

The Language of Motion: A Taxonomy for Interface

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Abstract. This project presents a taxonomic tool for designing with motion. Paul Klee dedicated his life to the study and teaching of motion. "I should like to create an order from feeling and, going still further, from motion." [1] The natural state of interaction with digitized information includes motion. Our human brains have evolved physiological systems and organic structures that respond instinctively, tuned to organic motion. This human bias toward organic, natural motion presents opportunities for the use of motion in interfaces. Using motion in computing devices inspired by the natural world will create deeper, more emotionally engaging experiences. This study focuses on understanding the basic elements of motion in order to use it as a component in the design of digital interfaces. It presents a taxonomy of motion with the goal of describing fundamental qualities of motion used in the 2-dimensional, framed space of a screen: screen position, direction, principles, attributes and the resulting behaviors that can be created using them. The documentation presented defines a language for motion in interface. The taxonomy was built on discrete gestural motion videos taken from nature. The video segments are limited to short motions that show a complete but definable idea. The videos tend to be a few seconds in length though a few of them take several seconds to complete their motion idea.

Keywords: Dynamic media, motion design, motion, interface, screen area, direction, principles, attributes, behavior, taxonomy.

1 Why Understand Motion?

This project emerged from a desire to use motion as an element in my own interface design practice. Motion in this case meaning motion within the framed space of the screen. The screen does not move, as a camera might move with the action in a film. Certain kinds of motions have long been used in interfaces to indicate functions taking place: progress bars to indicate a process is under way, for example.

A while ago, a web-based product development application that I was designing, calling for information displayed in three levels of detail, posed a problem difficult to address with static tools. The display required areas showing complete detail, partial detail and abbreviated detail, a level that displayed no more than an indication of change in a database. Most data sources in this application used a numerical chart that changed by incrementing numbers to indicate changes in the abbreviated level data. If the data source had many changes, the motion of the incrementing numbers made the

change visible. During periods when few updates were entered in the database, the numerical value change was the only indication that activity was taking place in that data source. As an information display, it was easily overlooked. Motion of some sort seemed a natural fit to express the idea of change taking place in the database; difficult to address using the tools available at that time.

1.1 Motion Exists in Time

Time permits the perception of motion. In “From Eternity to Here,” [2] Sean Carroll defines time as an increment, a definable point, and a medium through which we move.” On planet earth we count time as a fragment of each daily revolution. Visualizing the passing of increments can show time as we conceive of it.

The human perception of time is influenced by psychological perspective more than rational perception. Another approach for visualizing time is by interval. Rather than counting durations into smaller slices, relationships of intervals compared against a mean or against other intervals shows time through intersection or separation of motions. By considering intervals in relation to each other, a different kind of information about time may be communicated that expresses the human perception of time in the communication experience of the interface.

2 The Essential Four Components

Four components define the essential definitions within the taxonomy. Screen position and the direction of motion comprise the obvious areas to start defining screen motion. Principles and Attributes refine and enrich motion messages.

2.1 Screen Position

Screen position refers to the area or areas of the screen where motion occurs. As with any interface, distribution of screen elements allows content and control areas to be easily distinguished.

Screen. The placement of motion as meaningful elements would take advantage of screen area to refine the meaning of those motions. The screen will contain areas where motion is located and in most cases, still areas. Moving spaces on the screen can be categorized. Motion may be localized to an area, may cover the whole screen, several areas or it may move from quadrant to quadrant. The motion may occur along the edges or take place in the center.

Whole screen

Part of screen

Center of screen

Edges of screen



Fig. 1. Whole screen



Fig. 2. Part of screen (bottom edge)

Screens of today cover a wide range of sizes and styles. Preference here was given to breaking the screen into thirds, allowing the definition of multiple areas within the videos. Limiting the number of areas maintains simplicity when analyzing the motion videos. This taxonomy does not differentiate for the screen size. In practice, a larger screen might be broken down into more areas. This analysis looks at the screen cut into thirds horizontally, vertically, in dimension on the z-axis and at geometric shapes that motion can take on the screen.

Position

- Left, center, right
- Top, middle, bottom
- Foreground, middle ground, background



Fig. 3. Position: left, center, right

Geometric shapes

- Oblique Square Triangle
- Circle Spiral Radial

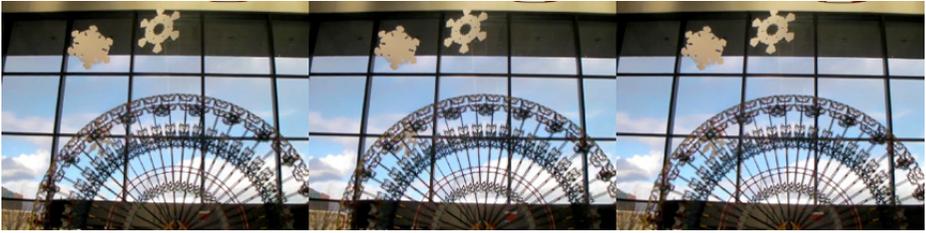


Fig. 4. Shape: circle

2.2 Direction

Motion implies direction. Regardless of the amount of space motion takes up on screen, or its speed, it will have a direction within the frame. Direction pertains to the orientation of the motion relative to the screen: up, down, left, right, toward, away from, at diagonals, concentric (toward center), eccentric (away from center); straight or turn; variables within direction; and combinations of the above.



Fig. 5. Direction: Right



Fig. 6. Direction: Left



Fig. 7. Direction: Away

2.3 Principles

In design as visual language, we use principles to allow us to isolate ways of identifying visual components into definable abstract ideas. Principles reflect back to the basic design theory: rhythm, texture, pattern, contrast, repetition, that may be stationary or moving, and sequence, interval, velocity, synchronization, pace, transition, etc. that require change over time to reveal themselves.

Identifiable sequences described as principles can be applied to still or mobile examples equally well. When the element of time is part of the example these principles become the building blocks for motion ideas used to create visual communication.



Fig. 8. Principle: contrast of direction



Fig. 9. Principle: texture

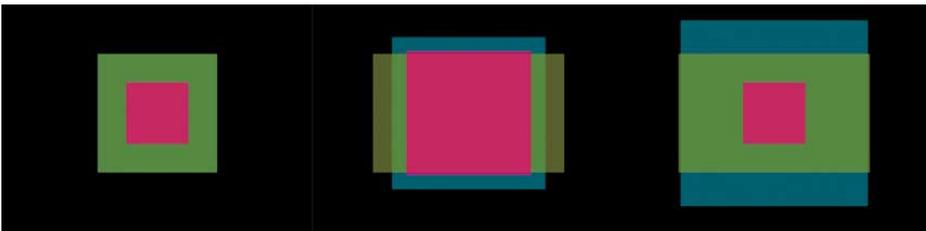


Fig. 10. Principle: interval

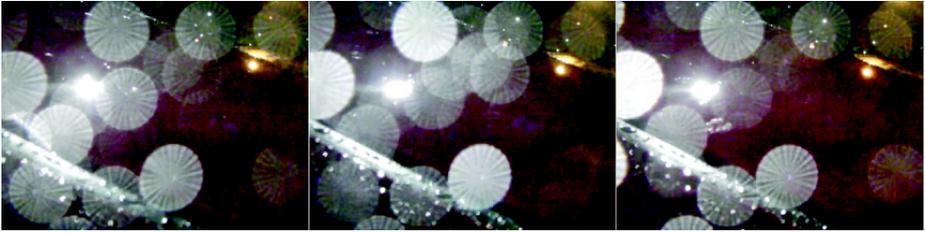


Fig. 11. Principle: pattern



Fig. 12. Principle: synchronous



Fig. 13. Principle: asynchronous

2.4 Attributes

Attributes to address the quality of the motion as it appears. Attributes exist in oppositional pairs. The quality of motion on the screen manifests in multiple ways. Understanding the attributes benefits when they are evaluated in contrast with opposite attributes.

Oppositional pairs:

- Proximity: together, apart
- Density: consolidated, dispersed
- Depth: pass in front, behind
- Distance: near, far away
- Quantity: single object, multiple objects



Fig. 14. Attribute: single object, multiple objects

- Scale: toward, away from
- Coincidence: before/after, during/simultaneously
- Size: large elements, small elements move
- Speed: fast, slow

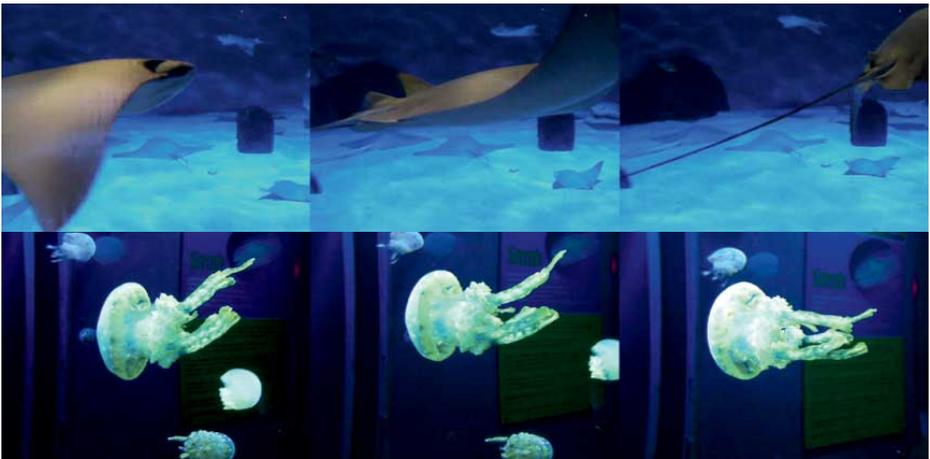


Fig. 15. Attribute: fast, slow

- Noticeability: obvious, subtle
- Change: change of focus, direction, quantity, ...
- Causality: cause, effect



Fig. 16. Attribute: obvious, subtle



Fig. 17. Attribute: cause and effect

3 Behavior

In the world, behaviors communicate intention and physical non-intention, or the logical conclusion of a gestural arc. Motion with meaning on screen can be defined as behavior. Something that goes from top of the screen to stop at the bottom is falling. The characteristics of its landing tell much about the quality of that fall. If the same thing travels from the top to the bottom of the screen and springs back up to the top, it would be bouncing. How those behaviors become articulated in an information system results in the user's understanding. Fall and bounce carry different connotations.

To create behaviors, combining elements from the essential four parts of the taxonomy builds behaviors. Richer dimension to the types of motions created with the understanding of these categorical definitions allow interface designers to mix motions without relying on narrative to create meaning within their products.



Fig. 18. Behavior: wave



Fig. 19. Behavior: bob



Fig. 20. Behavior: turn

4 Motion or Experience Design

The earliest Graphical User Interfaces included motion as part of their visual display. Though they were limited by the processing power of those early machines, interfaces used motions to convey certain kinds of messages: show, tell, orient, acquaint or warn.

Interface motion currently follows a few well-saturated forms. One common current use of motion maintains the orientation of the user as the interface transitions between states. Grafting motion into existing static interfaces is doomed to failure. Imagine the usability problems of a Microsoft Word with a motion-based interface.

Motion design informed by understanding the motion of natural environments has a place in interface design. Motion presents a rich area for solving interface challenges. As robust data collection allows flowing data analysis, motion carefully articulated for meaning could be used to find patterns within the flow otherwise invisible to static visualization. As more and more products incorporate user interfaces, a unique

motion scheme defining the personality of the product could differentiate its brand.

Newer devices, multi-user spaces or ambient components of complex systems will benefit from the use of motion. Those emerging environments will demand solutions to problems that traditional interfaces never faced. The inclusion of motions created through interacting with them may be required when more than one user is interacting on a single screen.

This work touches the surface of a broad and deep topic. The presentation of the taxonomy creates an environment for understanding motion on the screen. This taxonomy is not exhaustive. Exploration of more motion from nature, investigation into the use of moving textures and patterns as meaningful elements of moving interfaces promises exciting opportunities to leverage into new types of interaction.



Fig. 21. Principle: rhythm (light)

References

1. Klee, P.: *The Thinking Eye* by Jurg Spiller, 2nd revised edn. Percy Lund Humphries & Co. Ltd. (1964)
2. Carroll, S.: *From Eternity to Here: the quest for the ultimate theory of time*. Plume, New York (2010)