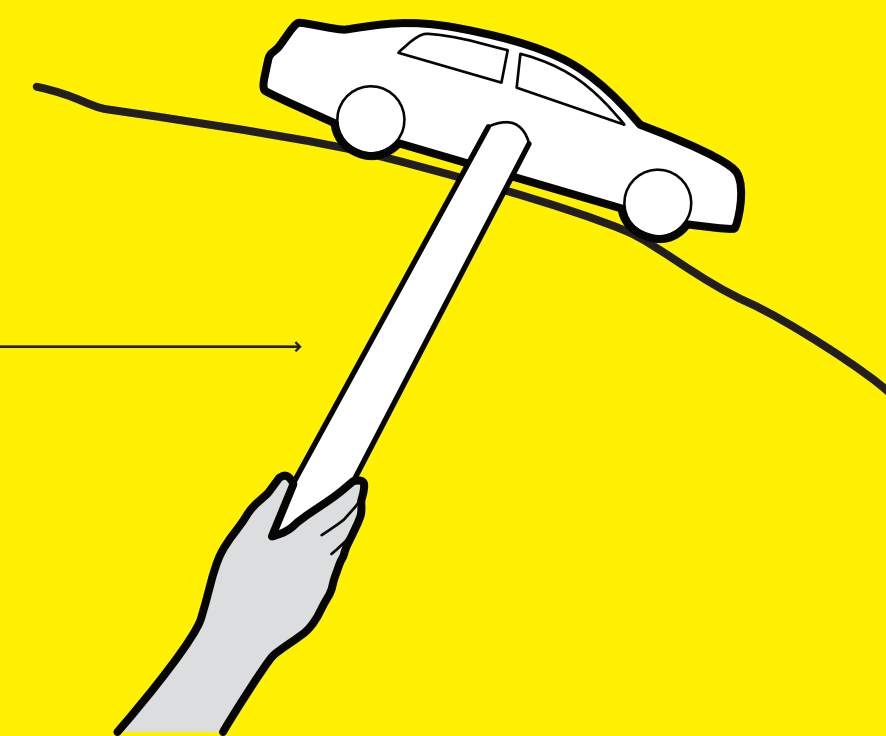
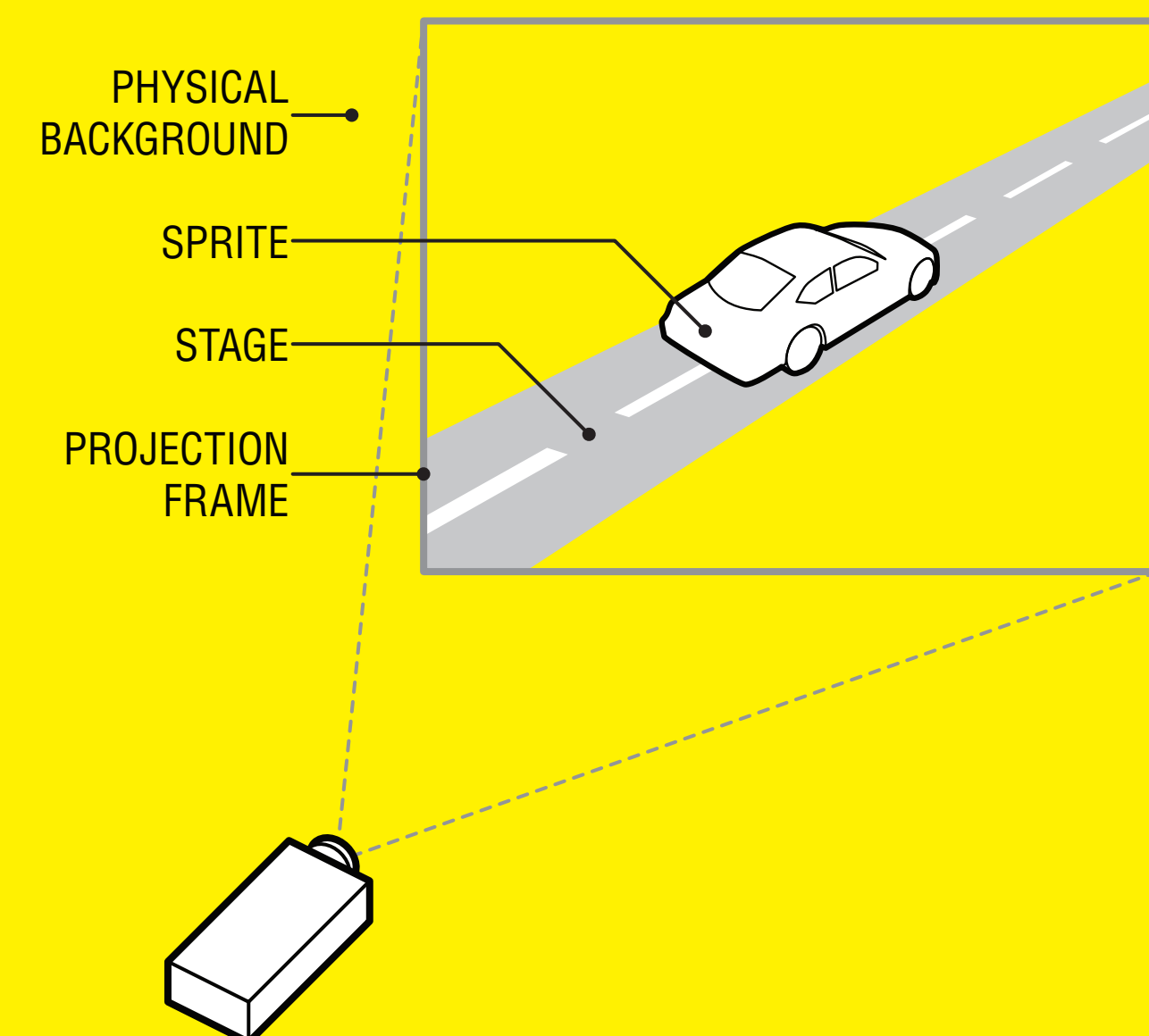
Designing for Movement with Handheld Projectors

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Our research explores how handheld projectors can be combined with sensing technology to interact with imagery in new ways and create new interactive experiences. By projecting personal imagery into public space, handheld projectors offer a unique opportunity to directly augment the surrounding environment and foster new forms of social interaction. However, a major challenge when working with handheld projectors is to design for physical movement of the device and the general problem of a moving projection frame.

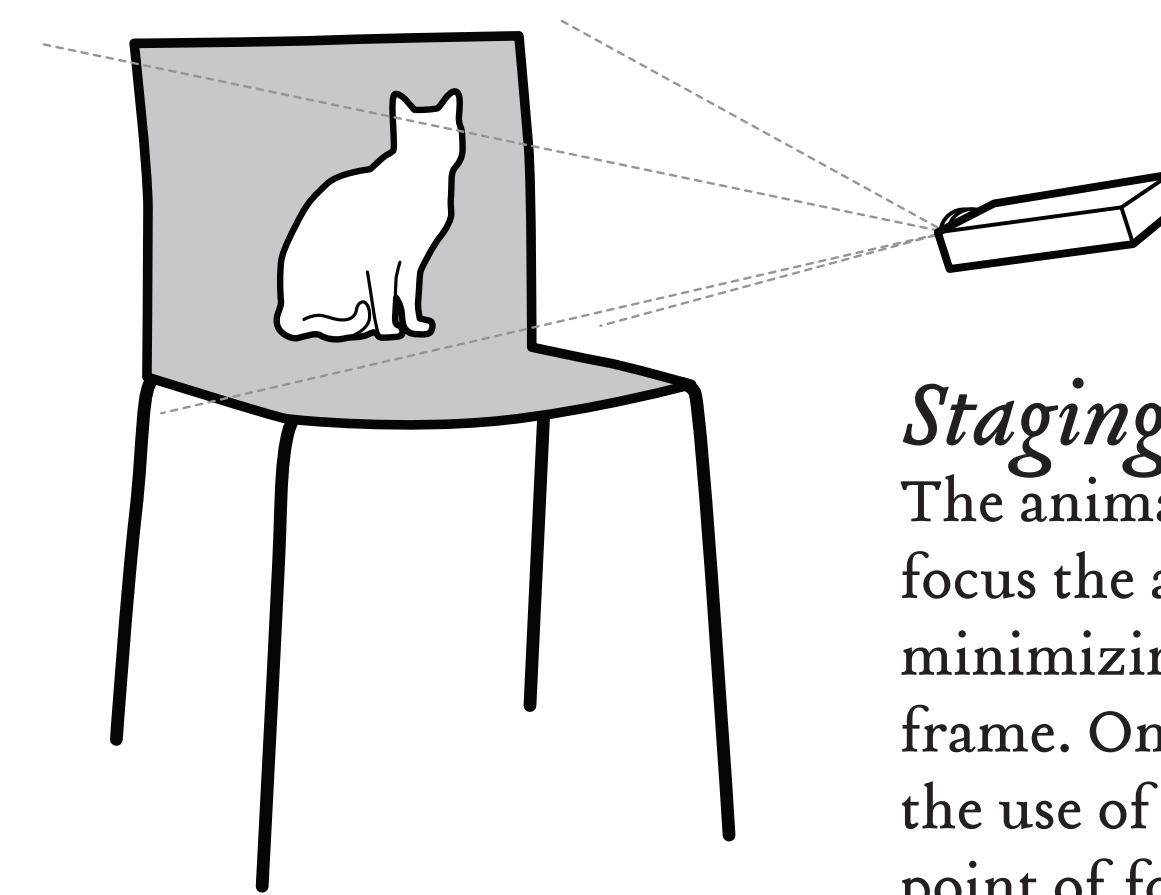
We introduce a novel interaction metaphor to utilize the physical movement of the handheld projector. Our approach focuses on the perceived movement of a projected foreground object across a physical background. We label the interaction metaphor *MotionBeam*, as the object behaves as if it is tied to the middle of the projection frame by a virtual 'beam'. An example of this is a car driving along a road; in 2D animation terminology the foreground object (the car) is known as a sprite, and the background (the road) is called the stage. The sprite object remains relatively static with the primary motion being that of the projection frame across the physical background.

In this poster we illustrate a number of techniques for implementing the *MotionBeam* metaphor based on the principles of traditional animation and sequential art. We are currently using the *MotionBeam* metaphor to create an interactive projected character that can be controlled with gesture and full body movement.



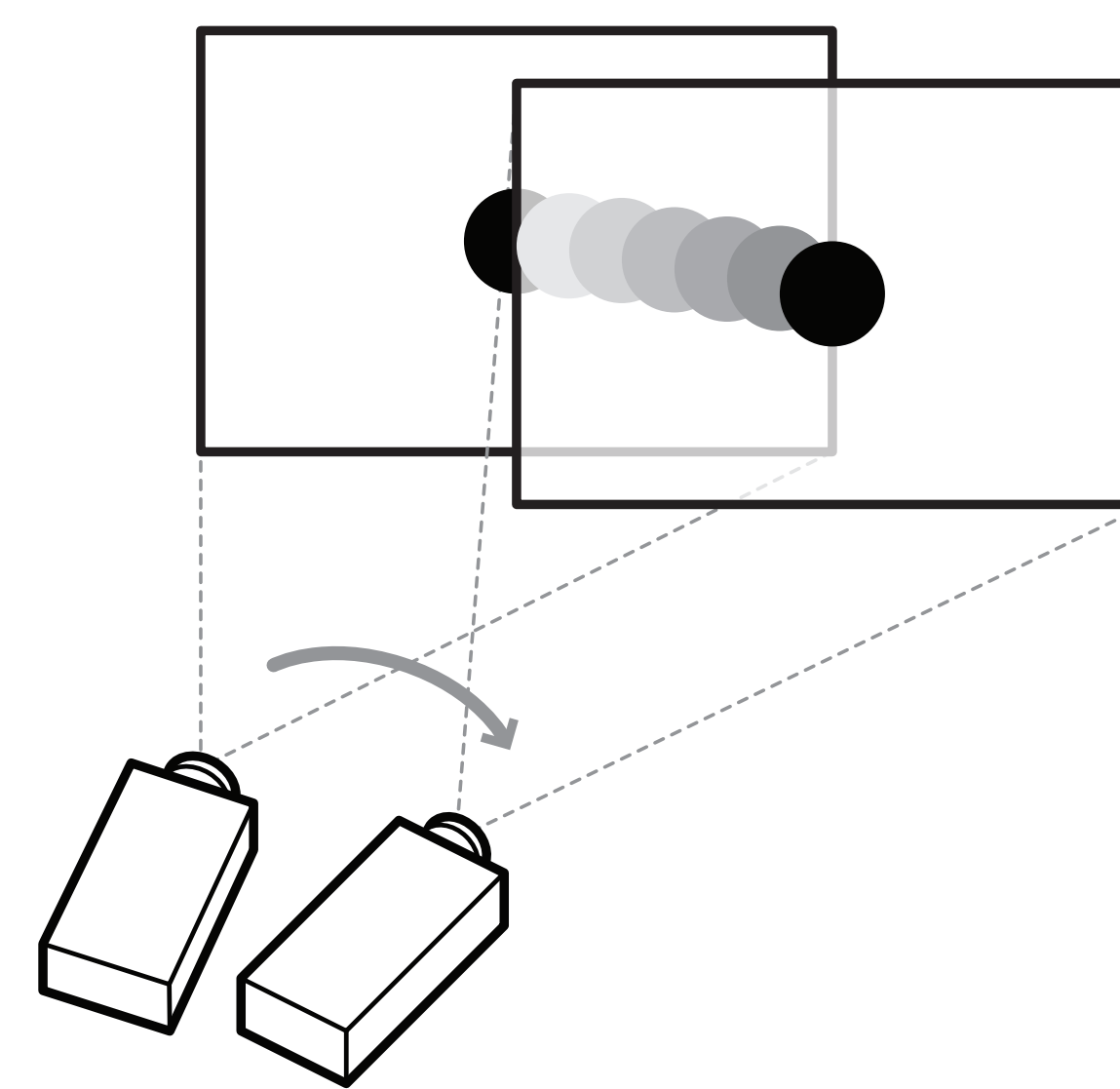
Perspective

Real-world perspective can be linked to sprite perspective by changing the viewing angle of the sprite to match the angle of projection. For example when projecting a 3D cube, pointing the projector to the ground displays the top of the cube; pointing the projector to the ceiling displays the bottom.



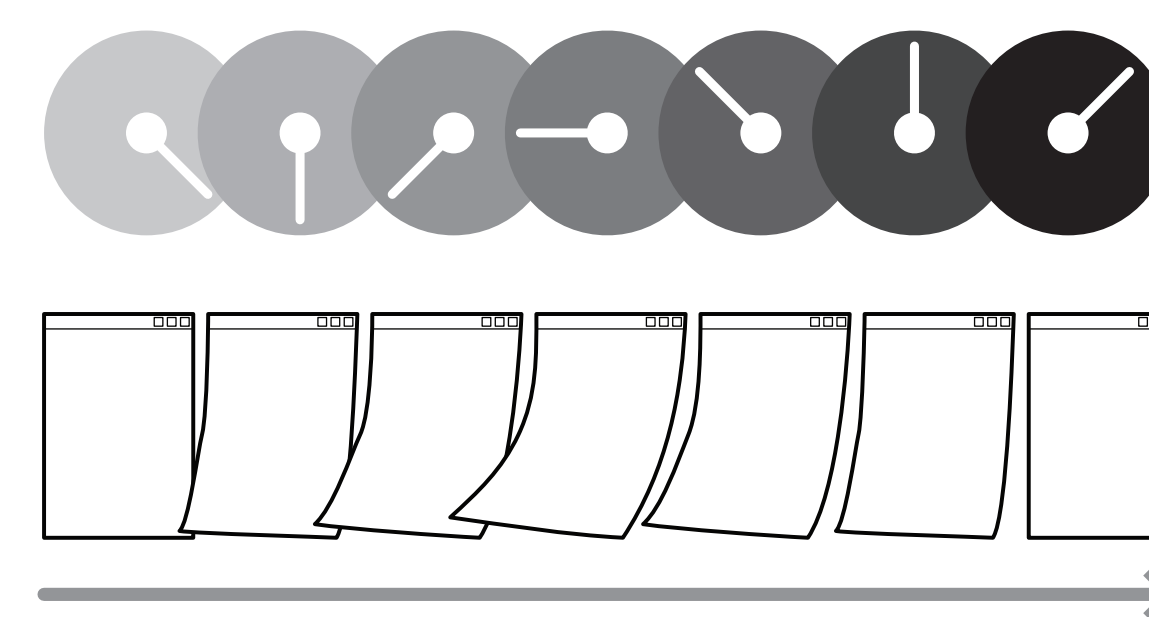
Staging

The animation principle of staging aims to focus the attention of the audience by minimizing other distractions in the frame. One important aspect of staging is the use of silhouette to highlight the main point of focus. To create the illusion of a sprite object existing unframed on the physical background, sections of the stage can be left black.



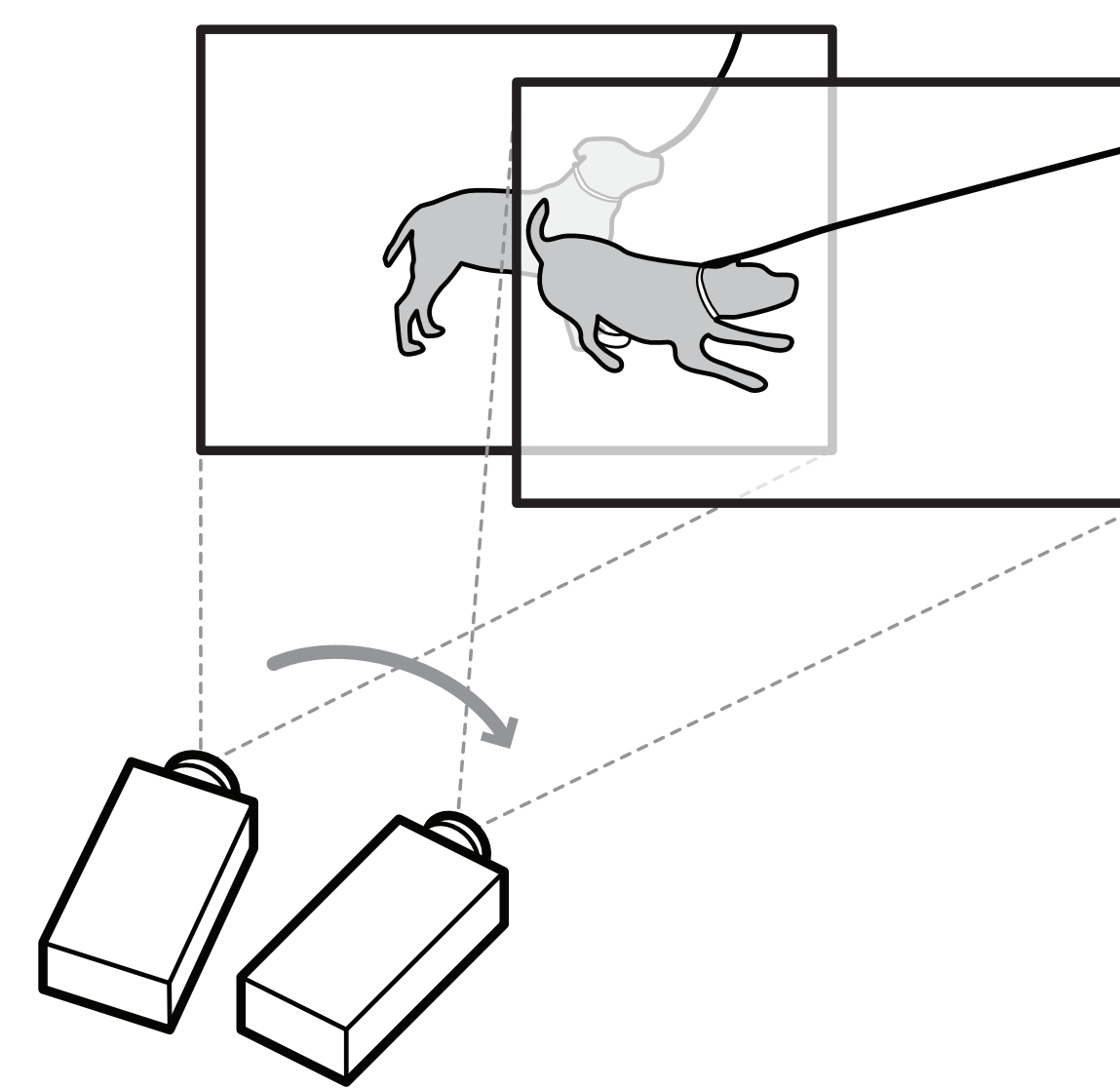
Movement

Movement can be emphasized using graphic art techniques such as zip ribbons, multiple images, and streaking/blurring. When dealing with a moving projection frame the sprite object is fixed to the middle of the frame and trails depicting movement are created on the opposite side from the direction of movement. By moving the projection frame from left to right, this creates a trail of images seeming 'left behind' from the previous position.



Animate

Sprite objects can be animated according to the heading and speed of the handheld projectors movement. For example, a wheel should turn in the correct direction and at the appropriate speed. The classic animation principle of squash and stretch can be used to deform the object in a convincing way according to heading and speed.



Physics

Physical properties such as friction, springiness, and gravity can be depicted by temporarily moving the sprite away from the middle of the projection frame. For example, sprite objects can create a feeling of resistance by moving in the opposite direction from the projection frame.



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The initial implementation of our ideas has focused on the interaction design for a projected character. Interaction with a character provides an ideal scenario to further explore the *MotionBeam* metaphor and the broader language of interaction with handheld projectors.

