Such a Rich Set of Affordances!

Mike Amundsen
@mamund
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@mamund
"I wish I had this book 20 years ago."

"A great classroom text or web guide."

"Useful in a way that doesn't tie it to specific technologies."
Some things to consider...

- The Nature of Ecosystems
- Hyperagent Anatomy
- Avoiding Monoliths
- Learning from Microservices
Affordances

"The value of a well-designed object is when it has such a rich set of affordances that the people who use it can do things with it that the designer never imagined."

-- Donald Norman (1994)

https://www.youtube.com/watch?v=NK1Zb_5VxuM
You're programming ecosystems, not machines.
var highlight = function($element, pattern) {
    if (typeof pattern === 'string' && (pattern.length > 0)) {
        var regex = (typeof pattern === 'string') ? new RegExp(pattern, 'g') : (null);
        // Highlight the matched text
    }

    var highlight = function(node) {
        var skip = 0;
        if (node.nodeType === 3) {
            var pos = node.data.search(regex);
            if (pos >= 0 && node.data.length > pos) {
                var match = node.data.match(regex);
                var spannode = document.createElement("span");
                spannode.className = 'highlight';
                spannode.appendChild(match[0].splitText(pos));
                var middletxt = match[0].splitText(match[0].length);
                var middlegenode = middletxt.cloneNode(true);
                spannode.appendChild(middlegenode);
                middletxt.parentNode.replaceChild(spannode, middletxt);
                skip = 1;
            }
        }
    }

    // Use the highlight function to highlight text in a document
}
pass messages, not code.
The Coffee Test

"A machine is required to enter an average home and figure out how to make coffee."

-- Steve Wozniak

By Gage Skidmore, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=63344547
Focus on the map, not the destination
<table>
<thead>
<tr>
<th>Feature</th>
<th>Symbol</th>
<th>Town</th>
</tr>
</thead>
<tbody>
<tr>
<td>desert/wasteland</td>
<td>![symbol]</td>
<td>town/village</td>
</tr>
<tr>
<td>grassland</td>
<td>![symbol]</td>
<td>cities</td>
</tr>
<tr>
<td>swamp</td>
<td>![symbol]</td>
<td>tower/fortress</td>
</tr>
<tr>
<td>hills</td>
<td>![symbol]</td>
<td>castle</td>
</tr>
<tr>
<td>mountains</td>
<td>![symbol]</td>
<td>country capital</td>
</tr>
<tr>
<td>cave</td>
<td>![symbol]</td>
<td>windmill</td>
</tr>
<tr>
<td>political border</td>
<td>![symbol]</td>
<td>forest</td>
</tr>
<tr>
<td>road</td>
<td>![symbol]</td>
<td>lake</td>
</tr>
<tr>
<td>river</td>
<td>![symbol]</td>
<td>reef</td>
</tr>
<tr>
<td></td>
<td>![symbol]</td>
<td>canyon</td>
</tr>
</tbody>
</table>
Affordances

"The affordances of the environment are what it offers ... what it provides or furnishes, either for good or ill."

James Gibson, 1977
<maze version="1.0">
  <collection href="URI">
    <link href="URI" rel="maze" />
    <link href="URI" rel="maze" />
    ...
  </collection>
  <item href="URI">
    <link href="URI" rel="start" />
    <debug>CDATA</debug>
  </item>
  <cell href="URI" debug="TEXT" total="NUMBER" side="NUMBER">
    <link href="URI" rel="current" debug="TEXT" total="NUMBER" side="NUMBER"/>
    <link href="URI" rel="north" />
    <link href="URI" rel="south" />
    <link href="URI" rel="east" />
    <link href="URI" rel="west" />
    <link href="URI" rel="exit" />
  </cell>
  <error href="URI">
    <title>TEXT</title>
    <code>TEXT</code>
    <message>CDATA</message>
  </error>
</maze>
function processLinks(response, headers)
{
    var xml, linkItem, i, rel, url, href, flg, links, rules;

    flg = false;
    links = [];
    rules = [];

    // get all the links in this document
    g.linkCollection = [];
    xml = response.selectNodes('//link');
    for (i = 0; i < xml.length; i++)
    {
        rel = xml[i].getAttribute('rel');
        url = xml[i].getAttribute('href');
        linkItem = {'rel': rel, 'href': url};
        g.linkCollection[g.linkCollection.length] = linkItem;
    }

    // is there an exit?
    href = getLinkElement('exit');
    if (href != '')
    {
        println('*** Done! ' + href);
        g.done = true;
        if (g.robot == true)
        {
            alert('Done in only ' + g.idx + ' moves!');
        }
        return;
    }

    // is there an entrance?
    if (flg == false && g.start == false)
    {
        href = getLinkElement('start');
        if (href != '')
        {
            flg = true;
            g.start = true;
            g.href = href;
            g.facing = 'north';
            println(href);
        }
    }
}
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        href = getLinkElement('start');
        if(href != '') {
            flg = true;
            g.start = true;
            g.href = href;
            g.facing = 'north';
            println(href);
        }
    }
}

*** Done! http://amundsen.com/examples/mazes/2d/five-by-five/999:east
http://amundsen.com/examples/mazes/2d/five-by-five/24:east
http://amundsen.com/examples/mazes/2d/five-by-five/19:east
http://amundsen.com/examples/mazes/2d/five-by-five/14:south
http://amundsen.com/examples/mazes/2d/five-by-five/13:east
http://amundsen.com/examples/mazes/2d/five-by-five/8:north
http://amundsen.com/examples/mazes/2d/five-by-five/9:east
http://amundsen.com/examples/mazes/2d/five-by-five/4:south
http://amundsen.com/examples/mazes/2d/five-by-five/3:south
http://amundsen.com/examples/mazes/2d/five-by-five/2:west
http://amundsen.com/examples/mazes/2d/five-by-five/7:south
http://amundsen.com/examples/mazes/2d/five-by-five/6:east
http://amundsen.com/examples/mazes/2d/five-by-five/1:west
http://amundsen.com/examples/mazes/2d/five-by-five/5:west
http://amundsen.com/examples/mazes/2d/five-by-five/1:west
http://amundsen.com/examples/mazes/2d/five-by-five/0:north
Hypermedia is the Affordance

Benefits of REST-based Architecture

Simplifies
  › hypertext is standardized (fewer UIs)
Simplifies
  › identification is standardized (less communication)
Simplifies
  › exchange protocols are standardized (fewer integrations)
Simplifies
  › interactions are standardized (fewer semantics)
Simplifies
  › data formats are standardized (fewer translations)

Affordance is the Key
Hyperagents
Separation of Concerns

"One is willing to study in depth an aspect of one's subject matter in isolation for the sake of its own consistency."

-- Edsger W. Dijkstra (1974)
SoC for an ecosystem

HTTP

Maze+XML

IANA LinkRels
How many concerns?

"A machine is required to enter an average home and figure out how to make coffee."

-- Steve Wozniak

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Agency and Curiosity
The Quest for Surprisal: Curiosity (in Math)

- Observations $x_t$ and $x_{t+1}$
- Action $a_t$ such that $x_t$ transitions to $x_{t+1}$
- Embedding $\phi(x)$
- Prediction $p(\phi(x_{t+1}) \mid x_t, a_t)$
- Reward $r_t = -\log p(\phi(x_{t+1}) \mid x_t, a_t)$
- Train to maximize $r_t$
- Agent now favors transitions with high prediction error

Danny Lange
VP of AI and ML at Unity Technologies

https://gotochgo.com/2019/sessions/719
Step 1: Navigate (Destination)
Step 1: Navigate (Destination)
Step 2: Choose (Map)
Avoiding Monoliths
A Close Encounter of the 'Furred' Kind!

WALT DISNEY PRODUCTIONS
THE CAT FROM OUTER SPACE

WALT DISNEY PRODUCTIONS
THE CAT FROM OUTER SPACE

KEN BERRY
SANDY DUNCAN
HARRY MORGAN
RODDY McDOWALL
McLEAN STEVENSON

Written by TED LEE
Co-produced by NORMAN TOLNER
Produced by RON MILLER
Directed by NORMAN TOLNER
Technicolor
Shopping Agent

Product Search
Shopping Agent

Product Search

Shopping Cart
Shopping Agent

- Product Search
- Shopping Cart
- Card Payment
Shopping Agent

- Product Search
- Shopping Cart
- Card Payment
- Package Delivery
It only *appears* to be a single agent.
Release It!
Second Edition
Design and Deploy
Production-Ready Software

Michael T. Nygard
Edited by Katharine Dvorak
Michael Nygard's Stability Patterns

- Timeout
- Circuit Breaker
- Bulkhead
- Steady State
- Fail Fast
- Handshaking
“Bugs will happen. They cannot be eliminated, so they must be survived instead.”

-- Michael T. Nygard
Intelligence in Biological Systems

Senses + Computation in nature that allow organisms to:

- Eat: Consume Energy
- Don’t get Eaten: Delay Becoming Energy Yourself
- Multiply: Become Abundant
- Beware of Physics: In Particular, Inertia and Gravity
- Agency: The Ability to Act upon the Environment

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Survive Failures
“No insect issues commands to another or instructs it to do things in a certain way.”

Deborah Gordon
Ants at Work, 1999
“The basic mystery about ant colonies is that there is no management.”

Deborah Gordon, Stanford Biologist
Respond to signals in the environment, not internal commands.
"The value of a well-designed object is when it has such a rich set of affordances that the people who use it can do things with it that the designer never imagined."

-- Donald Norman (1994)
Affordances

"The value of a well-designed ecosystem is when it has such a rich set of affordances that the agents who use it can do things with it that the designer never imagined."

-- Donald Norman (1994)

https://www.youtube.com/watch?v=NK1Zb_5VxuM
And So...
Populate Ecosystems
Focus on the Map, not the Destination
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    xml = response.selectNodes('//link');
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    {
        rel = xml[i].getAttribute('rel');
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        linkItem = {'rel':rel, 'href':url};
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    }

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    if(href != '')
    {
        println('**** Done! '+href);
        g.done = true;
        if(g.robot==true)
        {
            alert('Done in only ' + g.idx + ' moves!');
        }
        return;
    }

    // is there an entrance?
    if(flg==false & g.start==false)
    {
        href = getLinkElement('start');
        if(href != '')
        {
            flg=true;
            g.start=true;
            g.href = href;
            g.facing = 'north';
            println(href);
        }
    }

    // ok, let's "wall-follow"
    rules = g.rules[g.facing];
    for(i=0;i<rules.length;i++)
    {
Avoid Monoliths
Respond to signals in the environment, not internal commands.
# Legend to Map Symbols

## Country

<table>
<thead>
<tr>
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- Prediction $p(\phi(x_{t+1}) \mid x_t, a_t)$
- **Reward** $r_t = -\log p(\phi(x_{t+1}) \mid x_t, a_t)$
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- Observations $x_t$ and $x_{t+1}$
- Action $a_t$ such that $x_t$ transitions to $x_{t+1}$
- Embedding $\phi(x)$
- Prediction $p(\phi(x_{t+1}) | x_t, a_t)$
- Reward $r_t = -\log p(\phi(x_{t+1}) | x_t, a_t)$
- Train to maximize $r_t$
- Agent now favors transitions with high prediction accuracy

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