APIs to Affordances

A new paradigm for services on the Web

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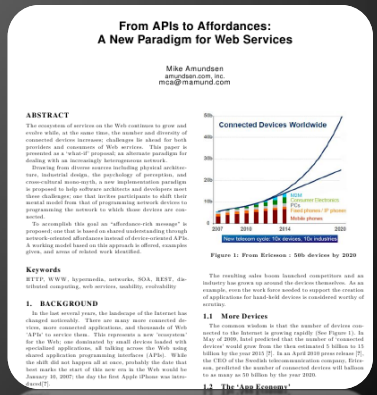

From APIs to Affordances:
A New Paradigm for Web Services

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ABSTRACT

The ecosystem of services on the Web continues to grow and evolve while, at the same time, the number and diversity of connected devices increases; challenges lie ahead for both providers and consumers of Web services. This paper is presented as a "what-if" proposal; an alternate paradigm for dealing with an increasingly heterogeneous network.

Drawing from diverse sources including physical architecture, industrial design, the psychology of perception, and cross-cultural mono-myth, a new implementation paradigm is proposed to help software architects and developers meet three challenges; one that invites participants to shift their mental model from that of programming network devices to programming the network to which those 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 working model based on this approach is offered, examples given, and areas of related work identified.

Keywords

HTTP, WWW, hypermedia, networks, SOA, REST, distributed computing, web services, usability, evolvability

1. BACKGROUND

In the last several years, the landscape of the Internet has changed noticeably. There are many more connected devices, more connected applications, and thousands of Web 'APIs' to service them. This represents a new 'ecosystem' for the Web; one dominated by small devices loaded with specialized applications, all talking across the Web using shared application programming interfaces (APIs). While the shift did not happen all at once, probably the date that best marks the start of this new era in the Web would be January 10, 2007; the day the first Apple iPhone was introduced[7].

Figure 1: From Ericsson : 50b devices by 2020

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

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1.2 The 'App Economy'

Better than a flying car?

Background

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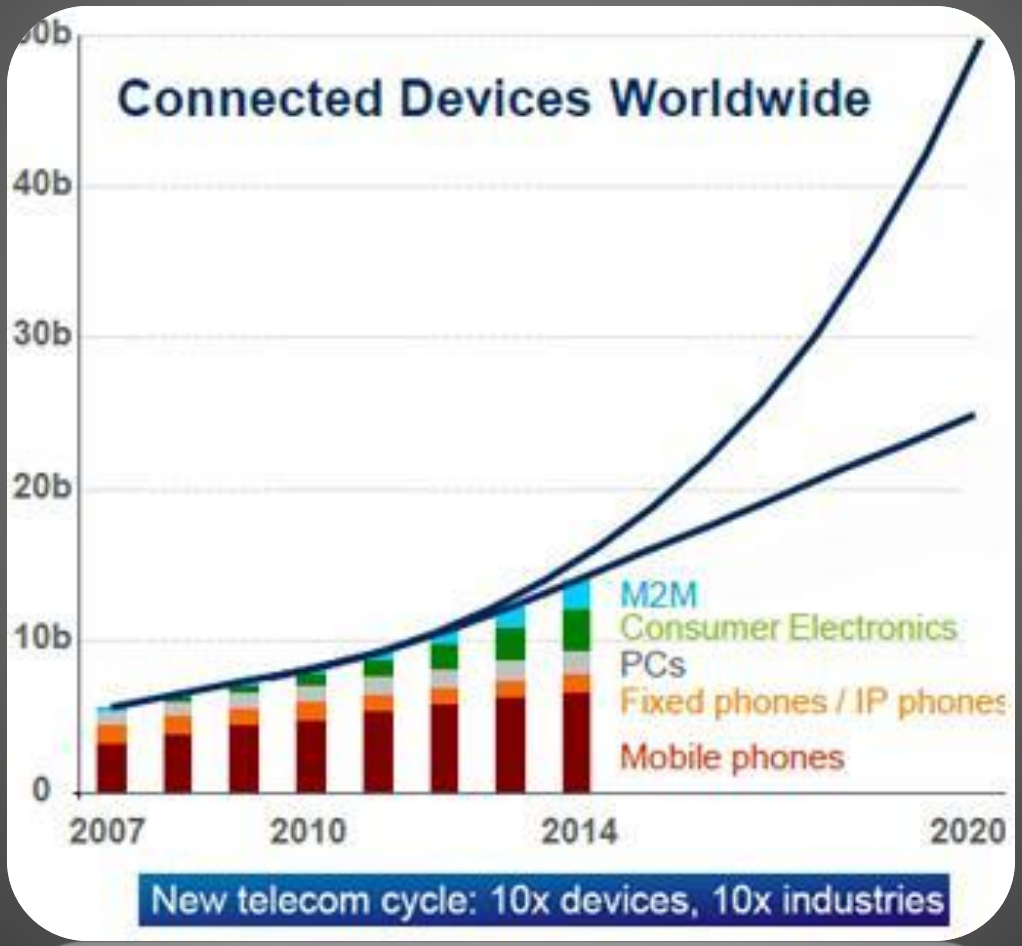
1.2 The 'App Economy'

50 billion devices by 2020?

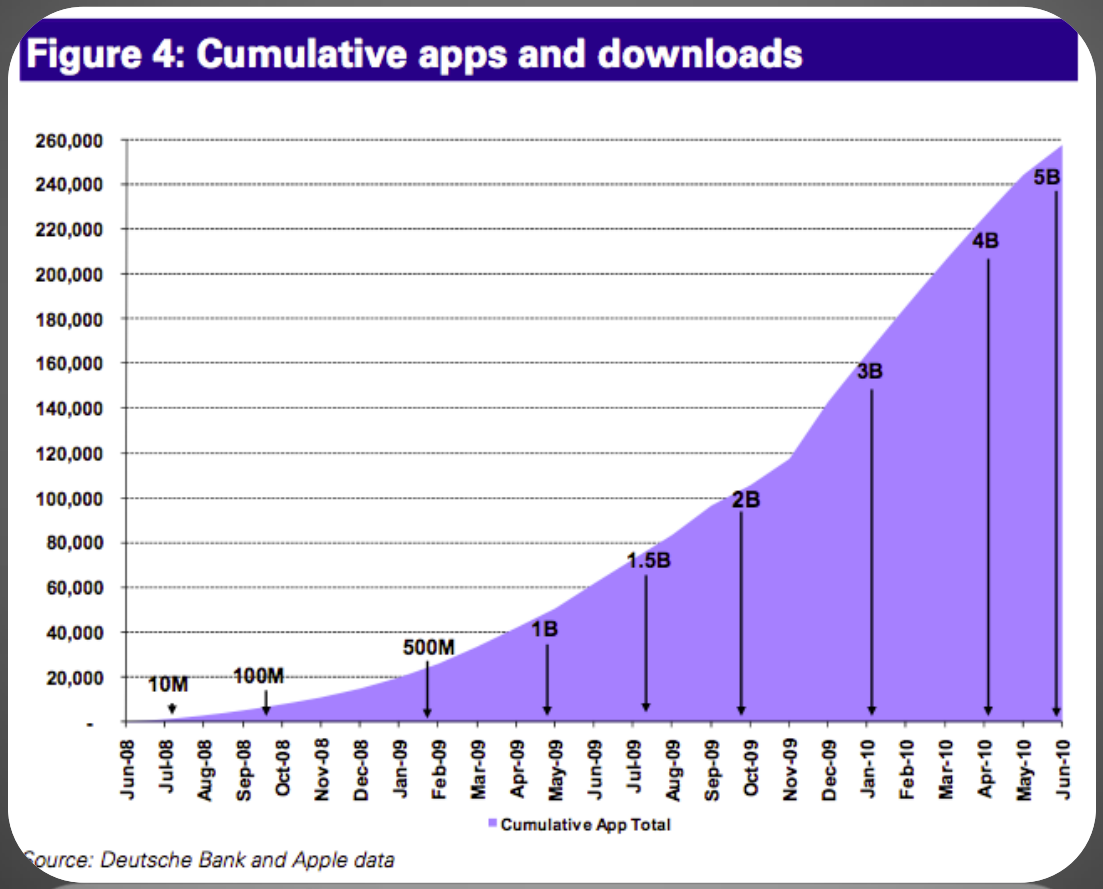


Erricsson 2011

150 million disposed in US each year

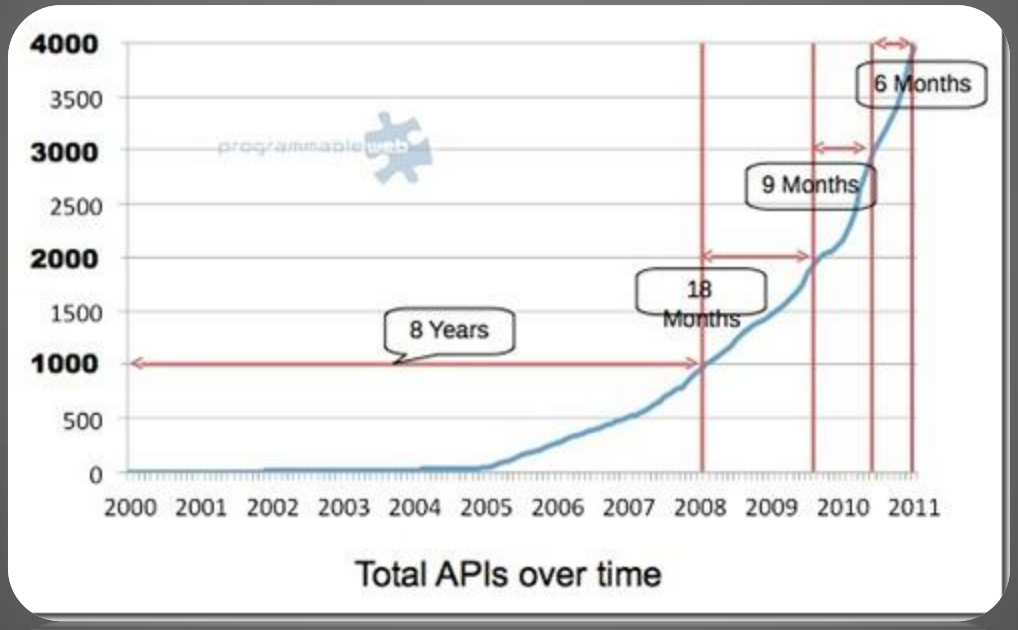
Gizmodo 2007

45 billion app downloads by 2016



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

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1.2 The 'App Economy'

Problems|Challenges

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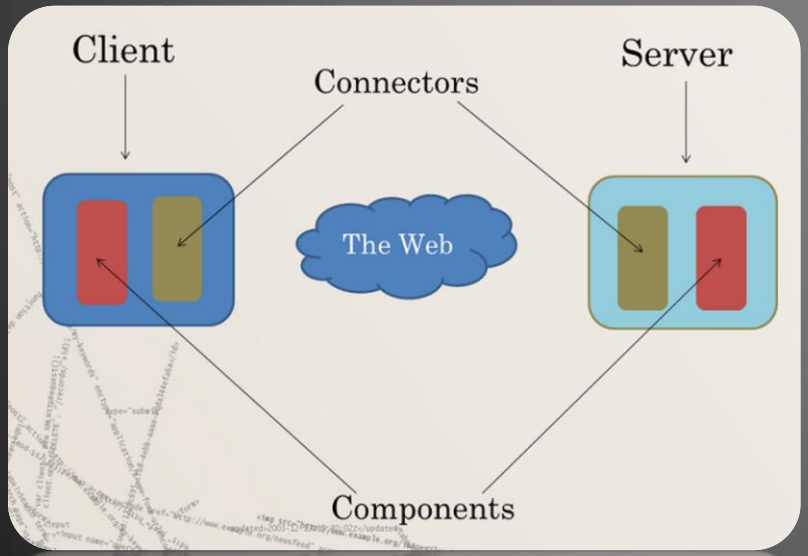
1.2 The 'App Economy'

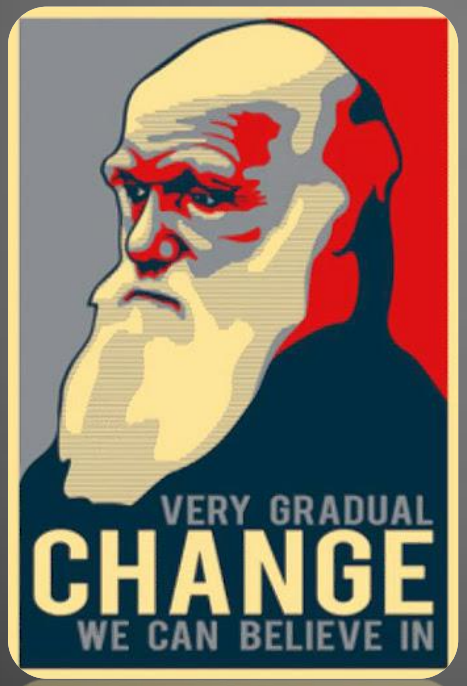
Technical Difficulties

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



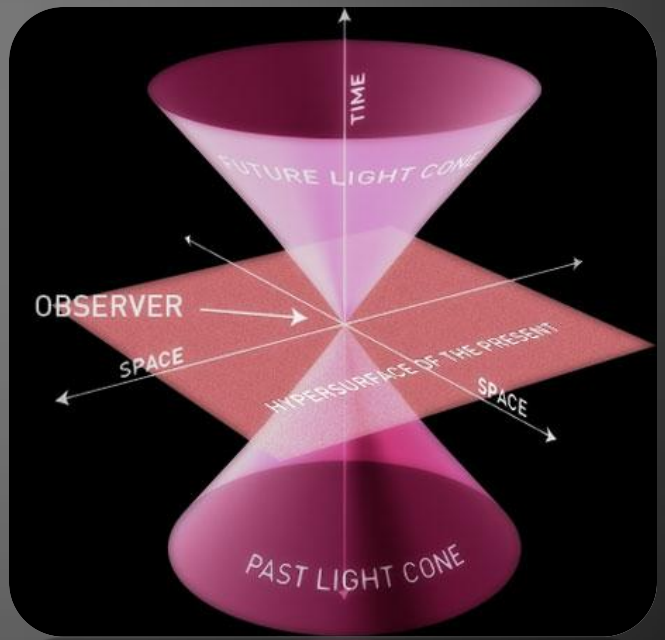
Competing Priorities

- Service/API Useability
- Long-term Evolvability



The Time Dimension

- REST Resources over time
- Common Static Constructs



Transient Devices
Permanent Networks

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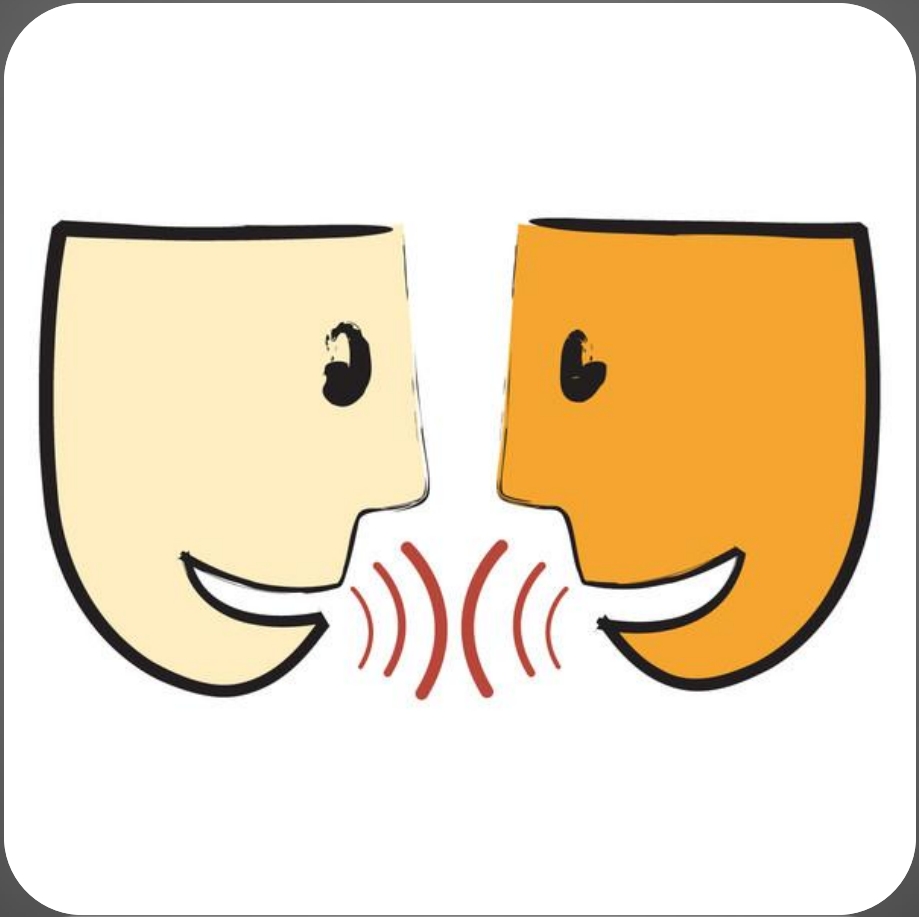
Other Disciplines



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

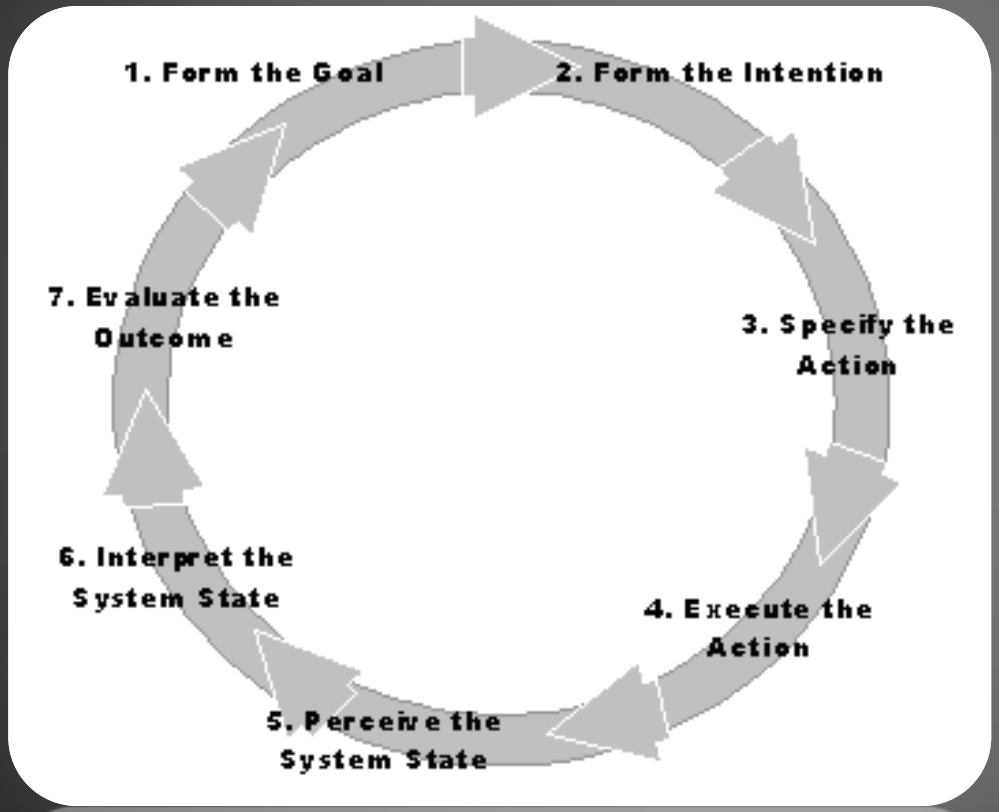
- The *foundation* for perception is ambient, ecologically available information.

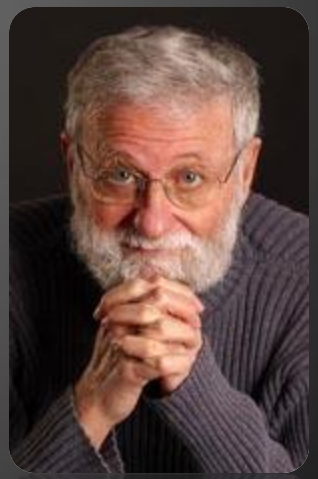
- Affordances are all "action possibilities" latent in the environment.

- James J. Gibson

Industrial Design

- Seven Stages of Action





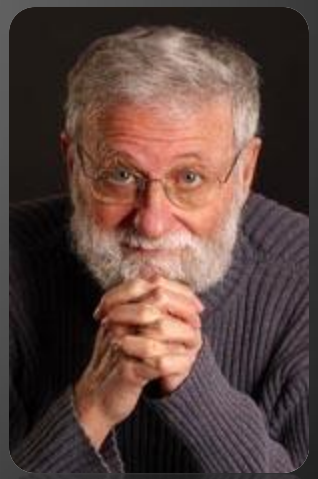
- Donald Norman

Industrial Design

- Knowledge (“head” vs. “world”)

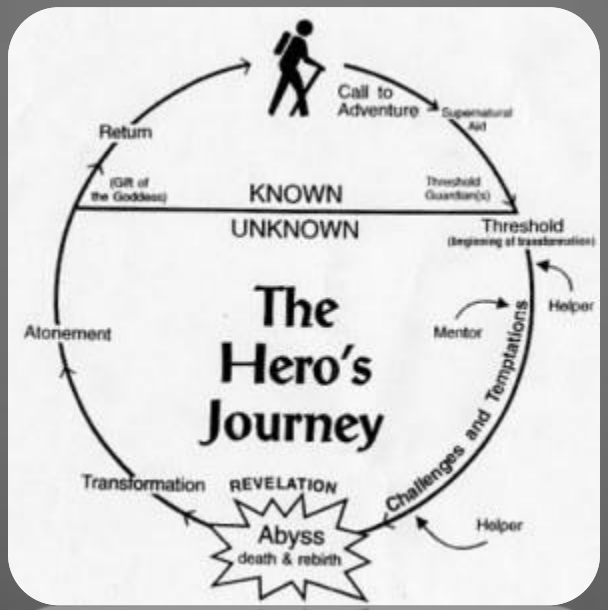
Property	Knowledge in the World	Knowledge in the Head
Learning	Learning not required. Interpretation substitutes for learning. How easy it is to interpret information is the world depends upon how well it exploits natural mappings and constraints.	Requires learning, which can be considerable. Learning 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.”

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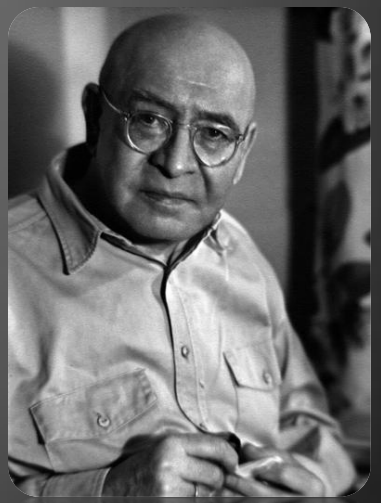
The Map is Not the Territory

- 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

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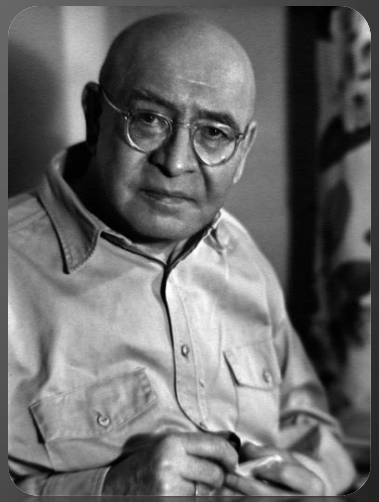

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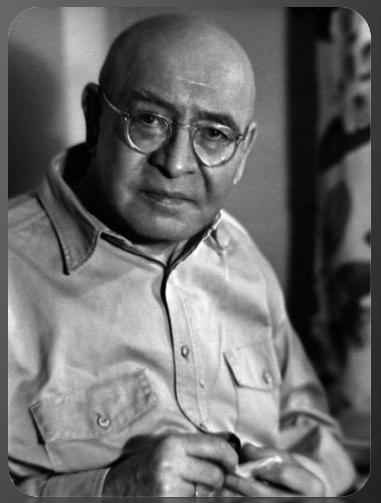
- Human knowledge is limited not only by our ability to perceive the world but also the language we use to describe what we perceive.

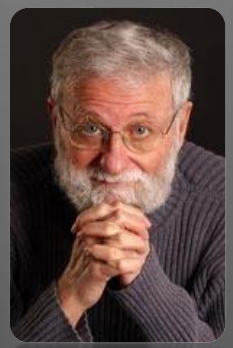
- The ability to function using only a general description of the world allowed humans to evolve.

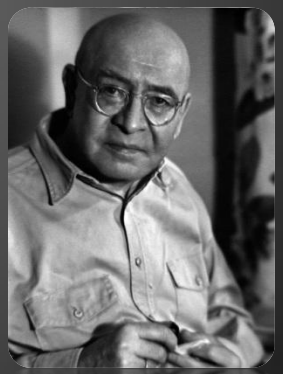
- Alfred Korzybski



So…

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





END
DETOUR

An Affordance Paradigm

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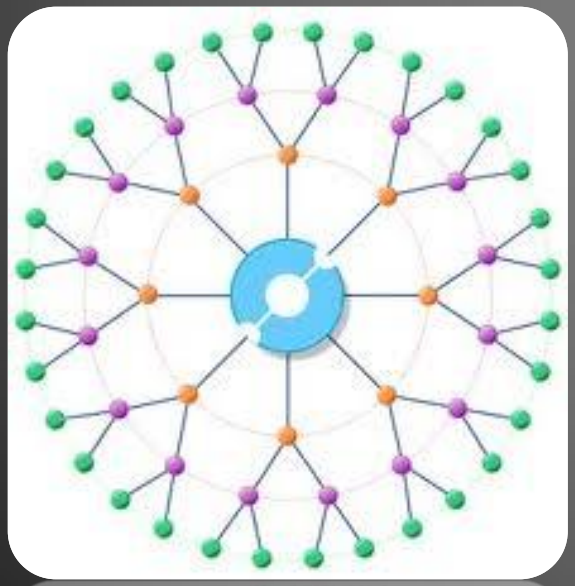
1.2 The 'App Economy'

Principles

- Stop programming devices
- Start programming networks

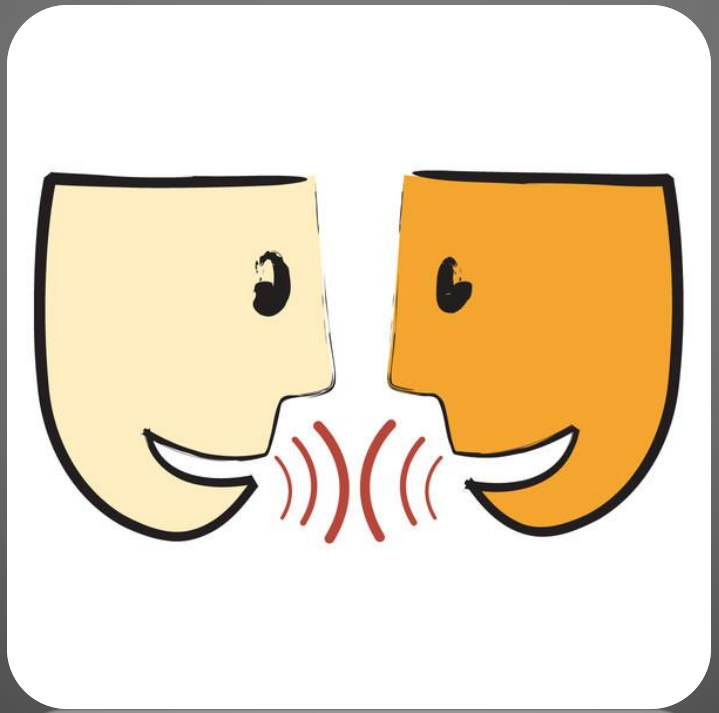


Principles

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

Principles

- Data is lifeless
- Affordances animate communication



Implementation Details

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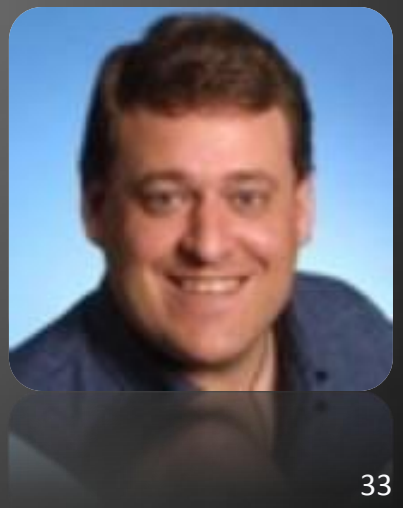
Affordance-Rich Messages (ARMs)

"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

Design useful ARM languages

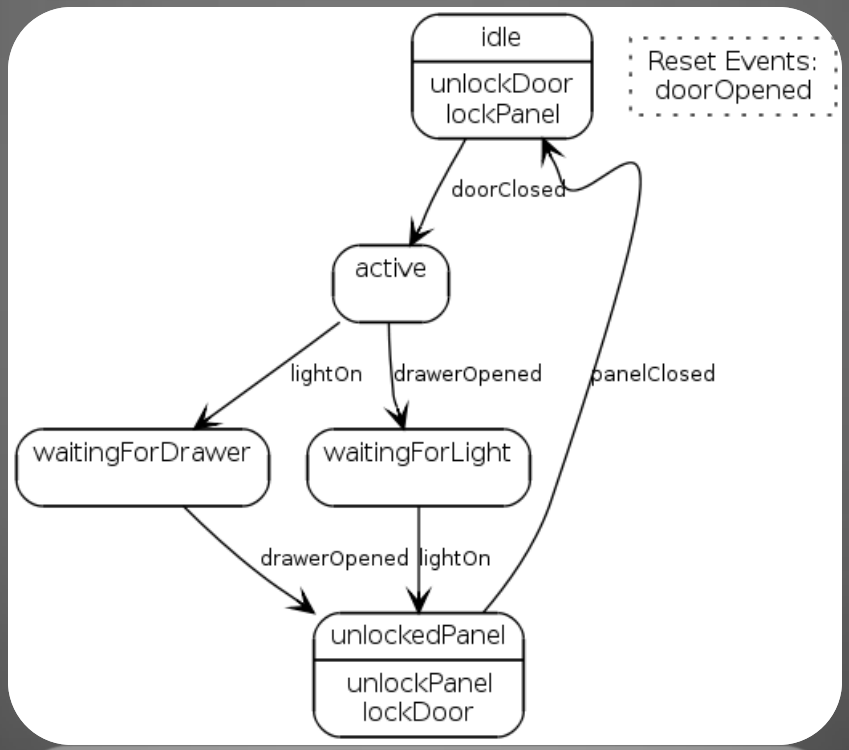
- When mapping a domain to hypermedia for humans you can assume quite a bit of knowledge “in the head.”

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.”

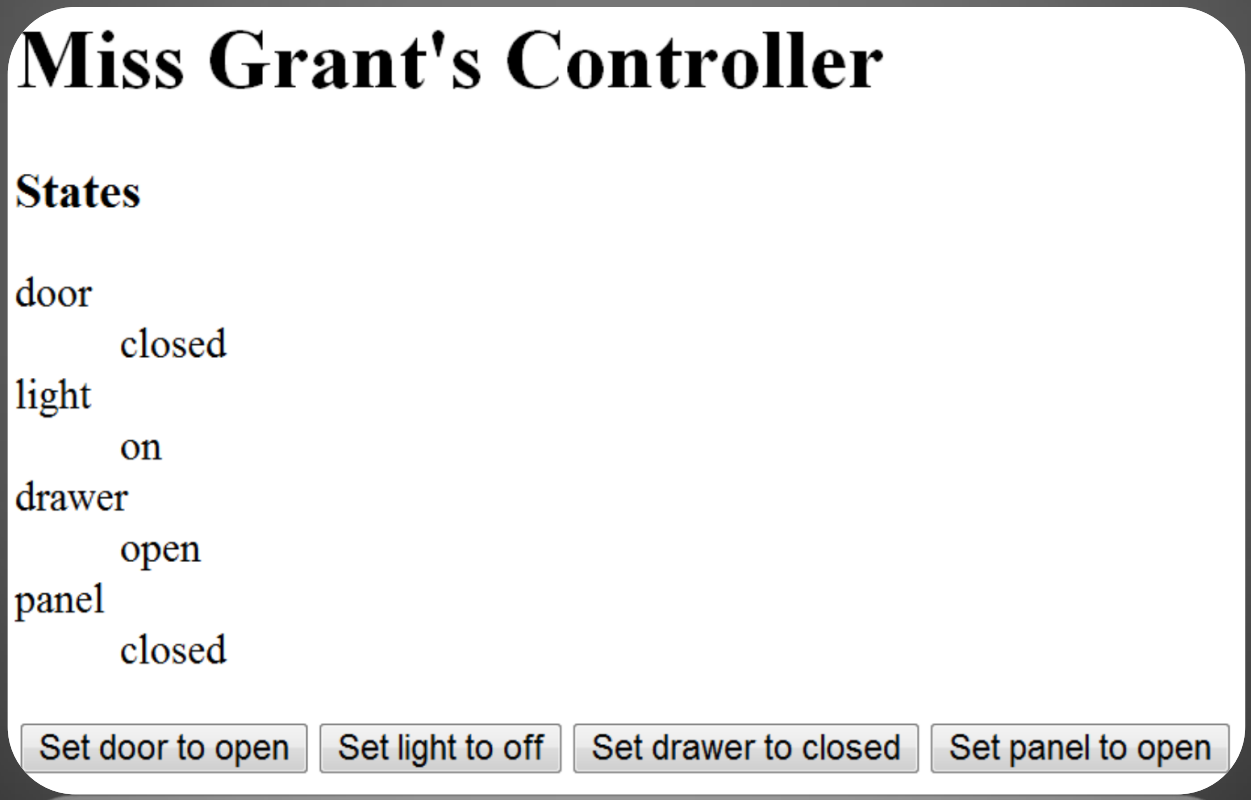
Miss Grant's Controller

- Example task model from Martin Fowler



Miss Grant's Controller

- "Translated" into Hypermedia for humans

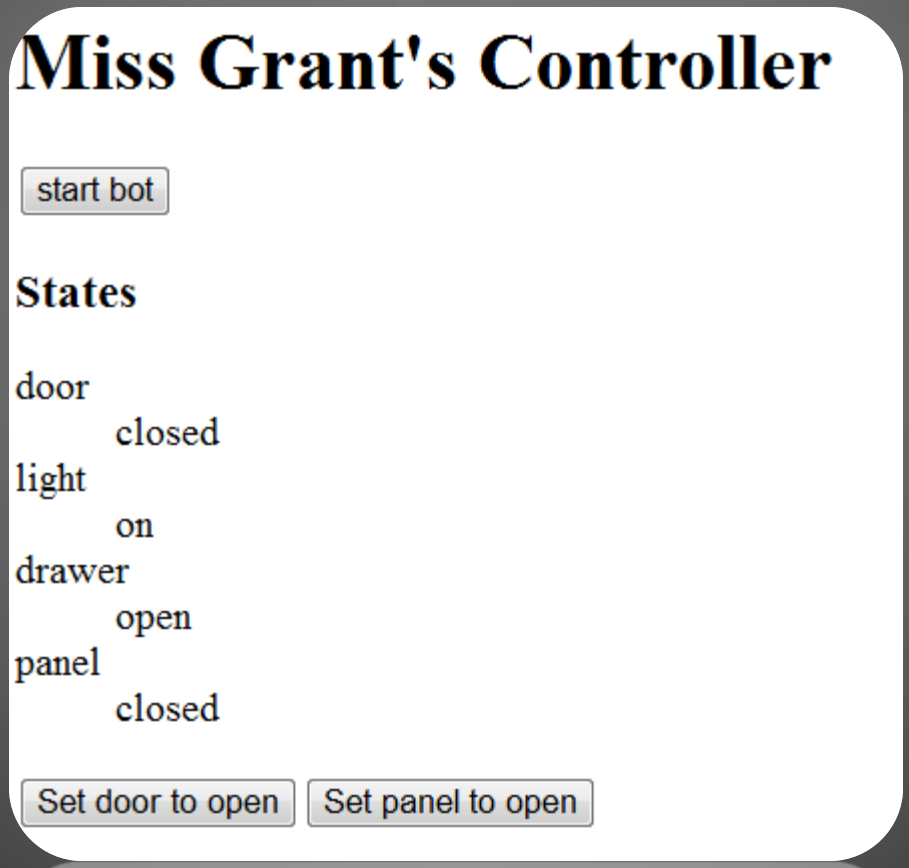


Miss Grant's Controller

- "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

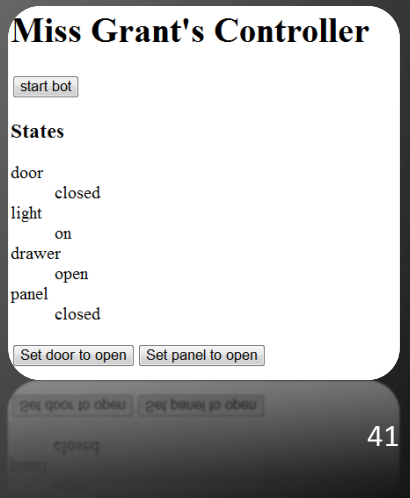
Miss Grant's Controller

- "Translated" into Hypermedia for machines



Miss Grant's Controller

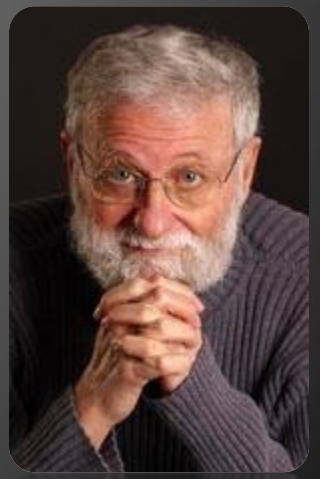
- "Translated" into Hypermedia for machines
- Keep options to a minimum (1 or 2)
- Varying identifiers can 'break' the client
- It's best to provide a single path to the goal



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



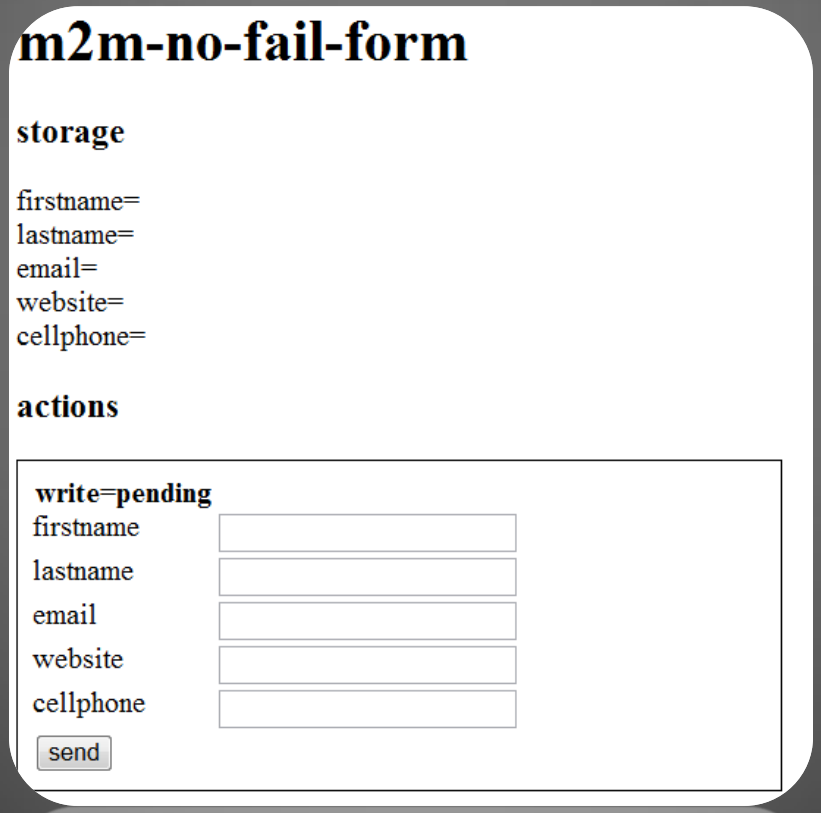
No-fail Forms

- 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.

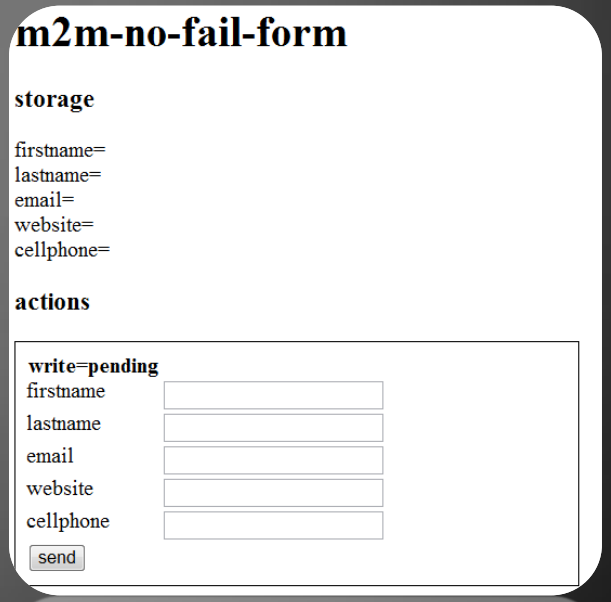
No-fail Forms

- “Translated” into hypermedia for humans



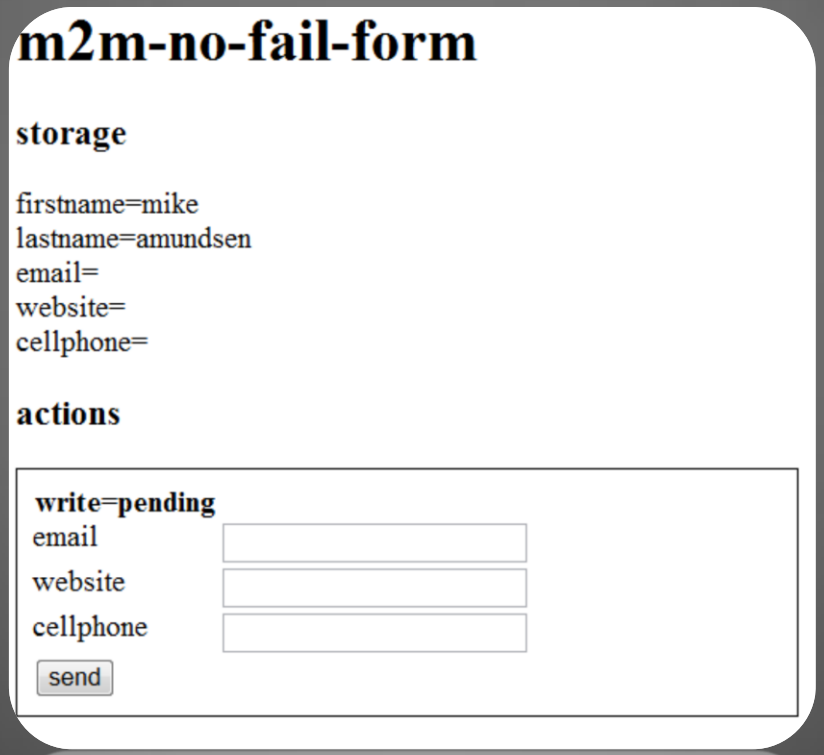
No-fail Forms

- “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



No-fail Forms

- "Translated" into hypermedia for machines



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

No-fail Forms

- Once complete, continue to next state

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.

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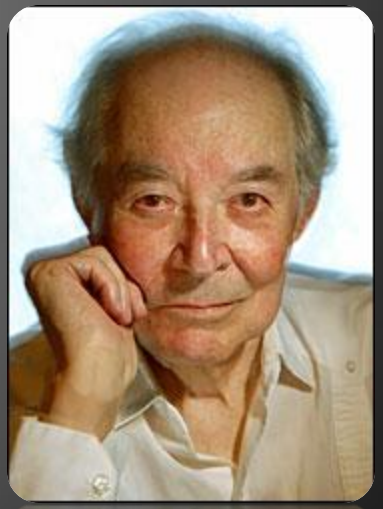
- We don’t need to make machines ‘smarter’, we need to accommodate them with ‘better’ languages.
- We don’t need to change the way humans use the web today.
- Machines don’t need to understand ‘meaning’, they need to recognize ‘identifiers’

Designing ARMs for the Web

"Every act of communication is an act of translation."

- Gregory Rabassa



The driverless car of the Web

APIs to Affordances

A new paradigm for services on the Web

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From APIs to Affordances:
A New Paradigm for Web Services

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ABSTRACT

Connected Devices Worldwide

Keywords

1. BACKGROUND

1.1 More Devices

1.2 The 'App Economy'