Algorithms for Animation

Simple formulas to activate your UI

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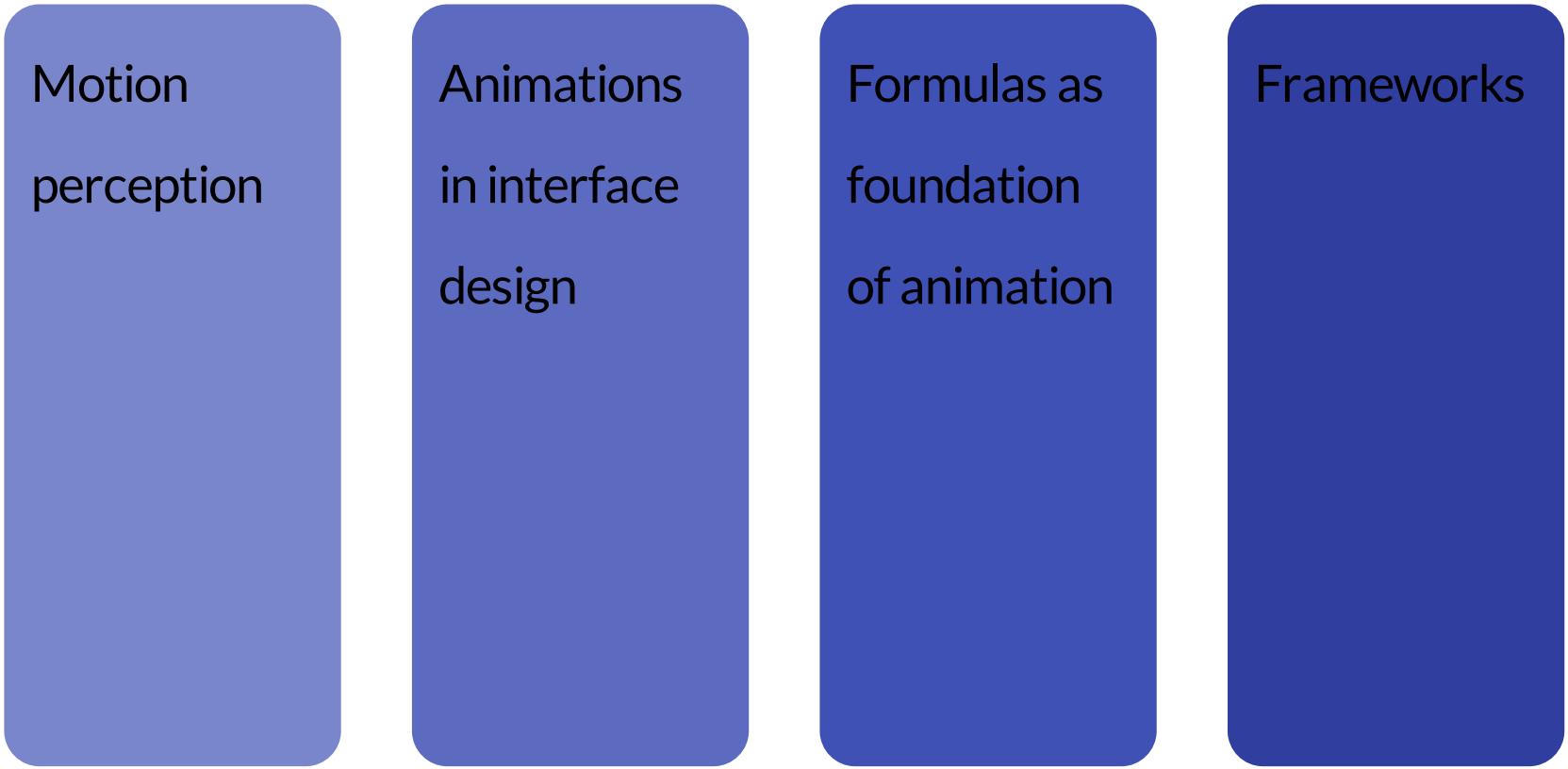
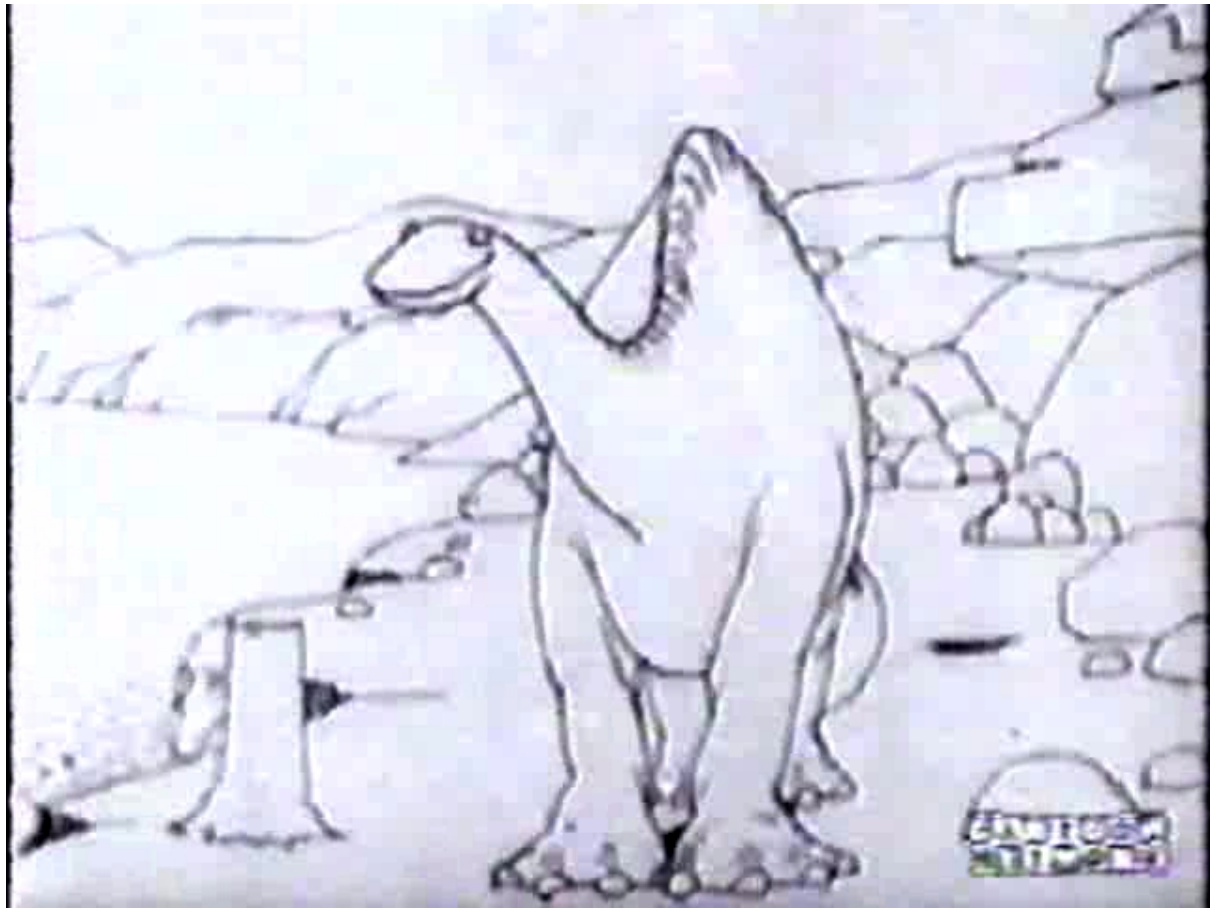
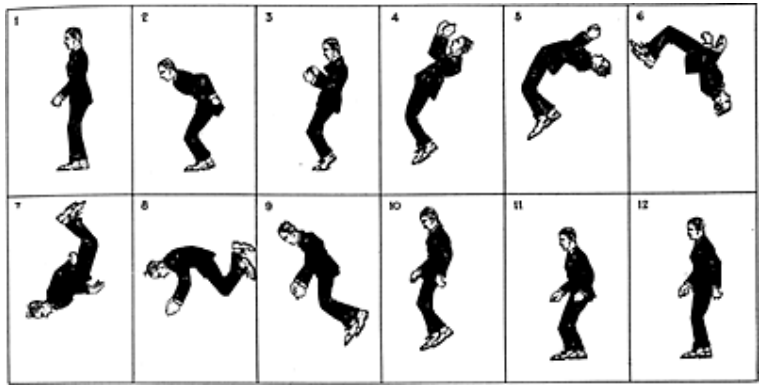

Motion perception
Animations in interface design
Formulas as foundation of animation
Frameworks


Design
Dev

Movement creates life




1
2
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12

Animations are cognitive aids

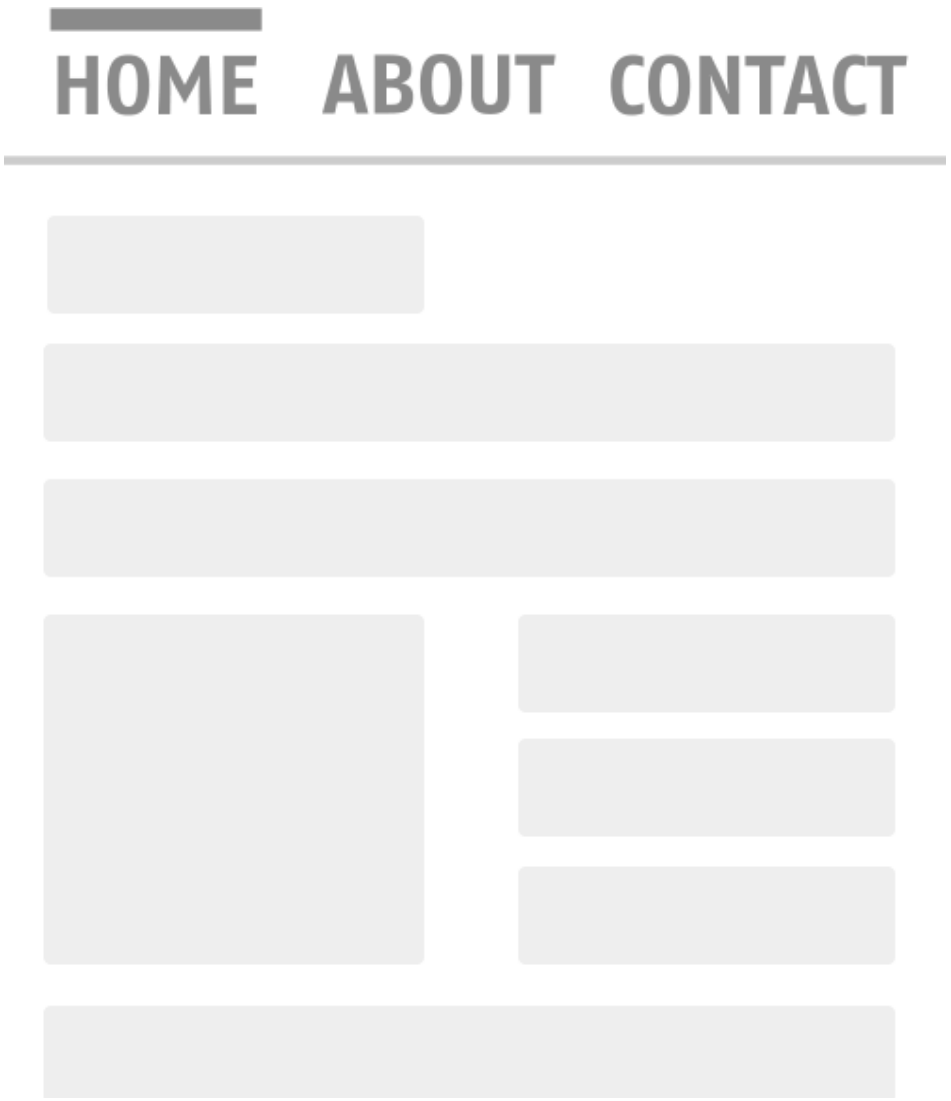
Affordance, percieved affordance & signifiers

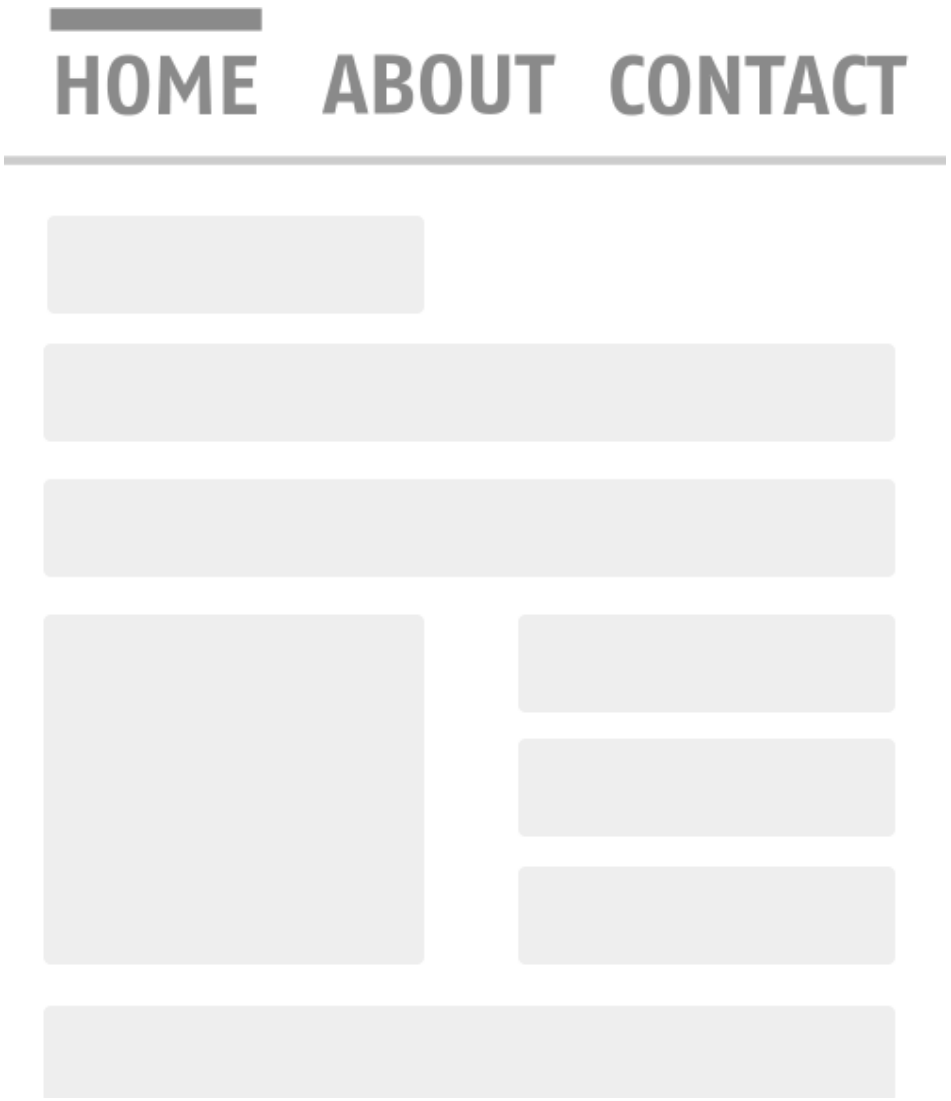
Motion detection

Right

Right

Navigation


HOME
ABOUT
CONTACT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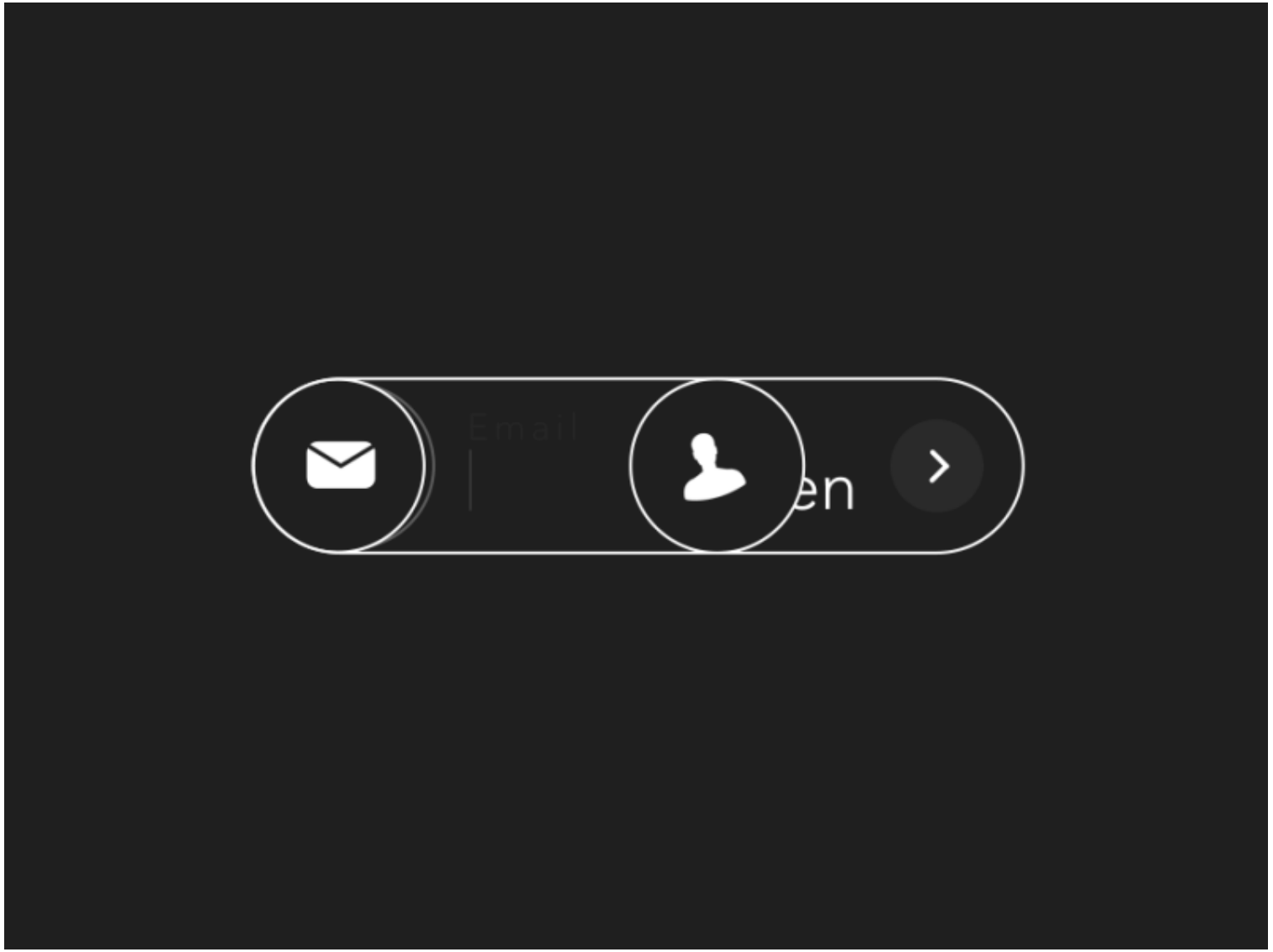
Progressive Disclosure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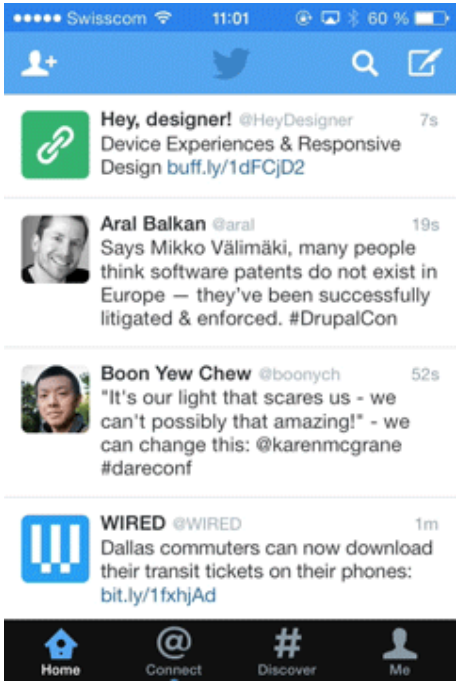
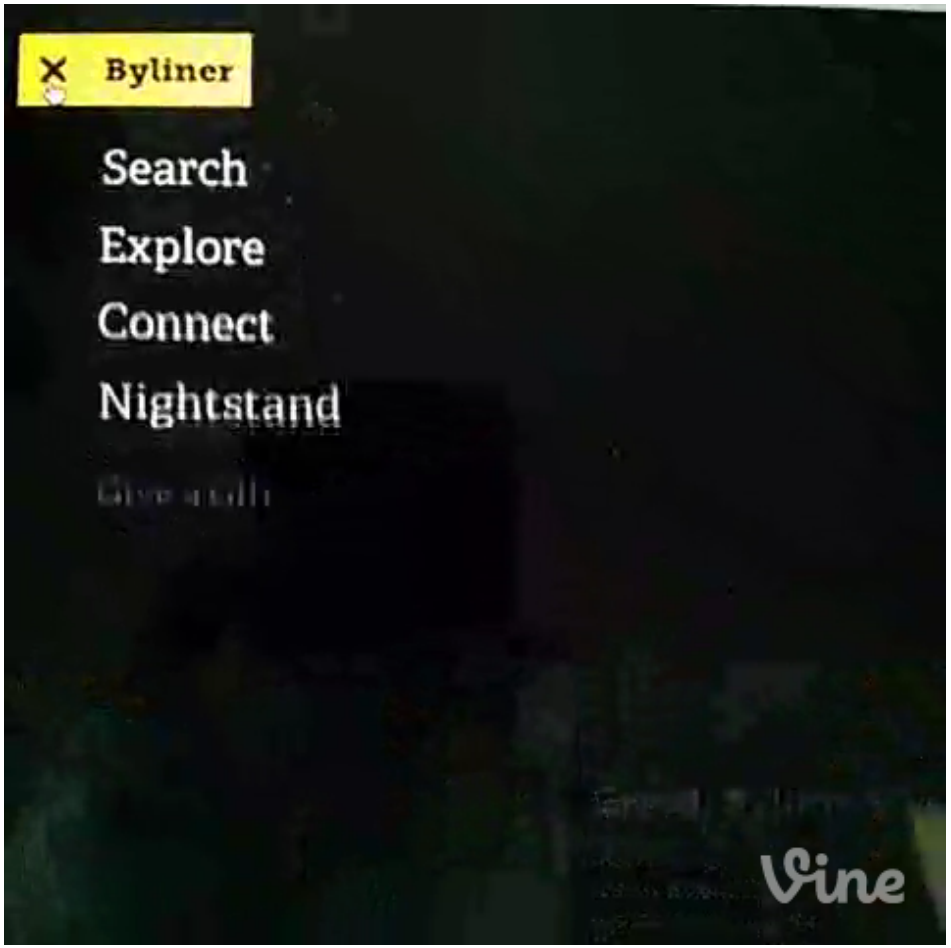
Context


Swisscom
11:01
60 %
Hey, designer! @HeyDesigner 7s
Device Experiences & Responsive Design buff.ly/1dFCjD2
Aral Balkan @aral 19s
Says Mikko Välimäki, many people think software patents do not exist in Europe — they've been successfully litigated & enforced. #DrupalCon
Boon Yew Chew @boonych 52s
"It's our light that scares us - we can't possibly that amazing!" - we can change this: @karenmcgrane #dareconf
WIRED @WIRED 1m
Dallas commuters can now download their transit tickets on their phones: bit.ly/1fxhjAd
Home
Connect
Discover
Me


Byliner
Search
Explore
Connect
Nightstand
Vine

How do you communicate animation ideas?

Math

Moving pixels

```
var ball = document.getElementById('ball');
var start = 0;

var basicAnimation = function (e) {
        start += 12;
        basic.style.left = start + "px";
        if (Math.abs(start) <= 800) { requestAnimationFrame(basicAnimation);
}
}
```

The basics of animation: interpolation

```
valueAtTime = (end - start) * time / duration + start
```

Breaking it down to [0-1]

```
valueAtTime = (end - start) * time / duration + start
```

---

change = end - start

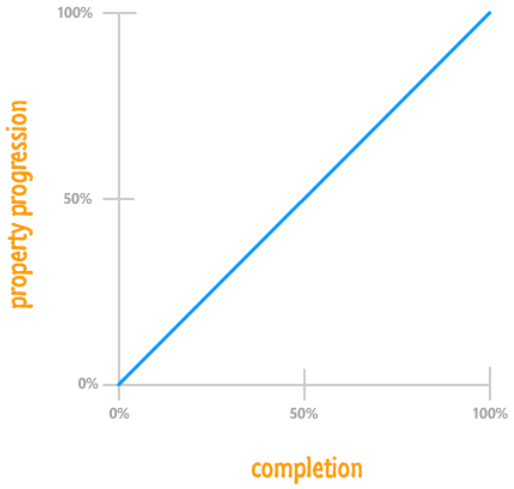
percent complete = time/duration

Timing

```
var time, startTime;

var start = function () {
        startTime = new Date().getTime();
        run();
}

var run = function () {
        time = new Date().getTime() - startTime;
        div.style.left = 900 * time / 1000 + "px";
        if(value < 1) requestAnimationFrame(run);
}
```




```
//valueAtTime = (end - start) * time / duration + start
div.style.left = 900-0 * time / 1000 + 0 + "px";
```

>

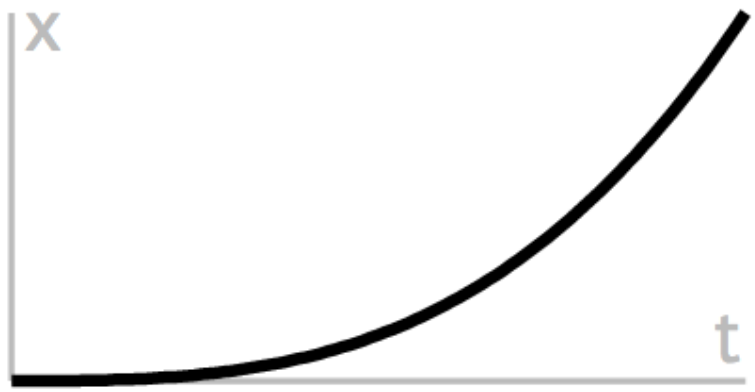
"Using a term like nonlinear science is like referring to the bulk of zoology as the study of non-elephant animals."

- Stanislaw Ulam

Natural movement

Torque, drag, spin, friction

Easing functions

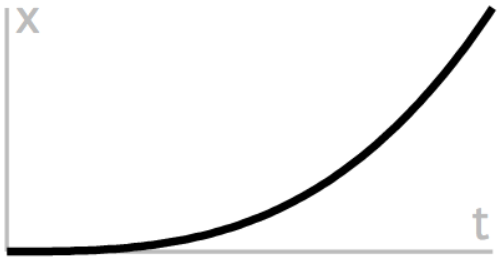


Easing

```
valueAtTime = (end - start) * easingfunction([0-1]) + start
```

Change in property times (some float) plus beginning value.

Power Functions - EaseIn

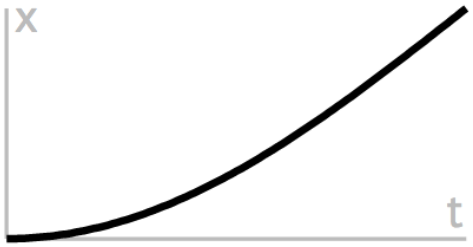



```
var run = function () {
  time = new Date().getTime() - startTime;
  div.style.left = 900 * Math.pow(percentChange, 3) + "px";
  if(time / duration < 1) requestAnimationFrame(run);
}
```

Power Functions - EaseOut


```
var run = function () {
  time = new Date().getTime() - startTime;
  div.style.left=(endX - startX)* (1 - Math.pow(1 - (t / d), 3)) +startX+"px"
;
  if(time / duration < 1) requestAnimationFrame(run);
}
```

Trig! ... sine :)



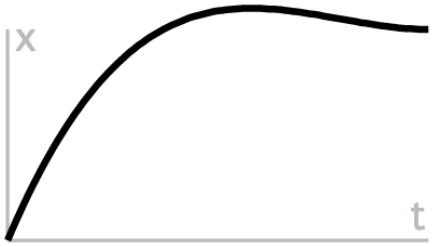

```
var run = function () {
  time = new Date().getTime() - startTime;
  div.style.left=(endX - startX)* Math.sin( t/d * Math.PI / 2 ) +startX+"px";
  if(time / duration < 1) requestAnimationFrame(run);
}
```

>

Follow Through

> 1

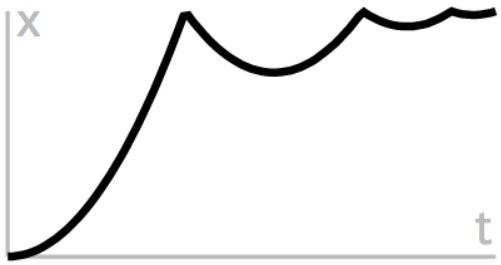
Elasticity




```
var run = function () {
  time = new Date().getTime() - startTime;
  div.style.left=(endX - startX)* k * k * ( ( s + 1 ) * k - s ) +startX+"px";
  if(time / duration < 1) requestAnimationFrame(run);
}
```

>

Bounce




```
var easeFunc = function(k) {
if ( k < ( 1 / 2.75 ) ) {
return 7.5625 * k * k;
} else if ( k < ( 2 / 2.75 ) ) {
return 7.5625 * ( k -= ( 1.5 / 2.75 ) ) * k + 0.75;
} else if ( k < ( 2.5 / 2.75 ) ) {
return 7.5625 * ( k -= ( 2.25 / 2.75 ) ) * k + 0.9375;
} else {
return 7.5625 * ( k -= ( 2.625 / 2.75 ) ) * k + 0.984375; }
}
div.style.left=(endX - startX)* easeFunc(t/d) +startX+"px";
```

Tools

Software

Adobe Edge Animate

Adobe After Effects

Flinto

Keynote

Quartz

JS Frameworks

Framer.js

Tween.js

GSAP (Greensock)

jQuery

CSS

Animate.css

SASS/LESS mixins

Performance

Go forth and animate!

References

Robert Penner - Easing Functions

Don Norman - The Design of Everyday Things

Google Material Design

Disney's Twelve Basic Principles of Animation

Smashing Magazine - *A New Mobile UX Design Material*