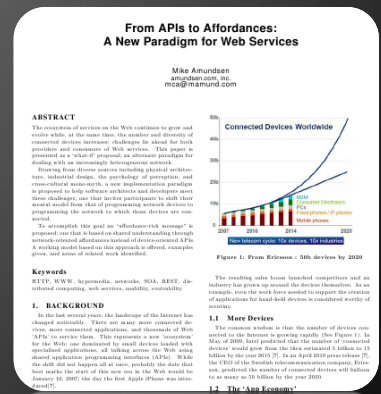


APIs to Affordances

A new paradigm for services on the Web

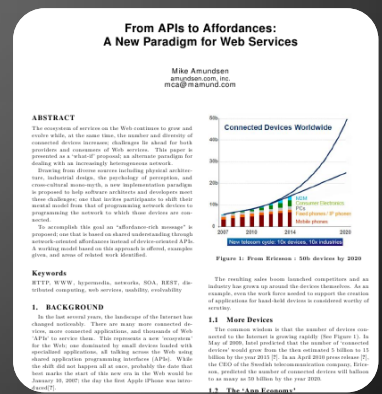
Mike Amundsen
amundsen.com, inc.
mca@mamund.com



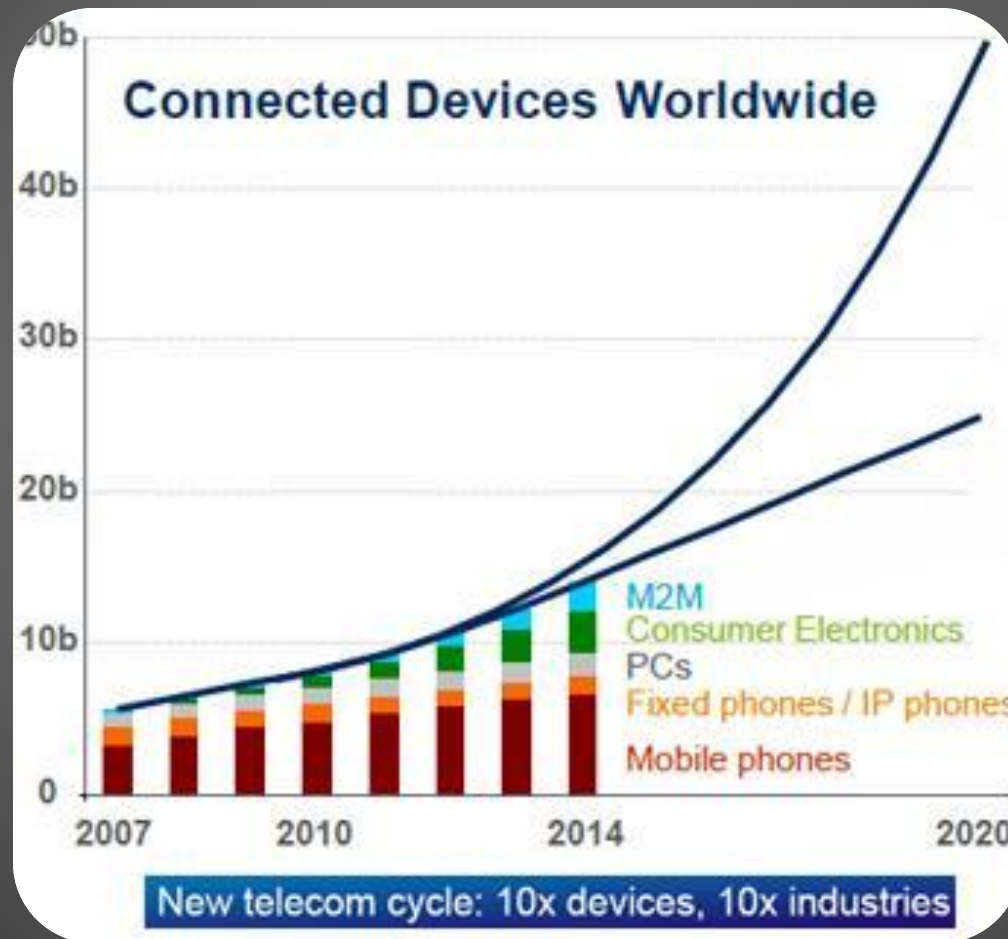
Better than a flying car?



Background



50 billion devices by 2020?



Ericsson 2011

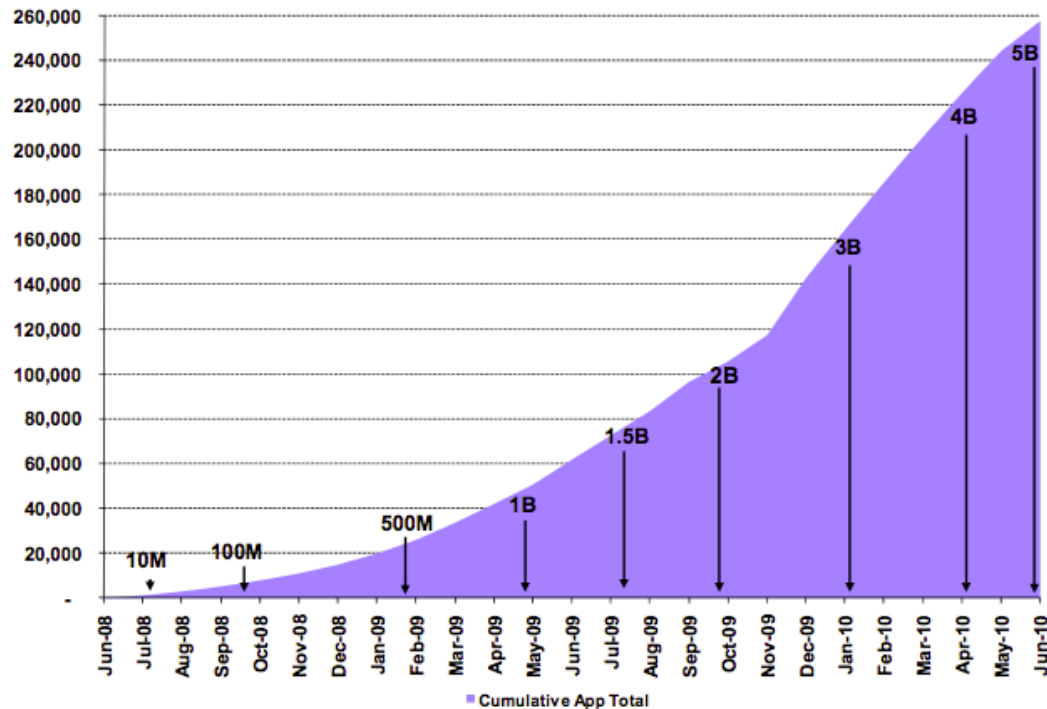
150 million disposed in US each year



Gizmodo 2007

45 billion app downloads by 2016

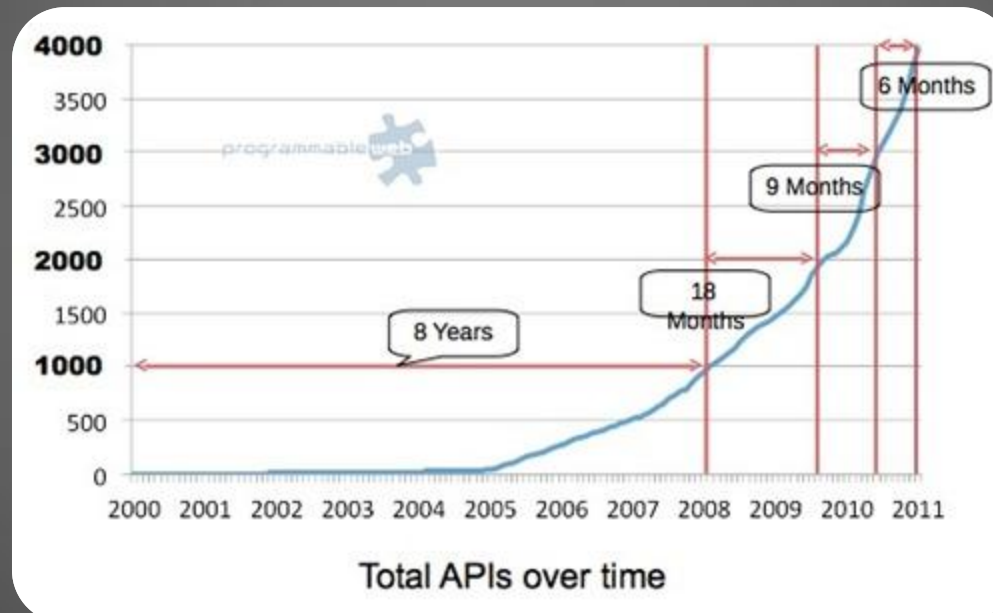
Figure 4: Cumulative apps and downloads



Source: Deutsche Bank and Apple data

Smart Insights
2010

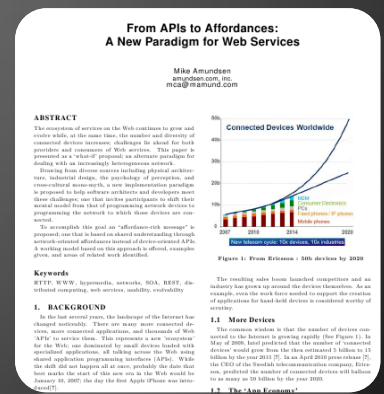
4000+ registered services by 2011



Programmable Web,
2011

So...

- Explosion Heterogeneous Devices
- Increased use of “native” apps for devices
- Growth in number of APIs/services available



Problems | Challenges

From APIs to Affordances: A New Paradigm for Web Services

Mike Amundsen
amundsen@mca.com, mca@mamund.com

ABSTRACT

The comparison of services on the Web continues to grow and evolve while, at the same time, the number and diversity of connected devices increases. Challenges to design for both providers and consumers of Web services. This paper is presented as a "white" paper, as a design portfolio for dealing with an increasingly heterogeneous network.

Drawing from diverse sources including physical metaphors, user, industrial design, the psychology of perception, and cross-cultural awareness, a new representational paradigm is proposed to help address usability and design issues.

These challenges are that before participants to shift their mental models from that of programming network devices to programming the network to which these devices are connected.

To accomplish this goal an "affordance-rich message" is proposed, one that is based on shared understanding through network-related affordances instead of device-oriented APIs. A writing model based on this approach is offered, examples given, and some of related work identified.

Keywords

APIs, REST, JSON, networks, SOA, REST, distributed computing, web services, usability, evolvability

1. BACKGROUND

In the last several years the landscape of the Internet has changed substantially. There are many more connected devices, more connected applications, and increased use of APIs to service them. This represents a new "turnover" for the Web, one dominated by small devices rather than personal computers. Allowing access to the Web using almost application programming interfaces (APIs). While the data did not change all at once, probably the date that best marks the start of this new era is the Web would be January 16, 2007: the day the first Apple iPhone was released.

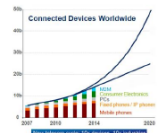


Figure 1: From Reference: 5th devices by 2015

The resulting sales boom launched competitors and an industry has grown up around the device themselves. As an example, even the work force needed to support the creation of applications for hand-held devices is increasing rapidly.

1.1. More Devices

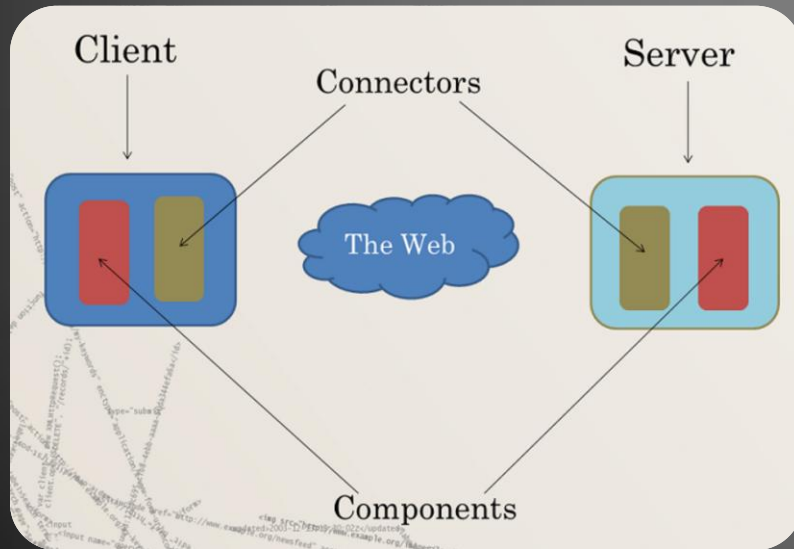
The common wisdom is that the number of devices connected to the Internet is growing rapidly (see Figure 1). As of May of 2008, Intel predicted that the number of connected devices could grow from the then estimated 1 billion to 1.5 billion by the year 2013 [7]. In an April 2010 presentation [8], the CEO of the Swedish telecommunications company, Ericsson, predicted the number of connected devices will balloon to as many as 20 billion by the year 2020.

1.2. The "App Economy"

The "App Economy" is the term used to describe the market for applications that run on mobile devices. The market is growing rapidly, with the number of applications available for download on the Apple App Store exceeding 100,000 in early 2010. The Google Play Store, which launched in late 2009, also has a large number of applications available for download.

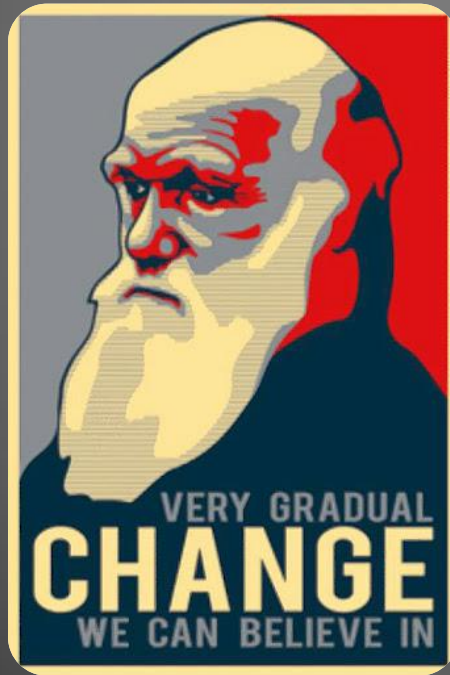
Technical Difficulties

- Treating HTTP as a transport
- Loss of Connector-Component model



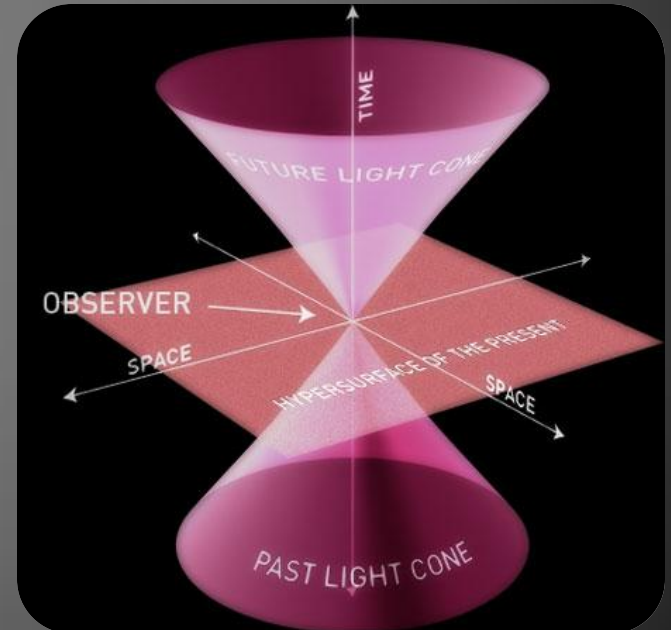
Competing Priorities

- Service/API Useability
- Long-term Evolvability



The Time Dimension

- REST Resources over time
- Common Static Constructs



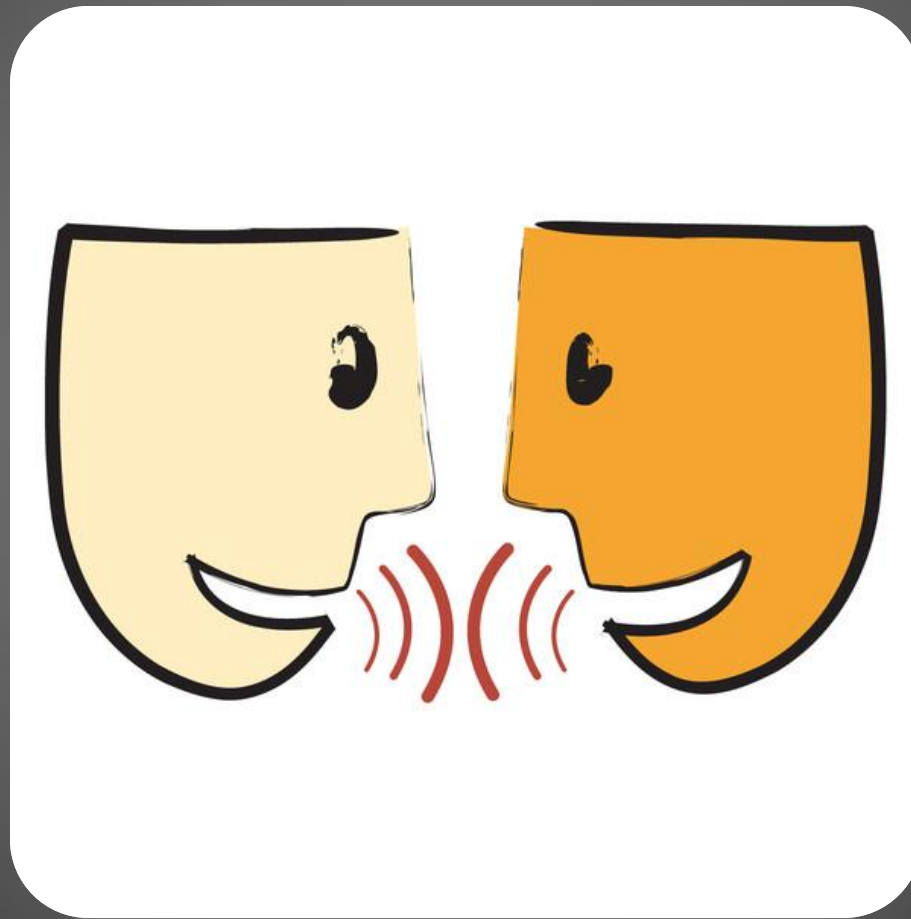
Transient Devices

Permanent Networks





Other Disciplines



Architecture

“A pattern language gives each person who uses it the power to create an infinite variety of new and unique buildings...”

- *Christopher Alexander*



Architecture

“A pattern language gives each person who uses it the power to create an infinite variety of new and unique buildings, *just as ordinary language gives him the power to create an infinite variety of sentences.*”

- ***Christopher Alexander***



Visual Perception

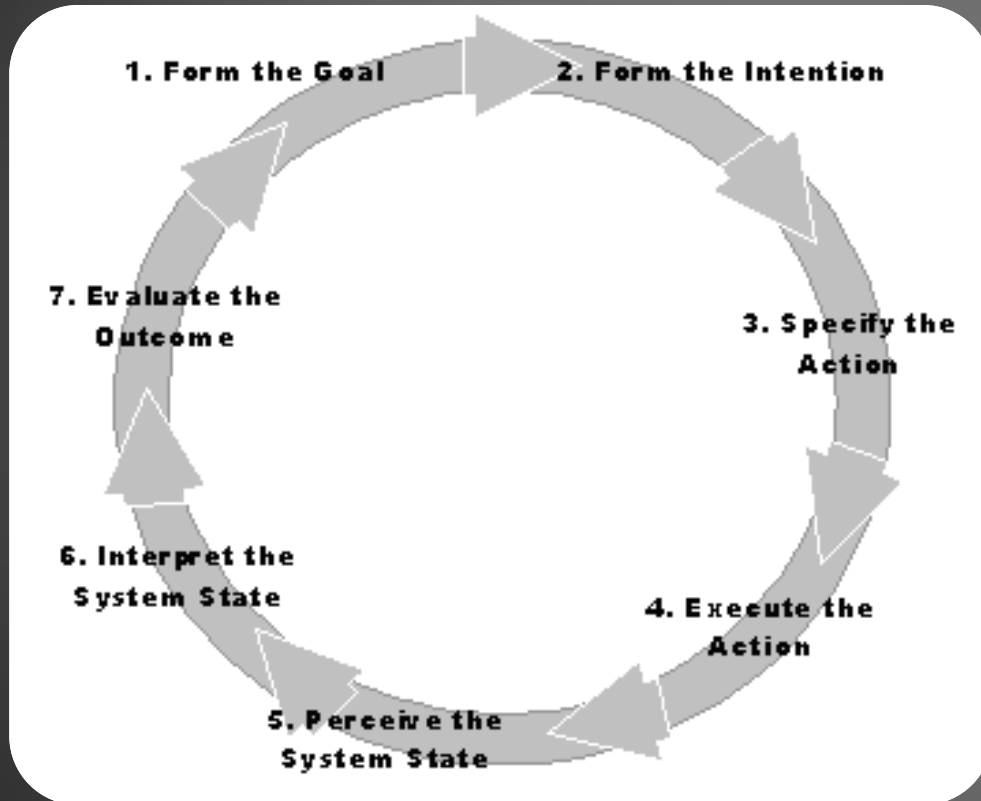
- The *foundation* for perception is ambient, ecologically available information.
- Affordances are all "action possibilities" latent in the environment.

- ***James J. Gibson***

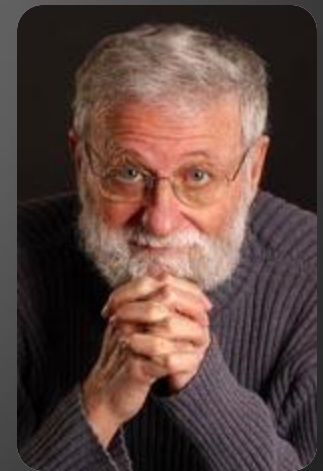


Industrial Design

- Seven Stages of Action



- *Donald Norman*

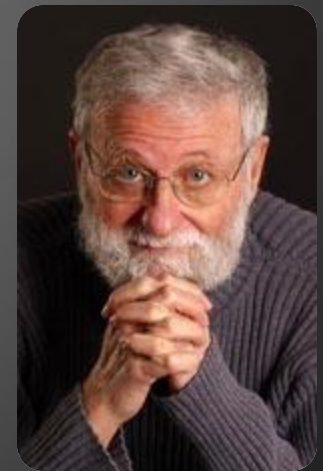


Industrial Design

- Knowledge (“head” vs. “world”)

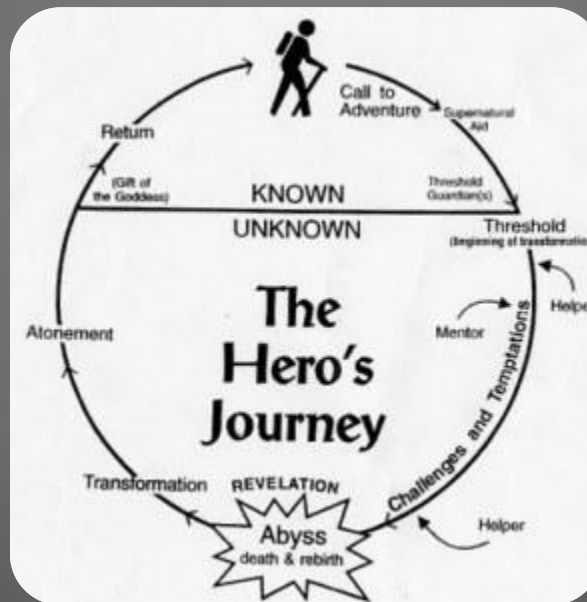
| Property | Knowledge in the World | Knowledge in the Head |
|---------------------------------------|--|--|
| Learning | Learning not required. Interpretation substitutes for learning. How easy it is to interpret information is the world depends upon how well it exploits natural mappings and constraints. | Requires learning, which can be considerable. Learning is made easier if there is meaning of structure to the material (or if there is a good mental model). |
| Efficiency of use | Tends to be slowed up by the need to find and interpret the external information. | Can be very efficient |
| Ease of use at first encounter | High | Low |

- *Donald Norman*



Cross-Cultural Myth

- “The Hero’s Journey”
- A cross-cultural story rooted in archetype and metaphor



- *Joseph Campbell*

Cross-Cultural Myth

- “The Hero’s Journey”
- A cross-cultural story rooted in archetype and metaphor
- “Computers are like Old Testament gods; lots of rules and no mercy.”

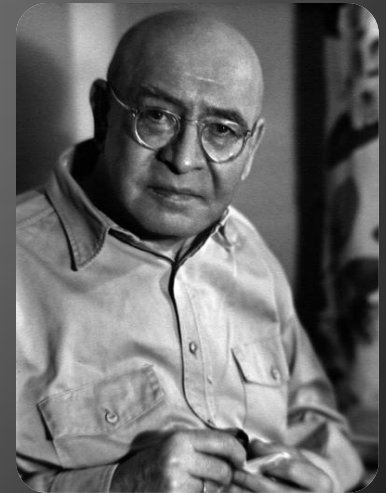
- *Joseph Campbell*



The Map is Not the Territory

- Human knowledge is limited not only by our ability to perceive the world but also the language we use to describe what we perceive.

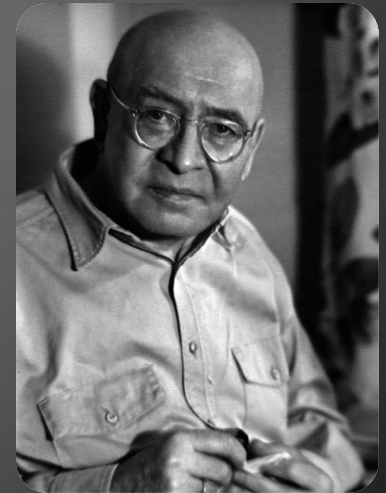
- *Alfred Korzybski*



The Map is Not the Territory



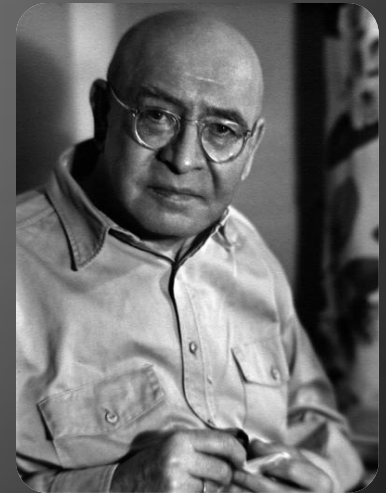
- **Alfred Korzybski**



The Map is Not the Territory

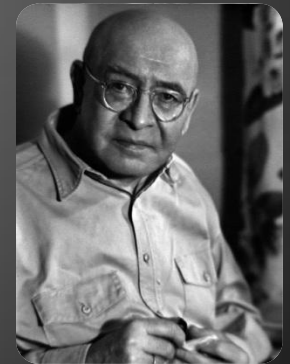
- Human knowledge is limited not only by our ability to perceive the world but also the language we use to describe what we perceive.
- The ability to function using only a general description of the world allowed humans to evolve.

- ***Alfred Korzybski***



So...

- Pattern languages
- Perceived affordances
- Knowledge in the head vs. the world
- Communication via archetype & metaphor
- The map is not the territory





An Affordance Paradigm

From APIs to Affordances: A New Paradigm for Web Services

Mike Amundsen
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mca@mamund.com

ABSTRACT

The complexity of services on the Web continues to grow and evolve while, at the same time, the number and diversity of connected devices increases. Challenges to design for both providers and consumers of Web services. This paper is presented as a "white paper" proposal, as a starting point for dealing with an increasingly heterogeneous network.

Drawing from diverse sources including physical interfaces, industrial design, the psychology of perception, and cross-cultural awareness, a new representational paradigm is proposed to help address usability and design issues and these challenges that both service providers and their users must face. That of programming network devices to programming the network to which these devices are connected.

To accomplish this goal an "affordance-rich message" is proposed, one that is based on shared understanding through network-oriented affordances instead of device-oriented APIs. A writing model based on this approach is offered, examples given, and some of related work identified.

Keywords

APIs, Web, hyperspace, networks, SOA, REST, distributed computing, web services, usability, evolvability

1. BACKGROUND

In the last several years the landscape of the Internet has changed substantially. There are many more connected devices, more connected applications, and increases of Web APIs to service them. This represents a new "turnover" for the Web, one dominated by small devices rather than personal computers. Allowing access to the Web using almost application programming interfaces (APIs). While the data did not suggest all of them, probably the data that best marks the start of this new era is the Web would be having, in 2007, the day the first Apple iPhone was released [7].

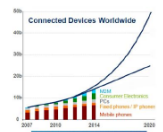


Figure 1: From Reference [5] 5th devices by 2010

The resulting sales boom launched competitors and an industry has grown up around the device themselves. As an example, even the work force needed to support the creation of applications for hand-held devices is increasing rapidly.

1.1. More Devices

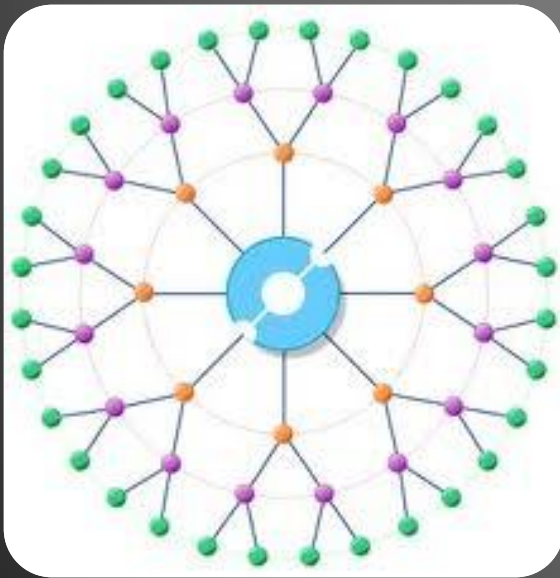
The common wisdom is that the number of devices connected to the Internet is growing rapidly. (See Figure 1). In May of 2008, Intel predicted that the number of connected devices could grow from the then estimated 1 billion to 15 billion by the year 2013 [7]. In an April 2010 presentation [7], the CEO of the Swedish telecommunications company, Ericsson, predicted the number of connected devices will balloon to as many as 20 billion by the year 2020.

1.2. The "App Economy"

The "App Economy" is a term used to describe the market for applications that run on mobile devices. It is a rapidly growing market, with the number of applications available for download on the Apple App Store exceeding 1 million in 2010. The market is expected to continue to grow rapidly in the years ahead.

Principles

- Stop programming devices
- Start programming networks



Principles

- Stop focusing on imperative statements
 - C, JS, Java, Python, etc.
- Start focusing on declarative affordances
 - HTML, Atom, VoiceXML, HAL, Collection+JSON, etc.

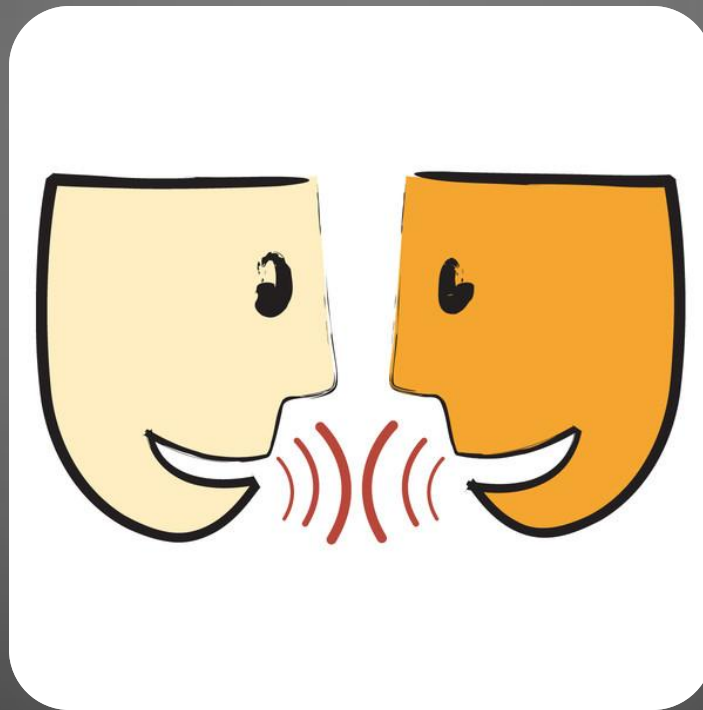
```
1 <!DOCTYPE HTML PUBLIC "-//W3C//DTD
2 "http://www.w3.org/TR/html4/strict
3 <html>
4   <head>
5     <title>Example</title>
6     <link rel="stylesheet" href="s
7   </head>
8   <body>
9     <div id="header">
10      <h1><a href="." title="Back
11    </div>
12    <div id="toolbar">
13      <span class="left">Today <sp
14      <span class="right">
15        <span id="time">&nbsp;</sp
16        <select id="timezone">
17          <option value="-12">(GMT
18          <option value="-11">(GMT
```

```
covers all fields in the neighborhood of a specific field (with coordi
x y) if they have no mines in the neighborhood itself
return x X coordinate of field
return y Y coordinate of field

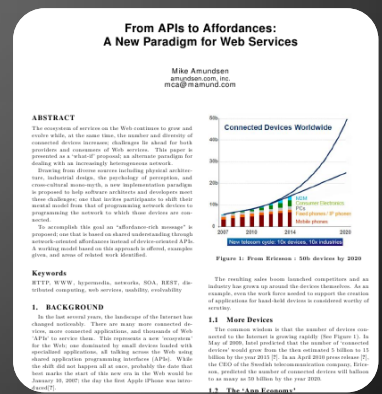
state void uncoverSaveFields(int X, int Y) {
  set diffX;
  set diffY;
  for (int u = -1; u < 2; u++) {
    for (int v = -1; v < 2; v++) {
      diffX = X + (u);
      diffY = Y + (v);
      if ((!(diffX == X) && !(diffY == Y))) {
        Field myNeighbor = getField(diffX, diffY);
        if (myNeighbor != null) {
          if (!myNeighbor.isDetected()) {
            myNeighbor.setDetected(true);
            // update the fields only when they are covered
            if (myNeighbor.getMinedNeighbors() == 0) {
              if (myNeighbor.getFieldStatus() == CellState.CO
                uncoverField(diffX, diffY);
              // recursion
              this.uncoverSaveFields(diffX, diffY);
            }
          } else {
            if (myNeighbor.getFieldStatus() == CellState.CO
              uncoverField(diffX, diffY);
            }
          }
        }
      }
    }
  }
}
```


Principles

- Data is lifeless
- Affordances animate communication



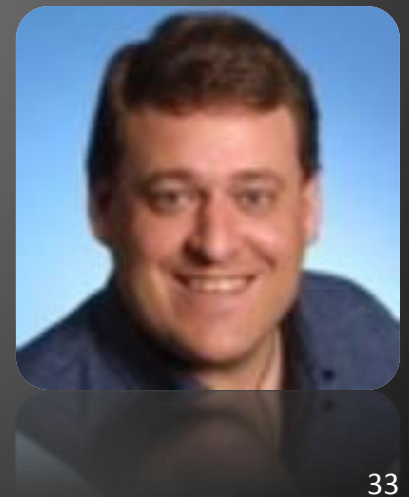
Implementation Details



Affordance-Rich Messages (ARMs)

“By hypertext I mean the simultaneous presentation of information and controls such that the information becomes the affordance through which the user obtains choices and selects actions.”

- ***Roy T. Fielding***



Design useful ARM languages

- “Human-driven” clients live in a different niche than “machine-driven” clients.
- Design languages that provide a supportive ecological niche for the targeted client



April 17, 2012



APIs to Affordances : WS-REST 2012



34

Design useful ARM languages

- When mapping a domain to hypermedia for humans you can assume quite a bit of knowledge “in the head.”



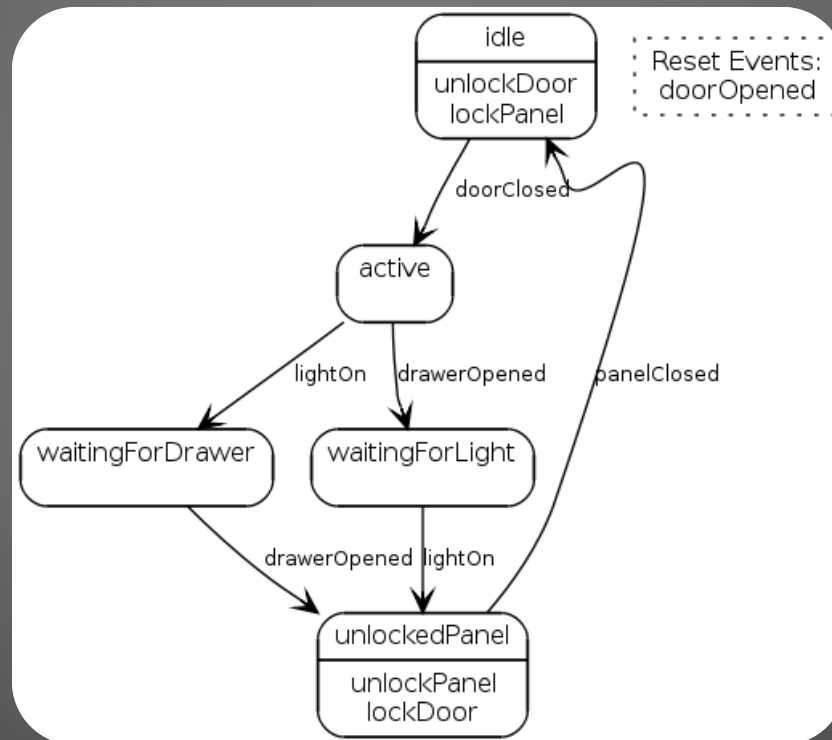
Design useful ARM languages

- When mapping a domain to hypermedia for machines you should assume little knowledge in the “head” and place more knowledge in the “world.”



Miss Grant's Controller

- Example task model from Martin Fowler



Miss Grant's Controller

- “Translated” into Hypermedia for humans

Miss Grant's Controller

States

door

closed

light

on

drawer

open

panel

closed

Set door to open

Set light to off

Set drawer to closed

Set panel to open

Set door to open

Set light to off

Set drawer to closed

Set panel to open

Miss Grant's Controller

- “Translated” into Hypermedia for humans
- You can provide several options at once
- You can usually vary the identifiers without ‘breaking’ the client
- You can usually provide multiple paths to the same goal

Miss Grant's C

States

door

Miss Grant's Controller

- “Translated” into Hypermedia for machines

Miss Grant's Controller

start bot

States

door

closed

light

on

drawer

open

panel

closed

Set door to open

Set panel to open

Miss Grant's Controller

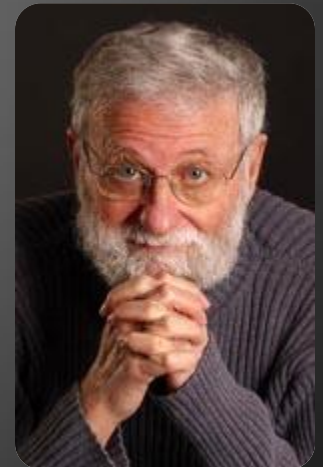
- “Translated” into Hypermedia for machines
- Keep options to a minimum (1 or 2)
- Varying identifiers can ‘break’ the client
- It’s best to provide a single path to the goal



Affordance-Rich Messages (ARMs)

“Think of each action by the user as an attempt to step in the right direction; an error is simply an action that is incompletely or improperly specified. ... Try to support, not fight, the user's responses. ... Design explore-able systems.”

- ***Donald Norman***



No-fail Forms

- An interaction example for sending data
- Request a set of inputs from the client
- Continue to return the input form until all data is provided
- Once all data is supplied, continue to the next state.

No-fail Forms

- “Translated” into hypermedia for humans

m2m-no-fail-form

storage

firstname=
lastname=
email=
website=
cellphone=

actions

write=pending

firstname
lastname
email
website
cellphone

No-fail Forms

- “Translated” into Hypermedia for humans
- You can provide several options at once
- You can usually vary the identifiers without ‘breaking’ the client
- You can usually provide multiple paths to the same goal

m2m-no-fail-form

storage

firstname=
lastname=
email=
website=
cellphone=

actions

write=pending

firstname
lastname
email
website
cellphone

No-fail Forms

- “Translated” into hypermedia for machines

m2m-no-fail-form

storage

firstname=mike
lastname=amundsen
email=
website=
cellphone=

actions

write=pending

email

website

cellphone

No-fail Forms

- “Translated” into Hypermedia for machines
- Support minimal input options (1)
- Varying identifiers can ‘break’ the client
- It’s best to provide a single path to the goal

m2m-no-fail-form

storage

firstname=mike
lastname=amundsen
email=
website=
cellphone=

actions

write=pending

email

website

cellphone

No-fail Forms

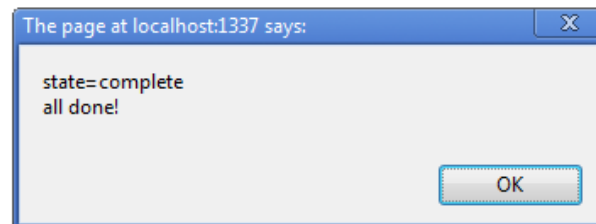
- Once complete, continue to next state

m2m-no-fail-form

storage

firstname=mike
lastname=amundsen
email=mamund@yahoo.com
website=http://amundsen.com
cellphone=1.234.567.8901

actions



Primary lessons from examples

- Humans can support variances since they have more knowledge in “the head”
- Machines require more knowledge in “the world”
- Machines rely on shared vocabularies to identify transitions and supply input data.
- Support “partial” form inputs
- Use different “translations” for different clients

Observations

- We don't need to make machines 'smarter', we need to accommodate them with 'better' languages.



Observations

- We don't need to make machines 'smarter', we need to accommodate them with 'better' languages.
- We don't need to change the way humans use the web today.



Observations

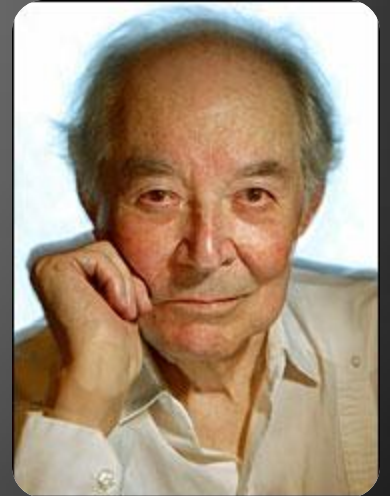
- We don't need to make machines 'smarter', we need to accommodate them with 'better' languages.
- We don't need to change the way humans use the web today.
- Machines don't need to understand 'meaning', they need to recognize 'identifiers'



Designing ARMs for the Web

“Every act of communication is an act of translation.”

- *Gregory Rabassa*



The driverless car of the Web



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