Semantic Interaction Design

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What is the first thing you do when you start to create/define/specify an Interaction Design?

Don’t do that!

There is a better way to start…

What

Chapter 1

Semantic IxD is a proven (cognitive science based) **scalable** UX design method that ensures maximum usability is achieved **10X** more effectively & efficiently than current UX practice today.

Origin of Semantic Interaction Design (IxD) theory goes back decades!

Human Factors Cognitive Ergonomics:
- Task action grammar/Complexity models
- Reisner (1979)
- Spence and Apperley (1984)

+

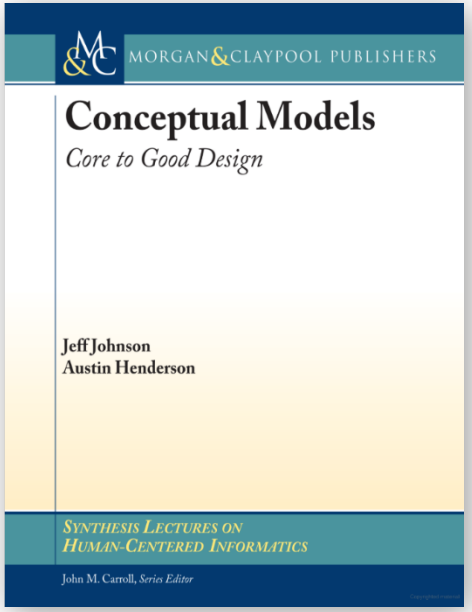
Cognitive Science:
- Stages of Action (Norman 2015)
- Design by Levels (Foley 1995)
- Activity Theory (Nardi 1996)
- Consistency (Shneiderman 1988)

+

Computer Science
- Objected-Oriented UI (Collins 1995)

Science starts here

2012



Practice Foundation

2020

Complete System

Learn about an innovative IxD method

Deliver designs faster/smarter

- Fewer iterations
- Minimize feature creep rework
- Fewer stakeholder meetings
- Science based tradeoff discussions (not opinions, not trial & error)

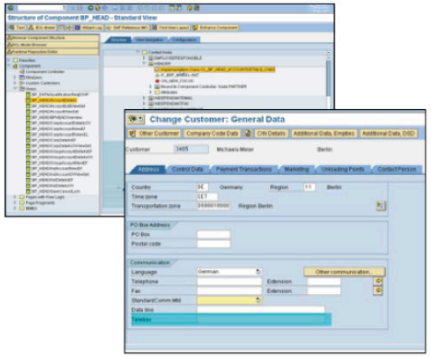
Deliver optimal UX designs

- Minimum number of screens
- Shortest flows
- Lowest cognitive load possible
- Ready to scale for next version

10X
Efficiency
(your labor)

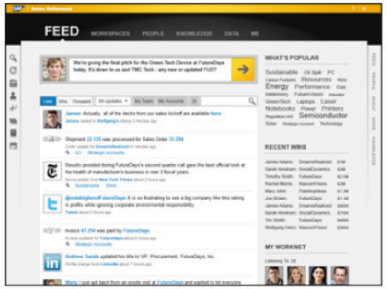
10X
Effectiveness
(design quality)

Can you support the 10X claim?



1000's of screens

100's of screens



10's of screens

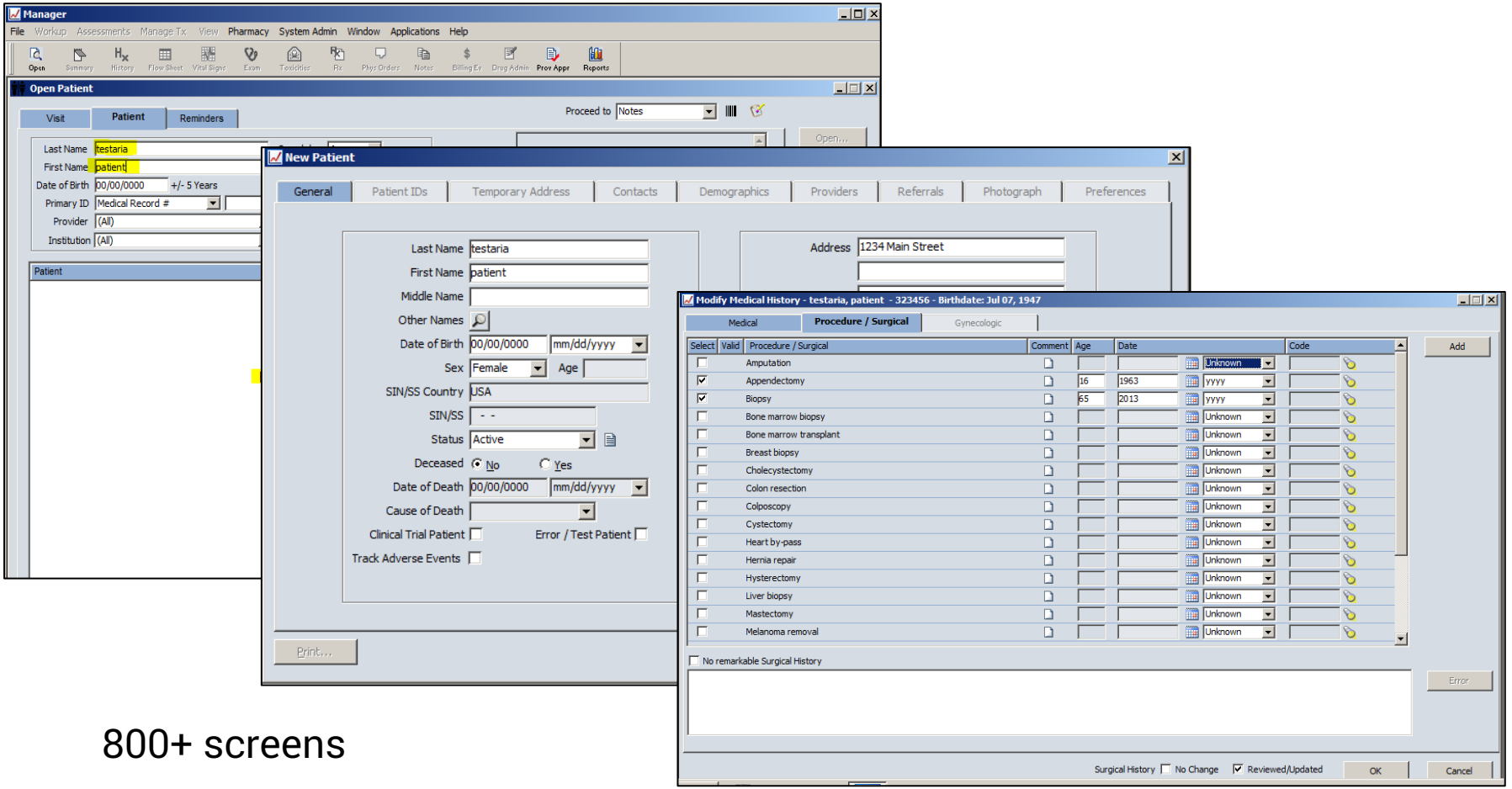
+

5 screens

= Over a 100X Improvement!

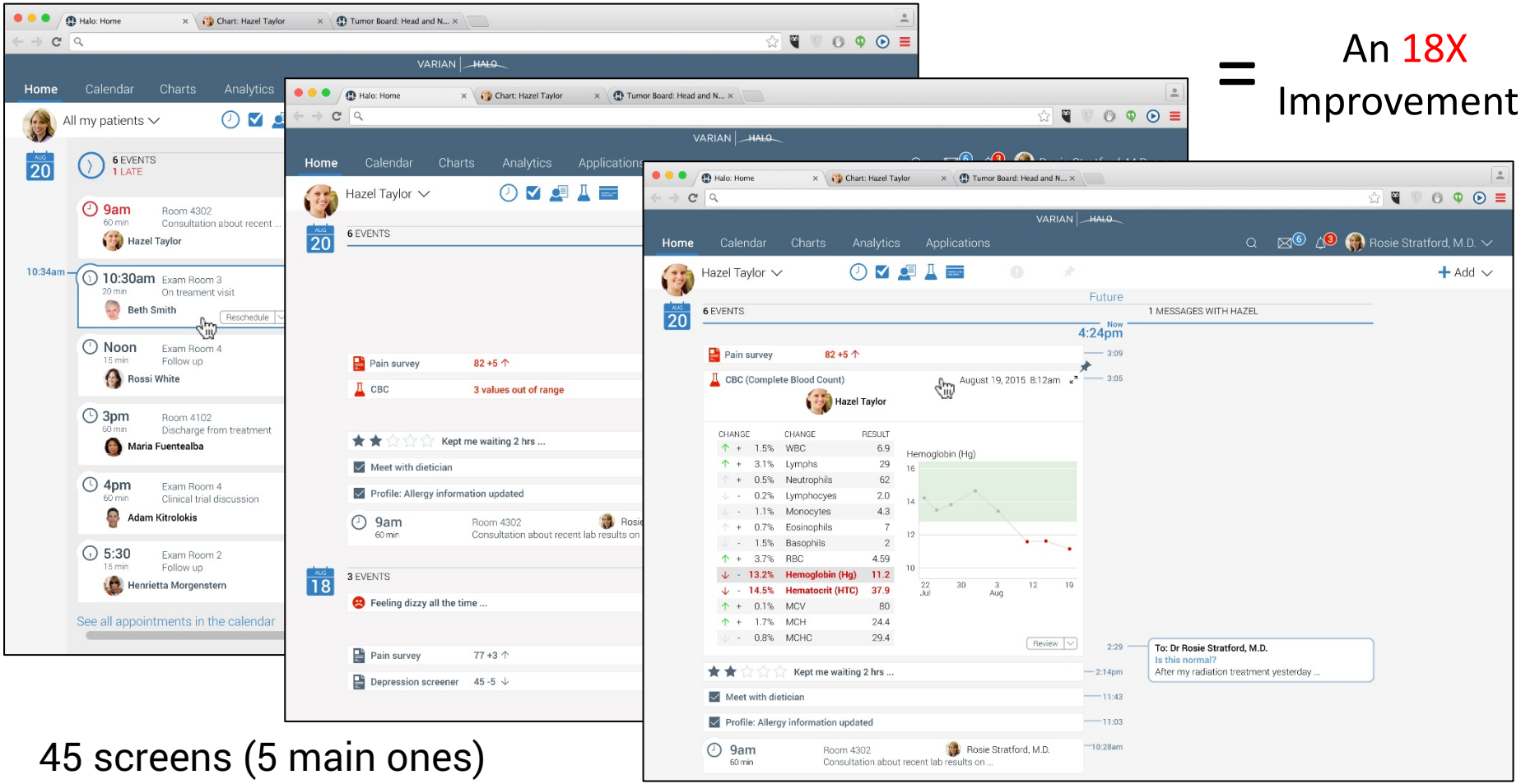
Case studies in the book

Before - Can you support this 10x claim?



800+ screens

After - Can you support this claim?



= An 18X Improvement!

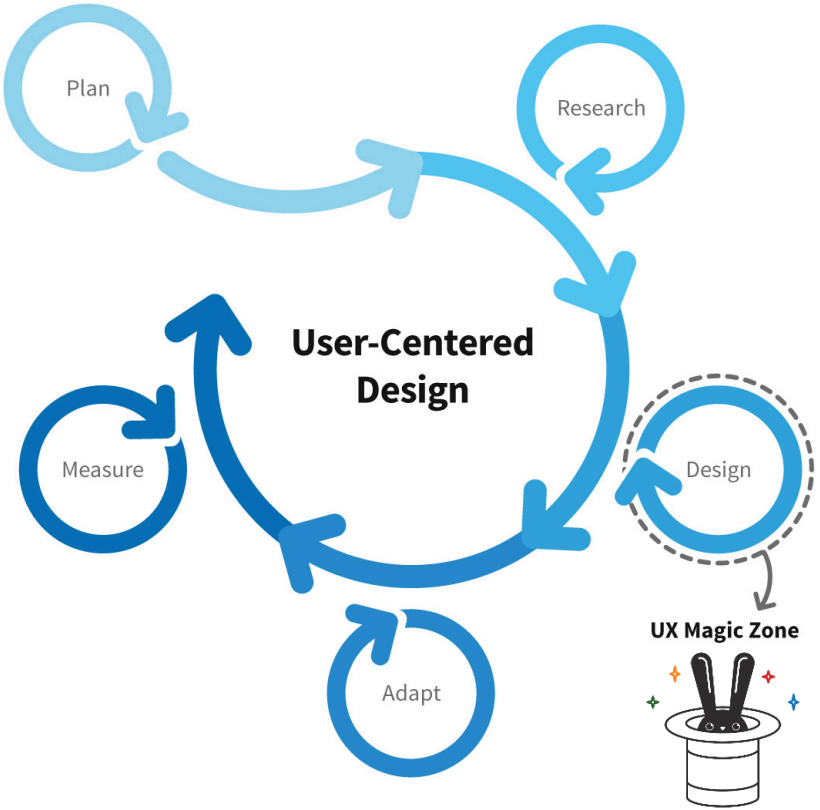
45 screens (5 main ones)

When

Chapter 1

At the heart of the User Centered Design step.

Focus – Only Interaction Design step (not full UCD life cycle)



- Other phases are important too
- Necessary but not sufficient

Why

Chapter 1

Because Design Darwinism does not work!

Current design methods don’t scale to complex systems, are inefficient and often lead to product failure at significant expense because

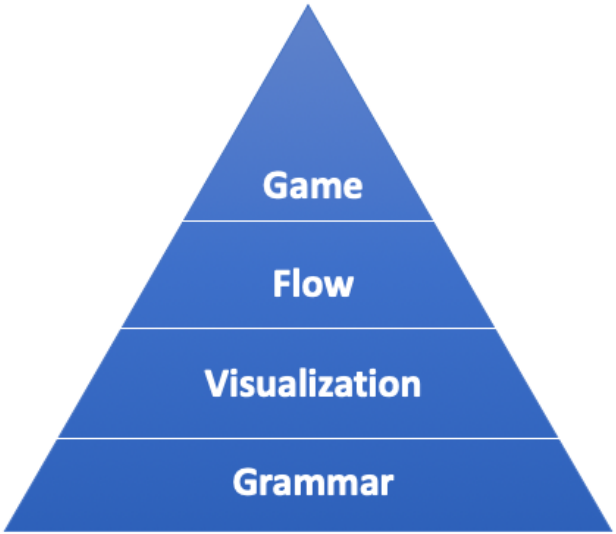
Real quality is not achieved by eliminating defects – occurs through design

*Design Darwinism = Believing A/B testing is a legitimate form of iteration

How (theory)

Chapter 2

Leverage 2 cognitive science principles at 4 modular levels of Interaction Design



Cognitive Science Foundation of Semantic Interaction Design

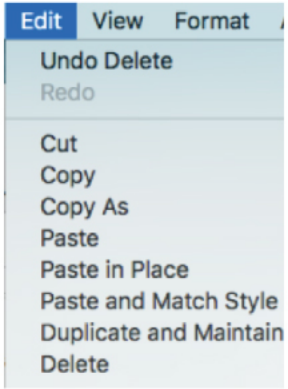
1. Language is the basis of conscious thought

2. Language grammar correlates with cognitive complexity
   - Cognitive load in Interaction Design can be measured (lab)
   - Cognitive load for Interaction Design can be predicted in advance

Simple Graphical User Interface (GUI) Semantic Example (Interaction Design Grammar)

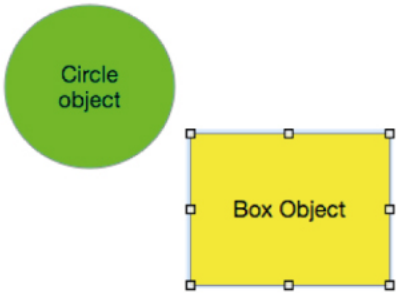
Grammar

Actions



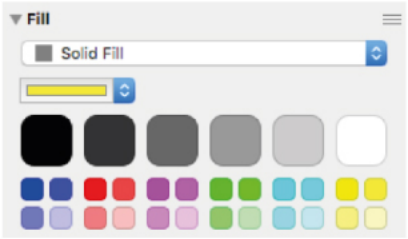
Menu

Objects



Canvas

Attributes



Inspector Dialog Box

Consistency vs. Cognitive Load

OBJECTS \ ACTIONS	Cut	Remove	Copy	Duplicate	Paste	Stamp	Print	Publish
Character	X		X		X			X
Word		X		X		X	X	
Paragraph		X	X		X		X	
Page		X		X		X		X
Document	X		X		X			X

Sparse Object-Action Grammar

Sparse is BAD!

Consistency vs. Cognitive Load

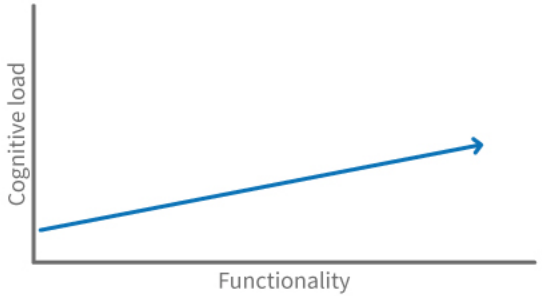
OBJECTS	ACTIONS			
	Cut	**Copy**	**Paste**	**Print**
Character	X	X	X	X
Word	X	X	X	X
Paragraph	X	X	X	X
Page	X	X	X	X
Document	X	X	X	X

Dense Object-Action Grammar

Consistency vs. Cognitive Load Calculation

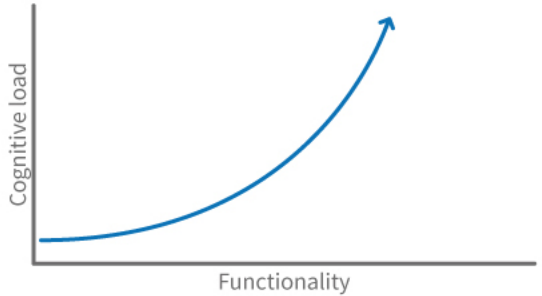
Dense matrix: Load on human memory = **Actions + Objects**

Objects \ Actions	Cut	Copy	Paste	Print
Character	X	X	X	X
Word	X	X	X	X
Paragraph	X	X	X	X
Page	X	X	X	X
Document	X	X	X	X

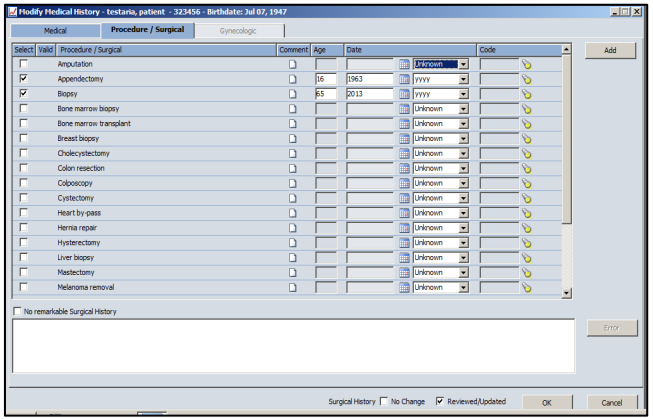


Sparse matrix: Load on human memory = **Actions x Objects**

Objects \ Actions	Cut	Remove	Copy	Duplicate	Paste	Stamp	Print	Publish
Character	X		X		X			X
Word		X		X		X	X	
Paragraph		X	X		X		X	
Page		X		X		X		X
Document	X		X		X			X

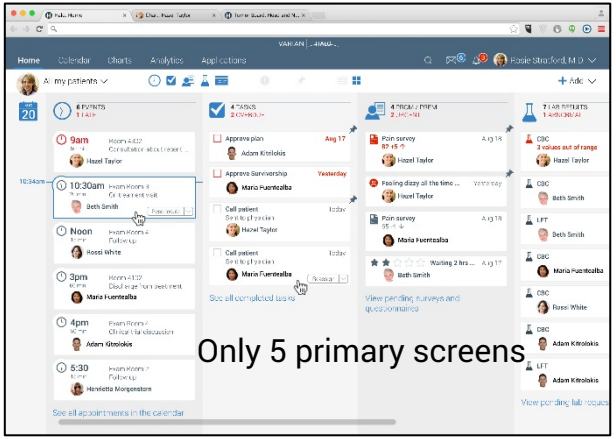


Real Conceptual Model 10x deconstruction in practice!



800 Screens

45 Screens



Only 5 primary screens

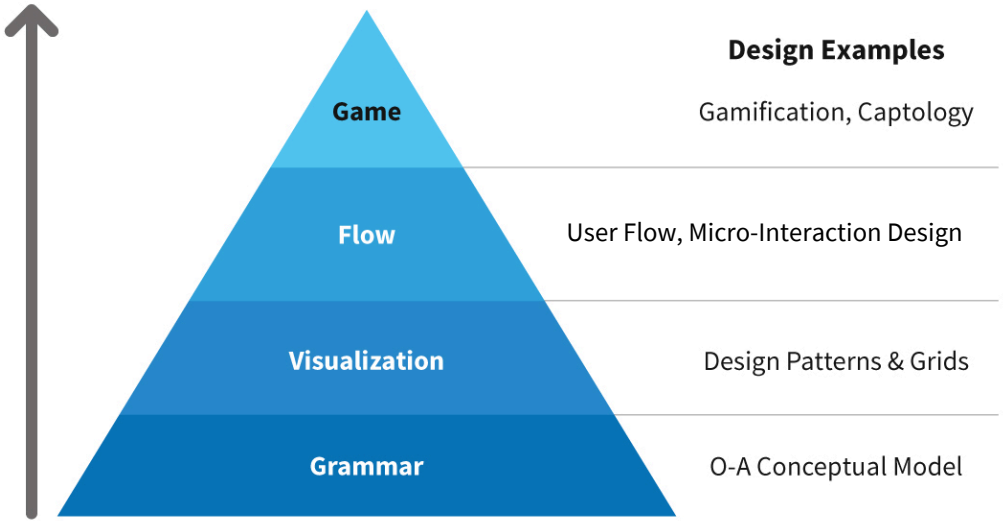
	Create	Update	Void	Accept	Reject	Delegate	Approve	Refer	Transfer	Pin
Patient	X	X		X	X			X	X	
Medical record	X	X	X	X	X	X	X	X	X	X
Treatment plan	X	X	X	X	X	X	X		X	
Appointment	X	X	X			X		X		X
Task	X	X	X	X	X	X	X	X		X
Messages	X	X	X			X		X	X	X
Note	X	X				X		X	X	X
Care team	X	X				X	X	X	X	

Only 10 objects and 10 actions can describe an entire EMR solution

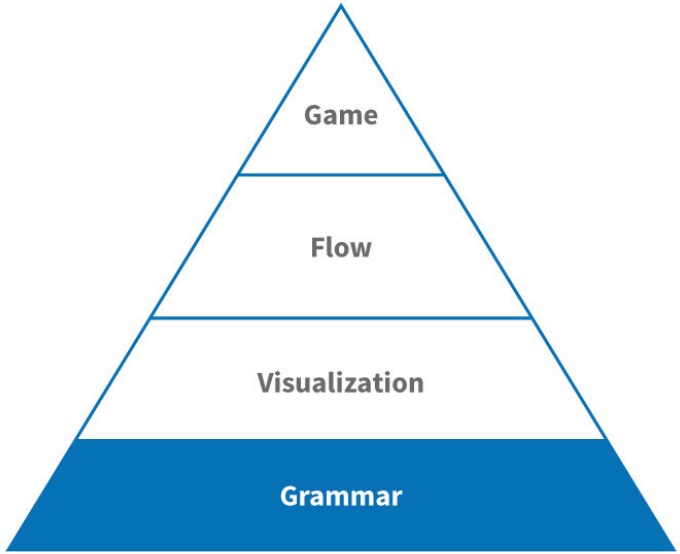
How (practice)

Chapters 4–7

Apply Semantic Interaction Design across all 4 modular **framework** levels



Layer 1- **Grammar**



Where do Objects and Actions come from?

Linguistic structure can be mapped to experience design as follows:

Language construct	UX construct	Example
Noun	Object	Box
Verb	Action	Copy
Adjective	Attribute	Color (Yellow)

Process

Define the Objects and Actions

Enumerate the Attributes for every Object

Prioritize the object / action pairs

Conversion of User Stories into conceptual model

Each story expresses a different user goal and can be easily analyzed to identify the nouns, verbs and adjectives the sentence contains.

"As a parent I want to find a friendly dog that will help teach my children to be responsible."

"As an elderly widow living alone I want to adopt a dog for my protection"

"As a runner I need an active dog that can fit into my exercise routine"

"As a happy owner I want to share photos of my new dog with the MatchDog community"

"As a pet lover I would like to donate so MatchDog can grow its service and help others"

The sentences above are color coded as follows:

Noun > Object Verb > Action Adjective > Attribute

Do the math! – 7X difference in cognitive load

Objects	Donate	Adopt	Join	Schedule	Share	Surrender
Animal	X	X		X	X	X
Money	X		X			X
Services	X			X		X
Info/Ed		X			X	
People		X		X	X	X
Events		X				
Calendar				X	X	X
Advocacy						
Community				X		
Organization		X		X	X	
Shop						

Table 4: A first-draft Object-Action matrix (too sparse and redundant)

Objects	Donate	Adopt	Schedule	Share	Learn
Dog	X	X	X	X	X
Owner	X	X	X	X	X
Organization	X		X	X	X
Money	X		X		

Table 5: Compact Object-Action matrix

Table 4 calculation: **Objects x Actions** = 66

Table 5 calculation: **Objects + Actions** = 9

9 divided by 66 is approximately 14% or **7.3X improvement**

Figure out the Object Attributes!

Animal	Money	People	Services	Event
Species	Donation	Employee	Medical	type
Age	Sponsorship	Customer	Adoption	time
Breed	Volunteer	Board M.	Membership	place
Health	Vehicle	Vet	Volunteer	cost
Personality		Volunteer		duration
Exercise				attendees
Kids friendly				
Other pets				

Attributes don’t add significant cognitive load!
They rely on **recognition** not **recall** (the two types of human memory)

Prioritization!

Task = Object + Action(s) combination

Object-Actions pairs don’t have the same level of importance

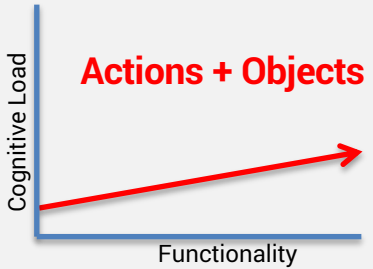
- To the user
- To the business model

Make Common Tasks Easily Accessible

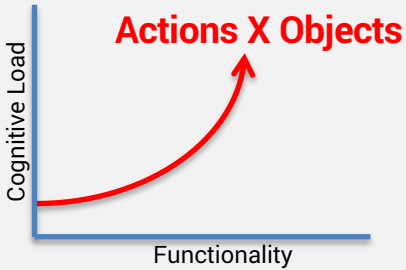
- Two dimensions to evaluate “common”:
  - Frequency (how often)
  - Volume (how many)

	By Many	By Few
Frequent	Most users will do task often	Few users do task, but those who do do it often
Rare	Most users do task, but only rarely	Few users do task, and only rarely
$ Financial	Micro revenue generation (e.g. advertising)	Macro revenue generation (e.g. paid subscription)

Use this knowledge immediately



Versus

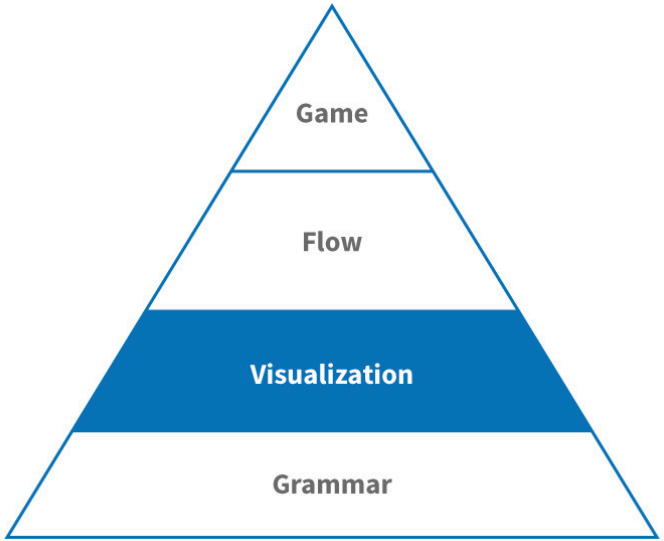


1. Alternative Heuristic **evaluation method**
   - assess cognitive load
   - find mismatches between user mental model and UX

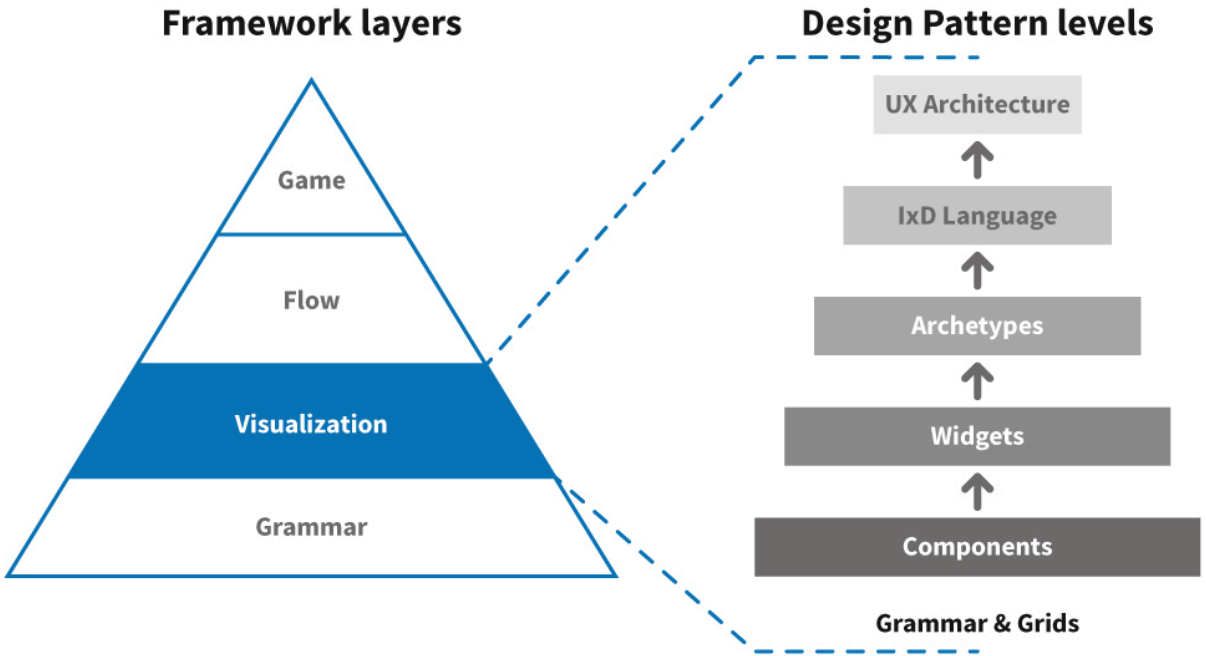
2. UX **Design** method of new projects
   - Minimize screen count and complexity (increase quality)
   - Prioritize tasks before creating mocks (save time)

3. UX **Evolution** of existing products
   - Add features as new **attributes of existing objects**
   - Minimizes complexity
   - Slows growth of cognitive load (due to feature creep)

Layer 2 - **Visualization**



Visualization Deconstruction



All pattern levels are optimized to present and manipulate actions, objects and attributes in different ways

Building a Calendar Page UX

Components

Buttons
labels

Widget (little)

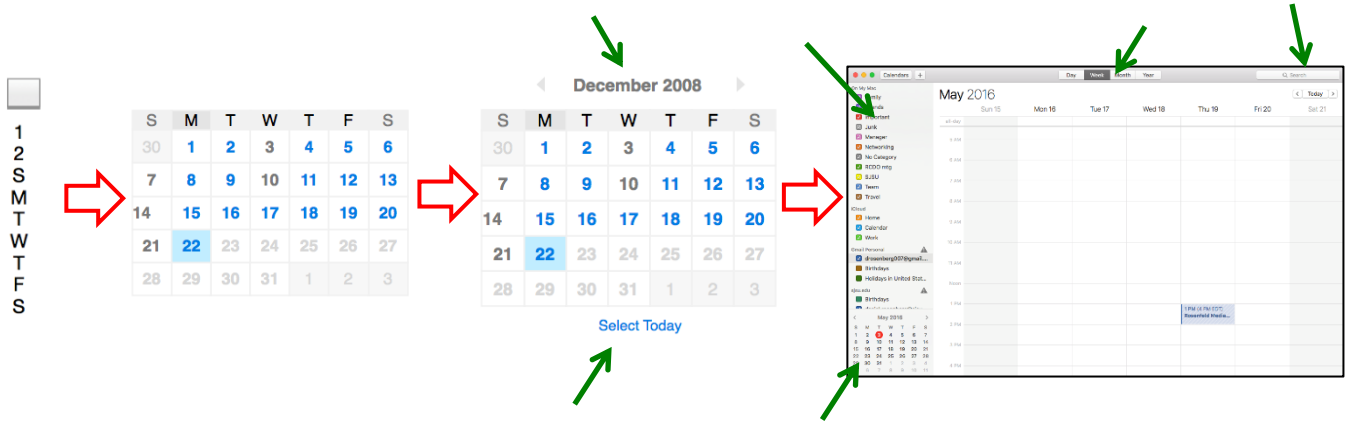
Grid
35 buttons
42 labels

Widget (bigger)

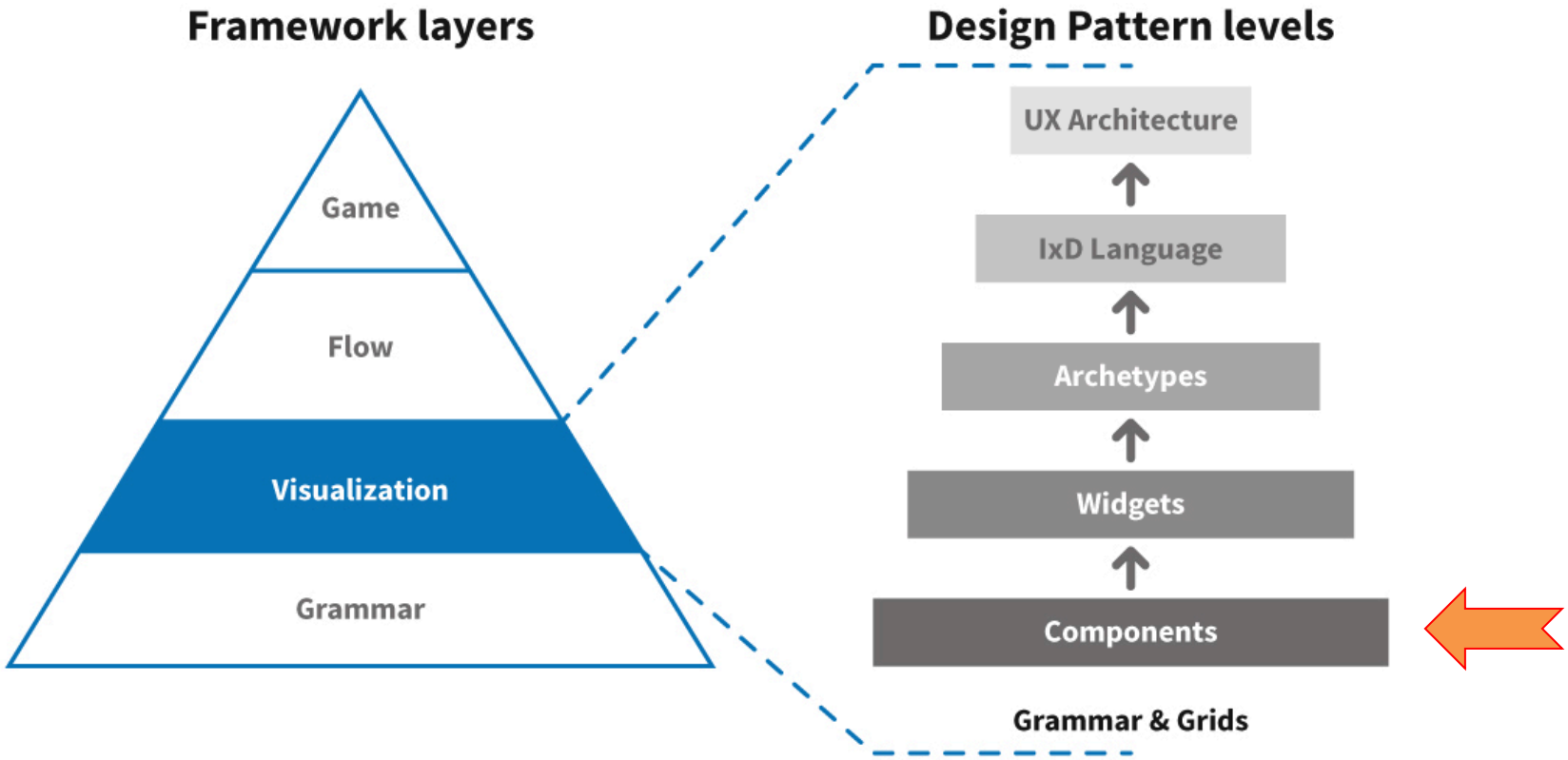
Change month icons
Show selection
“Today” button

Calendar **Archetype** Screen

Day/Week views
Add button
Search box
Color coding



Visualization Deconstruction



Component Patterns

Name	Attribute	Action	Object	Logic/Behavior
Label	x	x	x	The name attribute of anything, in hypertext a navigate action
Radio button	X			Selection of on state within a set of many attributes
Toggle Button	X			On/off state for only one attribute
Checkbox	X			One of many states of given attribute
Drop list	X			A collection of attribute values
Combo box	X	X		A collection of attribute values with the action to add a new attribute in place
Value Slider	X			Point and click way to choose the numeric value of an attribute
Button		X		Click to execute action it represents
Hypertext link		X		Special case of button with only action to be view/navigate
Icon	x	X		Mostly for actions, some can show visual state
Field (value)	X			Type a value which represents an attribute (typically on of many) for a parent object
Text entry box	X		x	Mostly for annotation which is an attribute
Menu	x	X		Mostly for actions but sometimes change the state of an attribute
Tabs	x		X	Used for granular unit of division for functionality

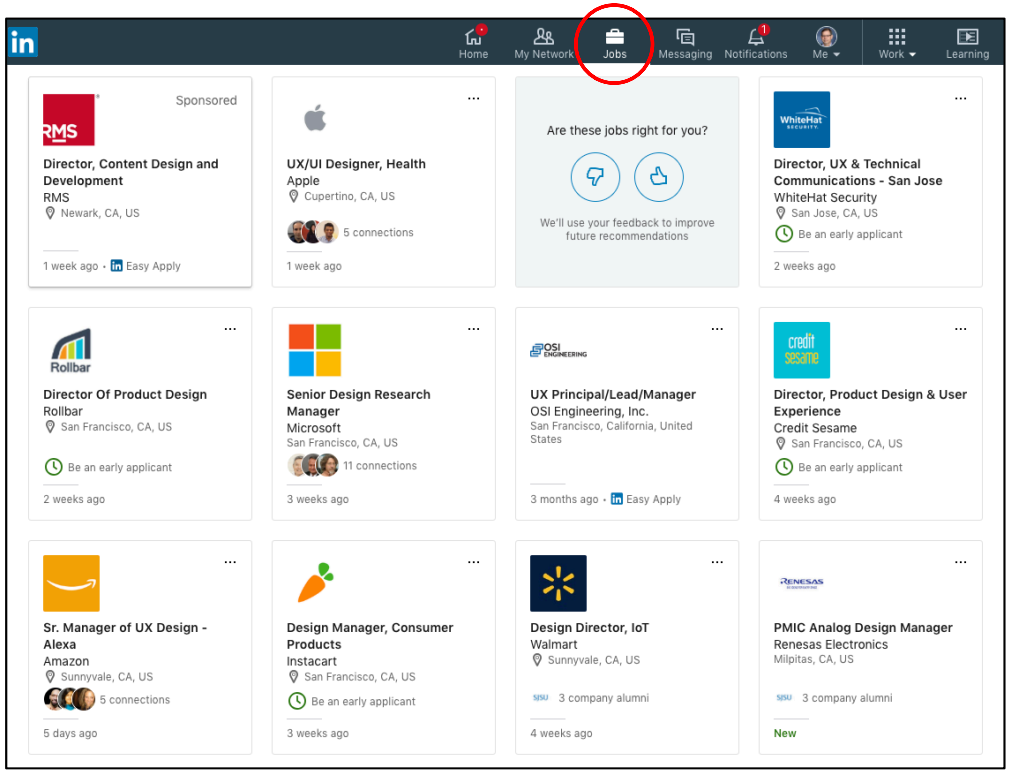
Legend: X (Primary) x (Secondary)

Use today:

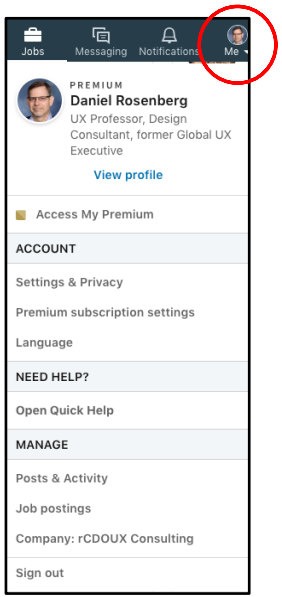
Are you choosing the optimal component to express your attributes?

Don’t use trial & error or intuition

Example – Menu as Actions versus Objects



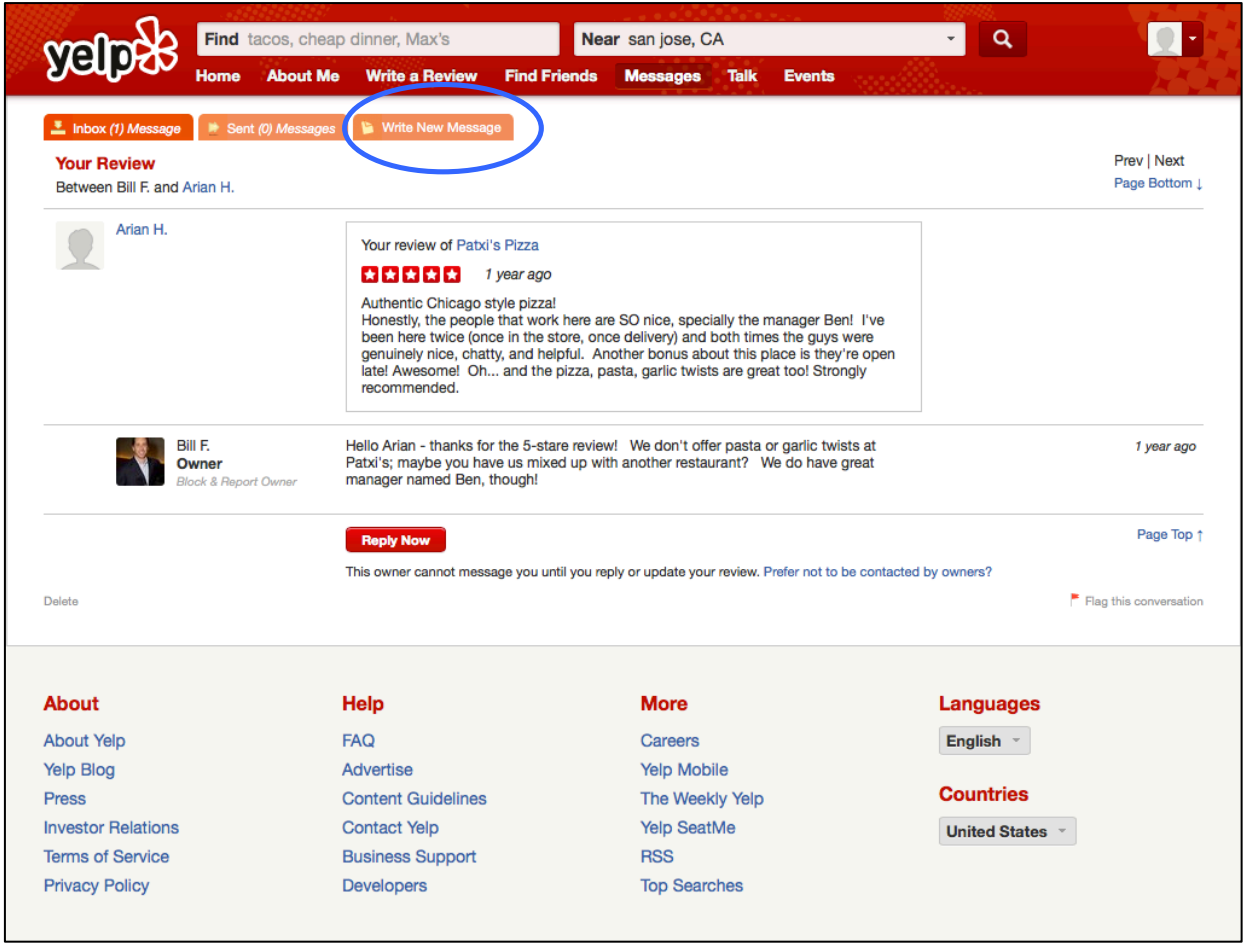
Menu of Jobs (**Objects**)



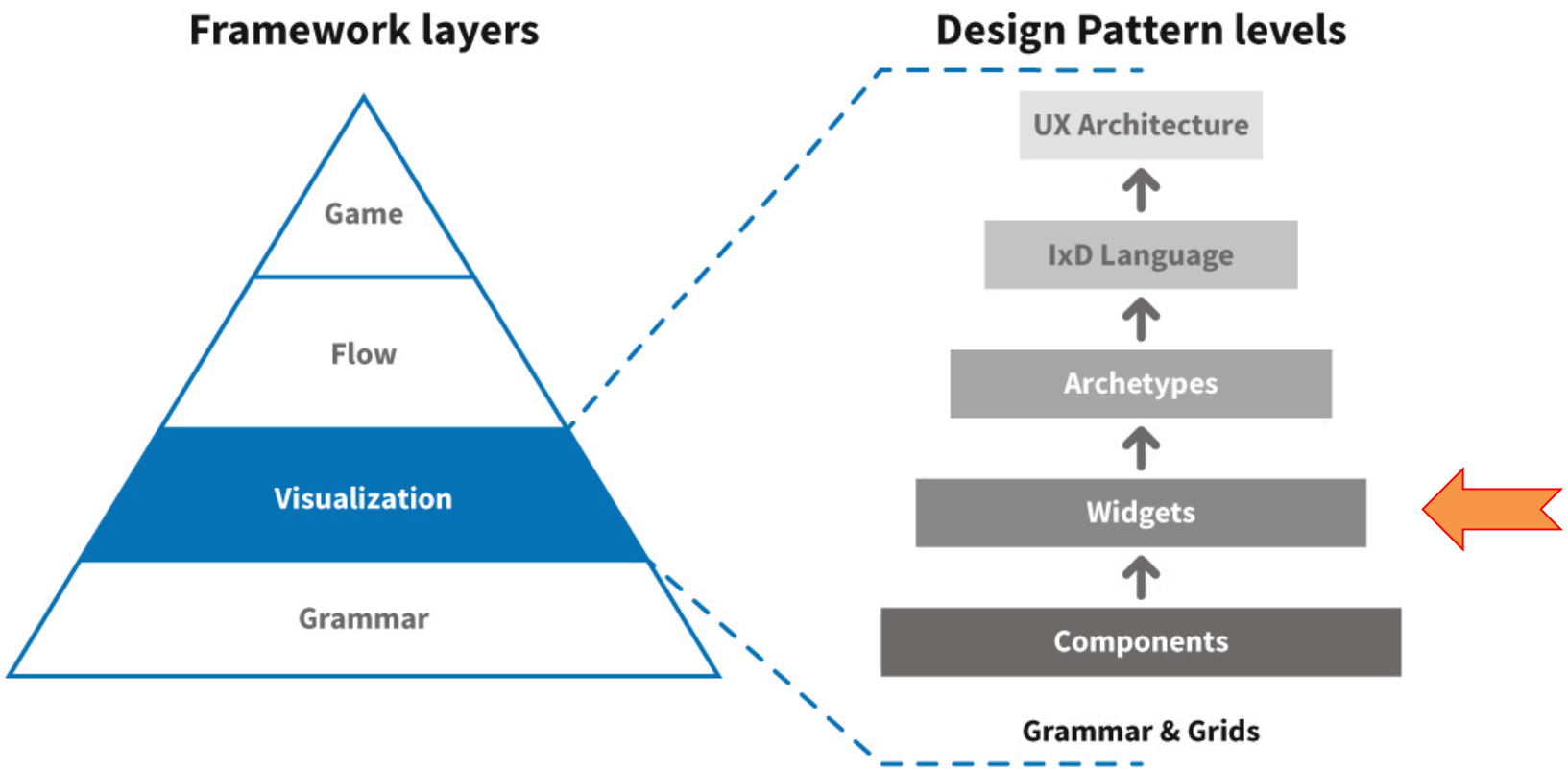
Menu of **Actions** related to profile

Bad Example

Tabs = 2 Attributes and 1 Action



Visualization Deconstruction



Widget Patterns

Name	Attribute	Action	Object	Logic/Behavior
List			X	Table with one column (can be horizontal like a Carrousel or Cover flow)
Table	x		X	Table itself or each row can be an object
Tree control			X	Represents hierarchy of Object
H-Grid				Combination of tree and table, so set attributes be shown as well
Master-detail	X		X	Combination of list of objects and its attributes or Attributes and sub-attributes
Form	x		X	Logically represents an object, fields and controls inside are attributes
Card	x		X	Expanding (Detail)/Collapsing (Summary) element used for a series of object.
Chat box		x	X	Conversation is an object as are the people you have it with
Filter panel	X	X		Uses the action of turning on/off specific attributes to filter data
Shuttle control			X	Two list boxes side by side that allow the selection of objects
Picker	X			Visual palette for colors, fonts, shadow and other visual attributes
Wizard	x	X		Context maybe one object, purposes is to set attributes and commit on final action
Property sheet	X			Container of attributes of given object type
Leader board	X		X	Gamification list of object (people or avatars) sorted in top to worst order
Media control		X		Stop, start, fast forward audio or video

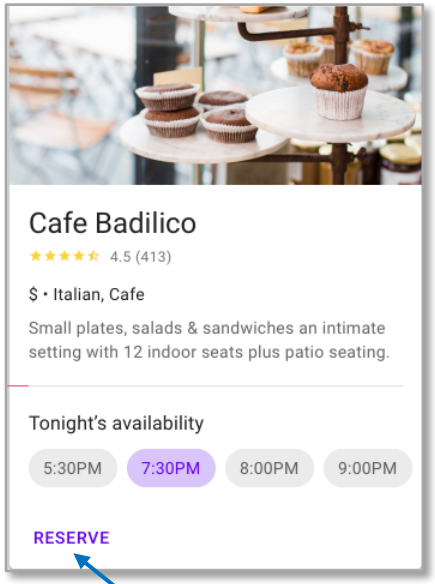
Use today:

Are you choosing the optimal widget to express your objects?

Don't use trial & error or intuition!

Legend: X *(Primary) | x (Secondary)*

Card Control – Semantic error example



Local action
(CM transactional)

Many attributes inside card

Local action
(not grammar relevant)

Non-grammatic Widgets

Time

- Feed
- Media controls (VCR)
- Timeline
- Breadcrumbs
- Search box

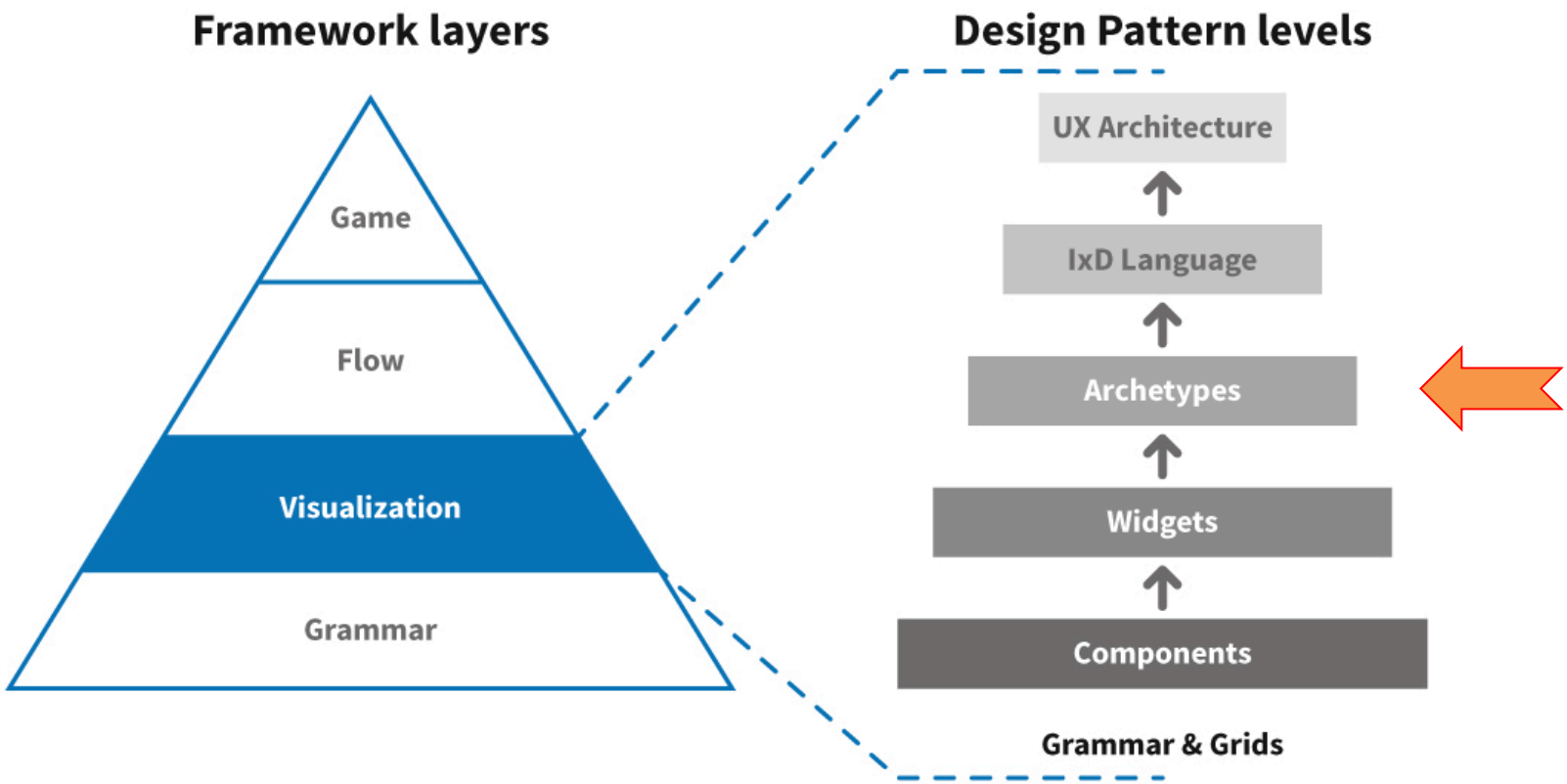
Space

- Zoom controls
- Pan
- Map
- Search results

Container only

- Dialog box
- Toolbar
- Portlet (html iFrame)
- Card
- Page
- Screen

Visualization Deconstruction



Screen **Archetype** Patterns

Name	Attribute	Action	Object	Logic/Behavior
Menu page		x	X	Object usage can have implicit or explicit selection, to display actions mostly a list
Catalog	X	X	X	Select item to purchase (put in cart)
Funnel	X	X	X	eCommerce “Shopping Cart” to pay and ship. As seen in tax preparation apps.
Desktop	X	X	X	Select item to object to open/run
Portal	X		X	iFrames represent object, content within attributes
Workflow	X	X	X	Multiple step process spanning a single object, actions and attributes embedded
Social	X	x	x	Organized content over time, mostly attributes of people, people are the object
Container organizer	X		X	Master-Master level for object, detail are content of object plus search and create
Tool & Canvas	X	X	X	Objects in canvas, (could be simple box or full engineering CAD drawing)
Workspace	X	X	X	Combines editors, prop sheet and toolbars
Administration tool	X	X	X	Object on the left in hierarchy, props on right
Dashboard	X		X	Frames represent objects, content inside are attributes, filters in panels or toolbars
Report	X		X	Report is the parent object, content is attributes of same
Calendar	X	x	X	Representation of time in a grid or linear layout (top to bottom or left to right)

Legend: X (Primary) x (Secondary)

Use today:

Are you choosing the optimal archetype to express your Interaction Design system?

Don’t use trial & error or intuition

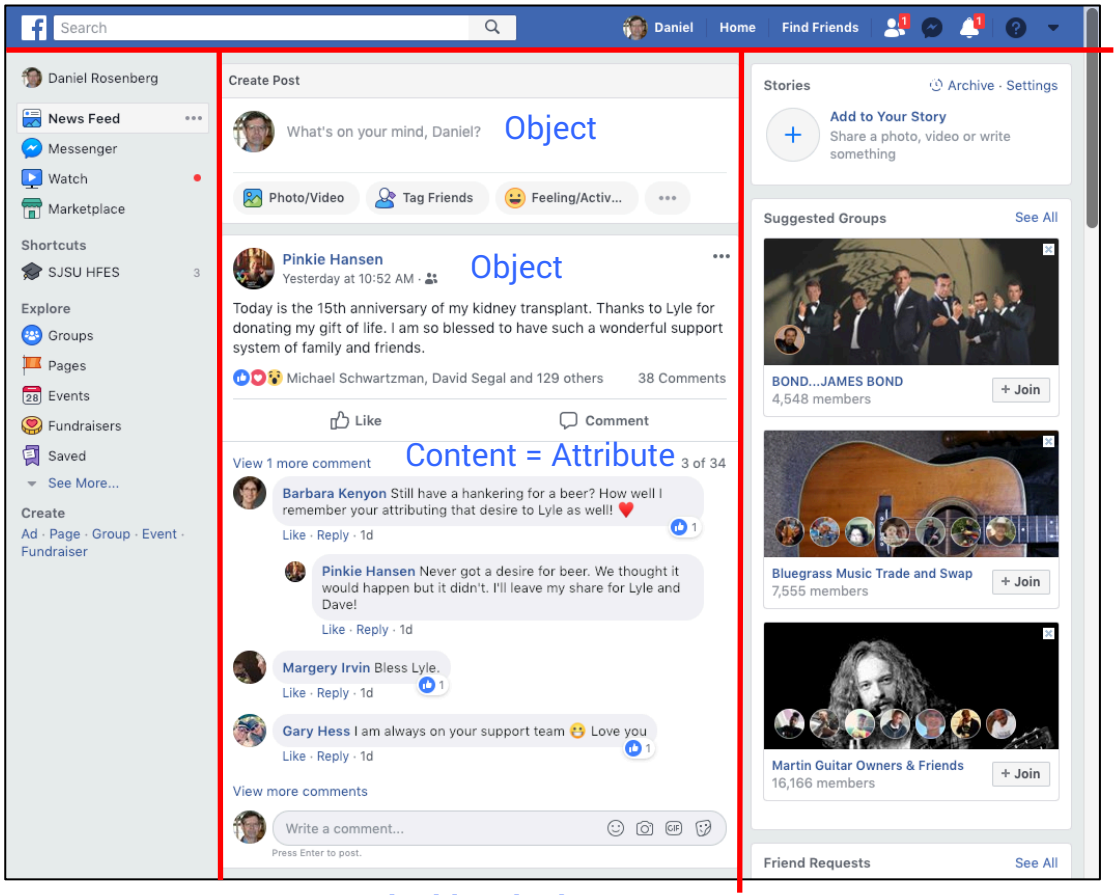
Archetype: Social (Feed and suggestions)

Objects

Action

Attribute filters

Actions



Global Actions

Local Actions

Local Actions

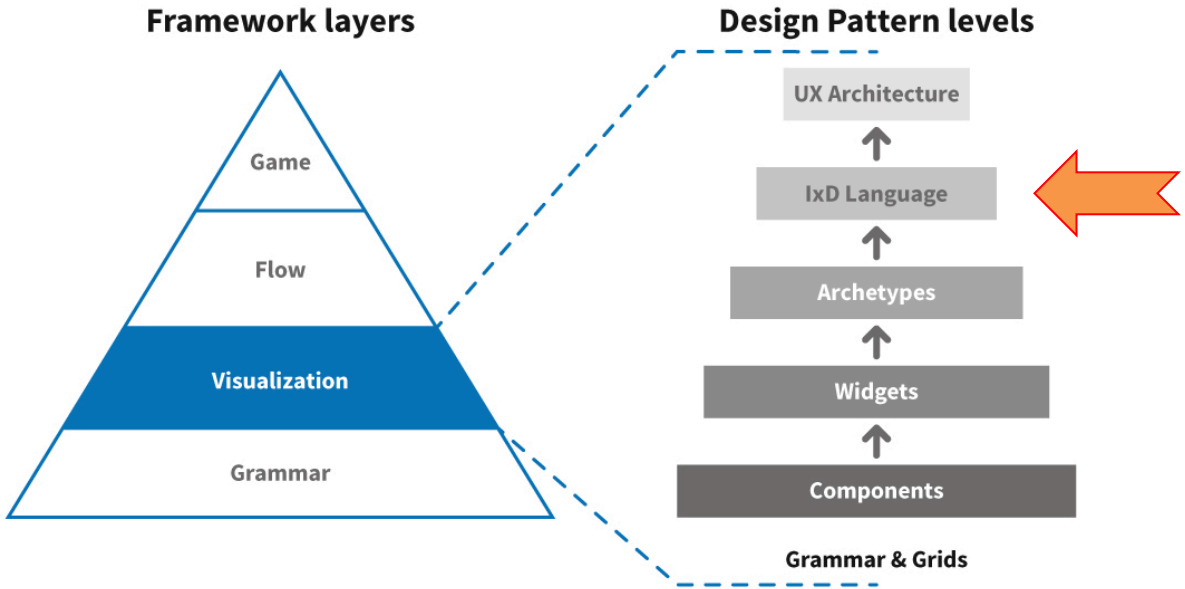
Local Actions

Local Actions

Local Actions

Feed Widget in the center

Visualization Deconstruction



Use today:

Are you consistently expressing the grammar across all your design decisions?

Medical Interaction Design Language examples

1. Behavior the Appointment Object inside different archetypes

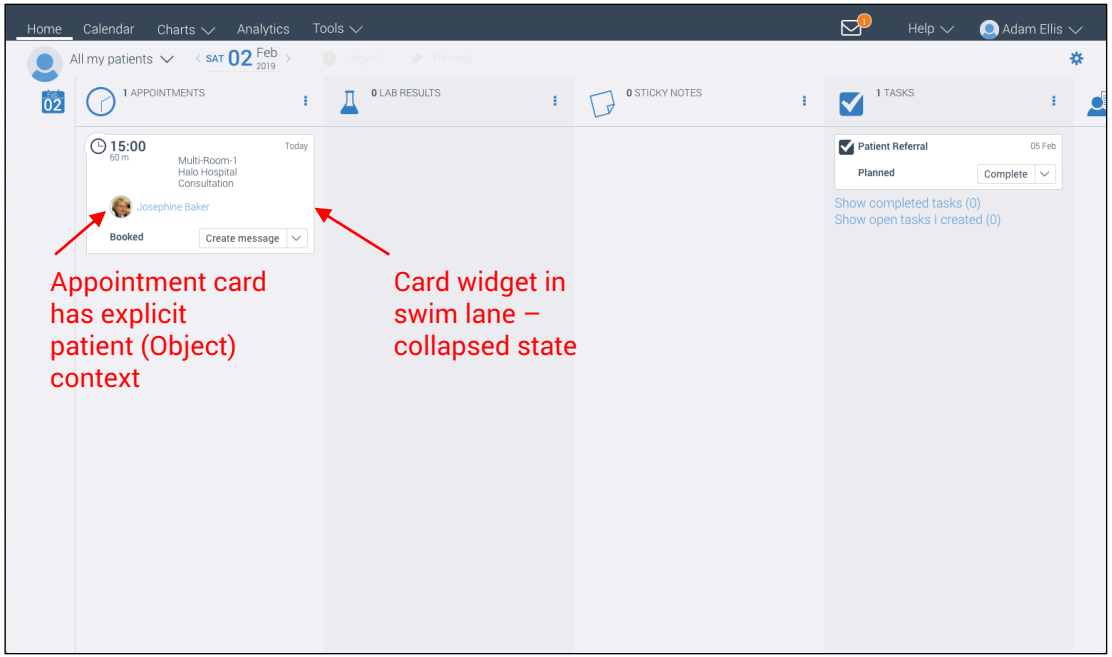
2. Consistent use of the Void Action to remove errors

A day in the life of…

EMR Conceptual Model

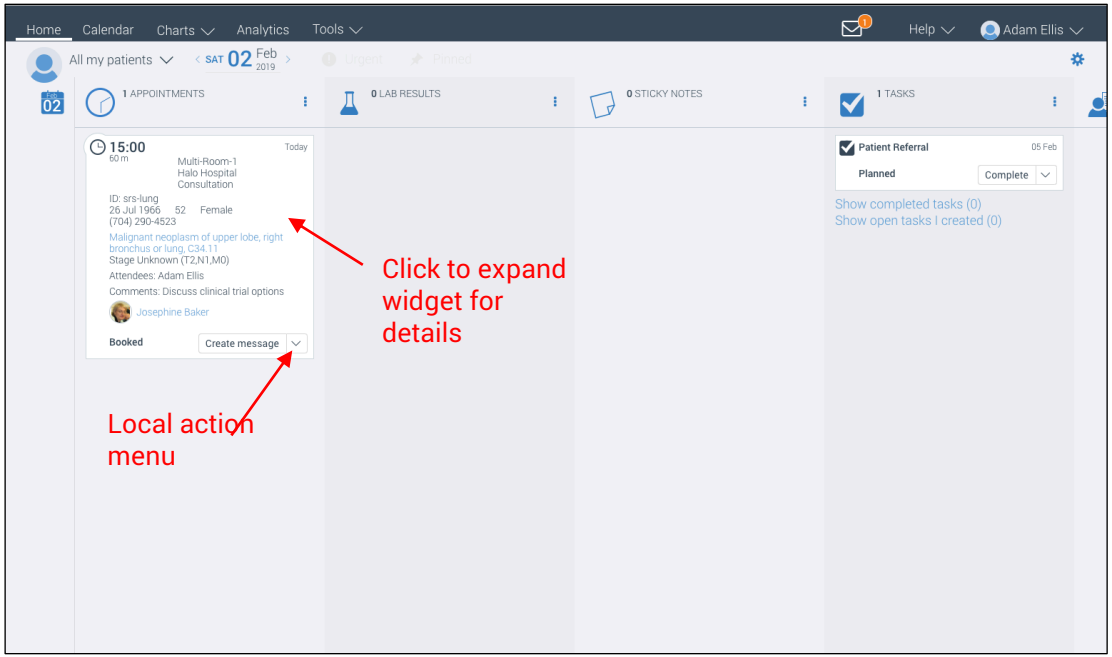
	Create	Update	Void	Accept	Reject	Delegate	Approve	Refer	Transfer	Pin
Patient	X	X		X	X			X	X	
Medical record	X	X	X	X	X	X	X	X	X	X
Treatment plan	X	X	X	X	X	X	X		X	
Appointment	X	X	X			X		X		X
Task	X	X	X	X	X	X	X	X		X
Messages	X	X	X			X		X	X	X
Note	X	X				X		X	X	X
Care team	X	X				X	X	X	X	

Interaction Design Language: Object Example - Appointment



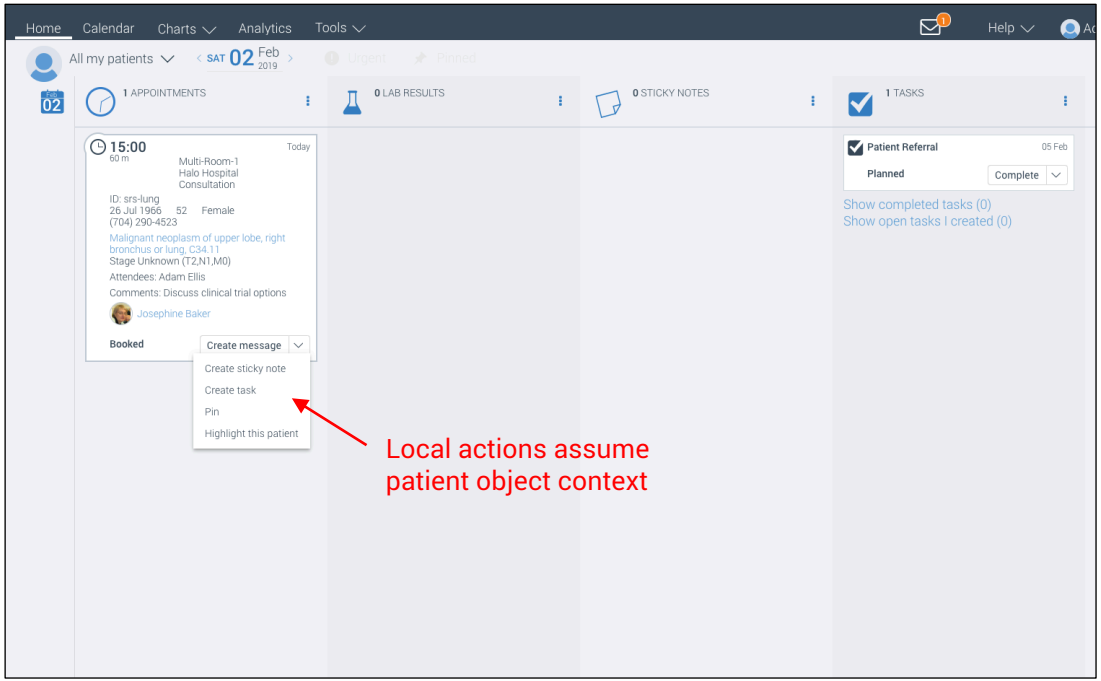
Swimlane Archetype Pattern

Interaction Design Language: Object Example - Appointment



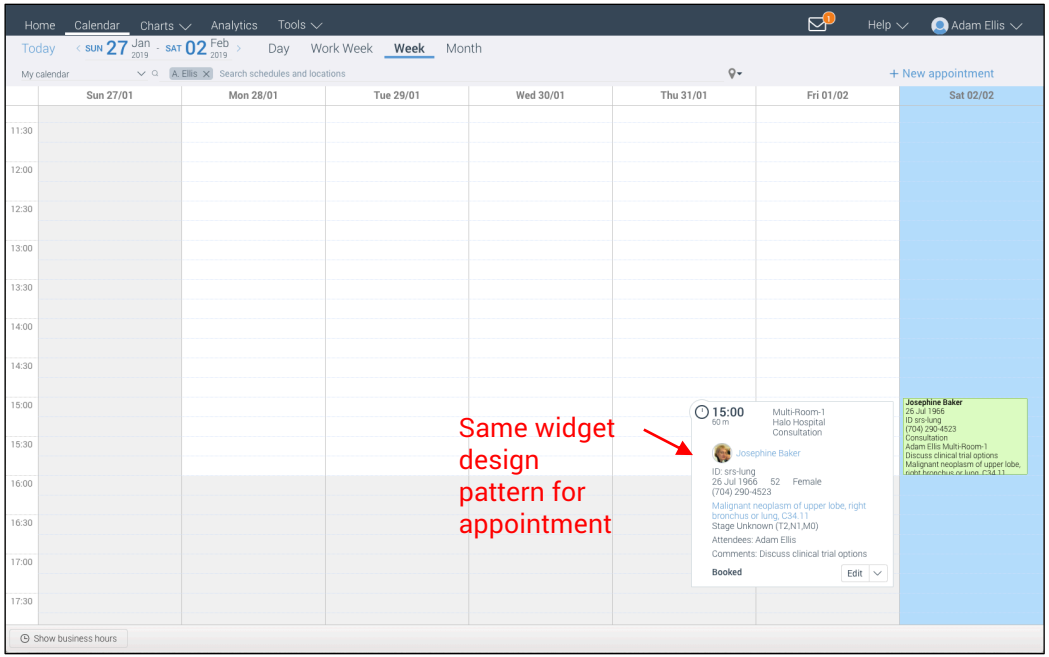
Swimlane Archetype Pattern

Interaction Design Language: Object Example - Appointment



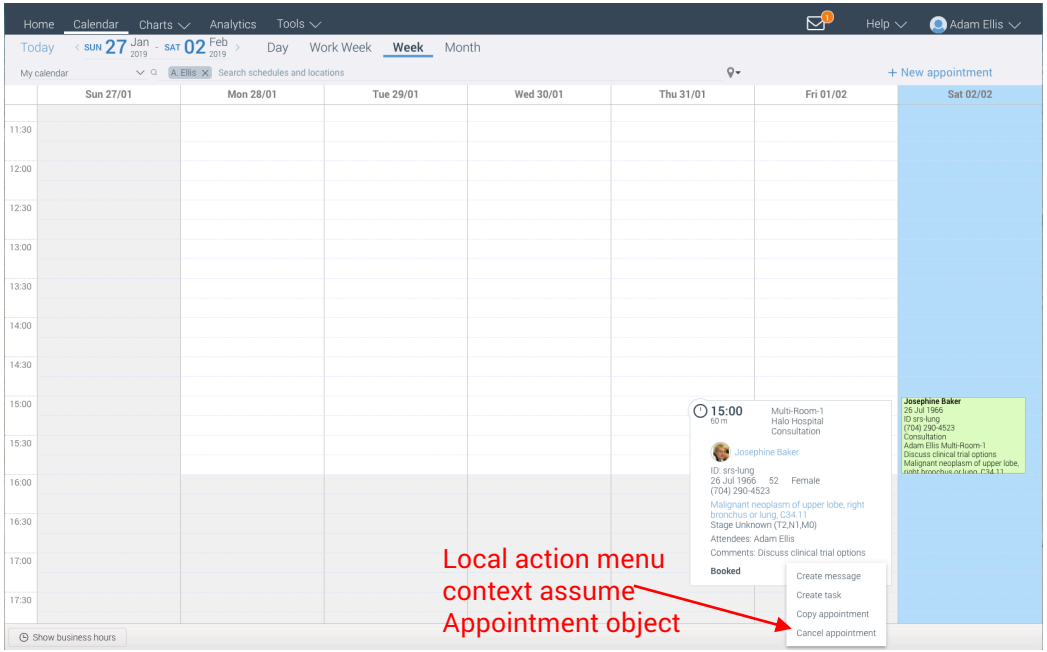
Swimlane Archetype Pattern

Interaction Design Language: Object Example - Appointment



Calendar Archetype Pattern

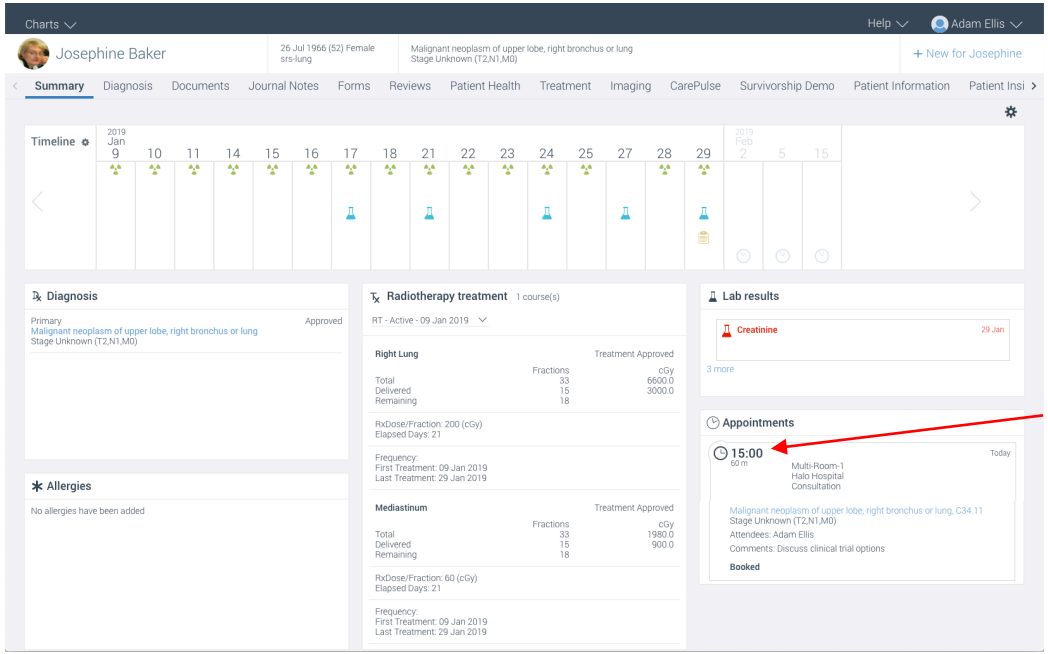
Interaction Design Language: Object Example - Appointment



Local action menu context assume Appointment object

Calendar Archetype Pattern

Interaction Design Language: Object Example - Appointment



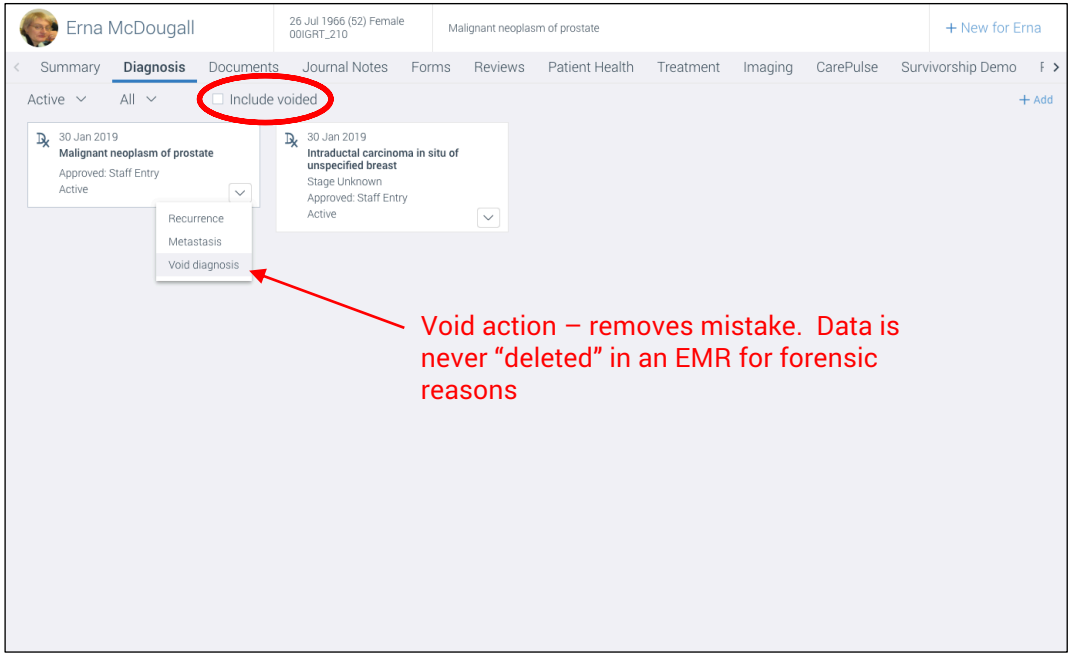
Next upcoming appointment summary in widget

Portal Archetype Pattern

Conceptual model

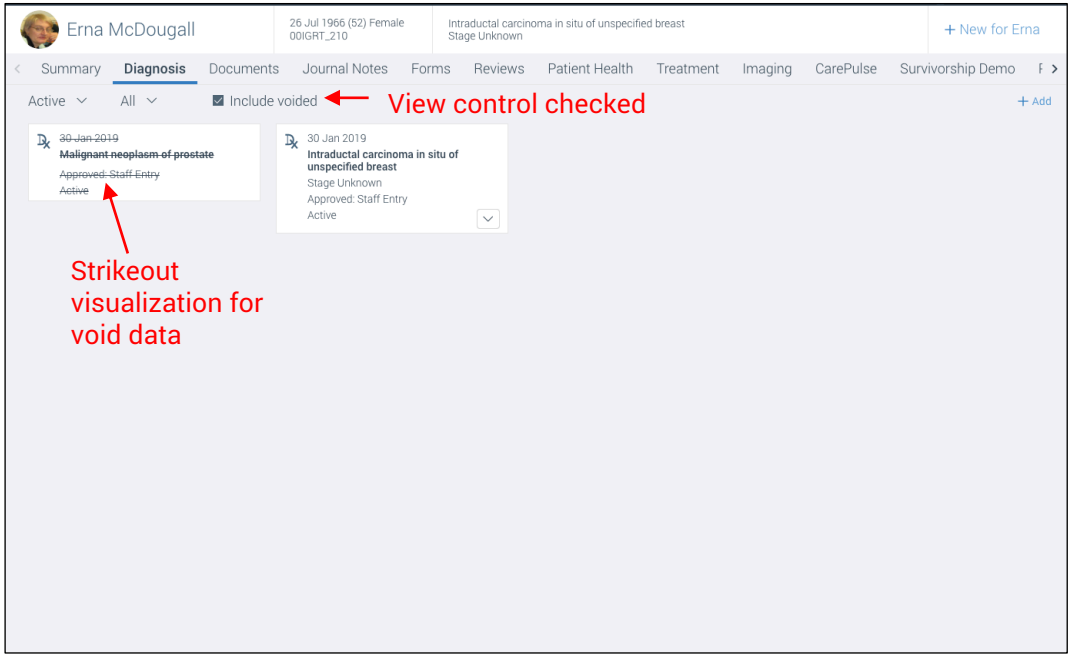
	Create	Update	Void	Accept	Reject	Delegate	Approve	Refer	Transfer	Pin
Patient	X	X		X	X			X	X	
Medical record	X	X	X	X	X	X	X	X	X	X
Treatment plan	X	X	X	X	X	X	X		X	
Appointment	X	X	X			X		X		X
Task	X	X	X	X	X	X	X	X		X
Messages	X	X	X			X		X	X	X
Note	X	X				X		X	X	X
Care team	X	X				X	X	X	X	

Interaction Design Language: Action Example – Void Data



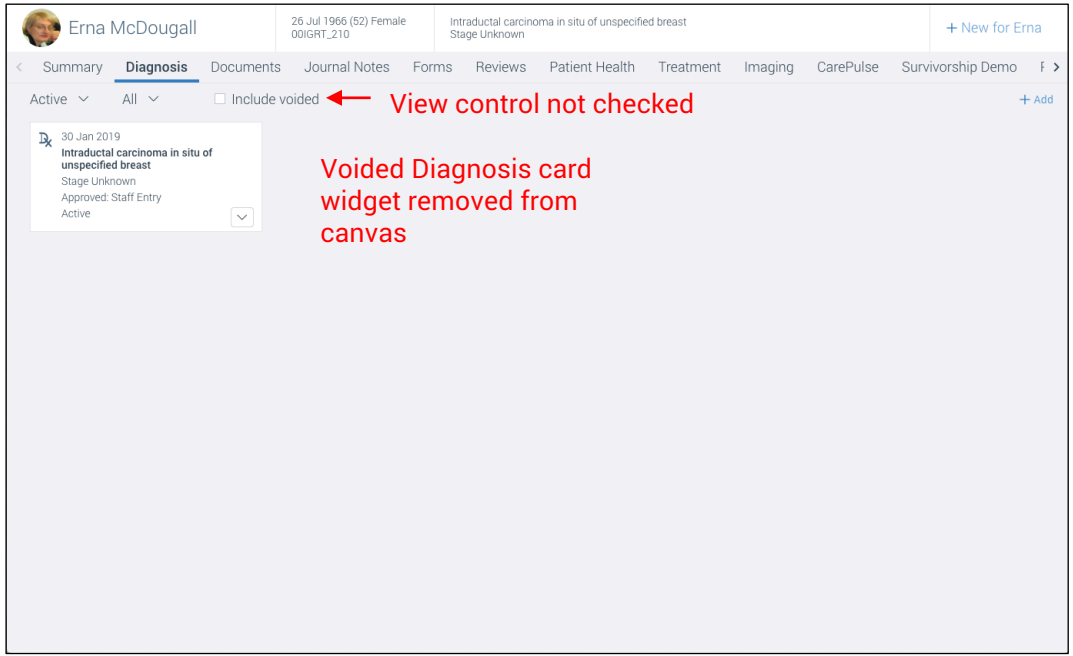
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



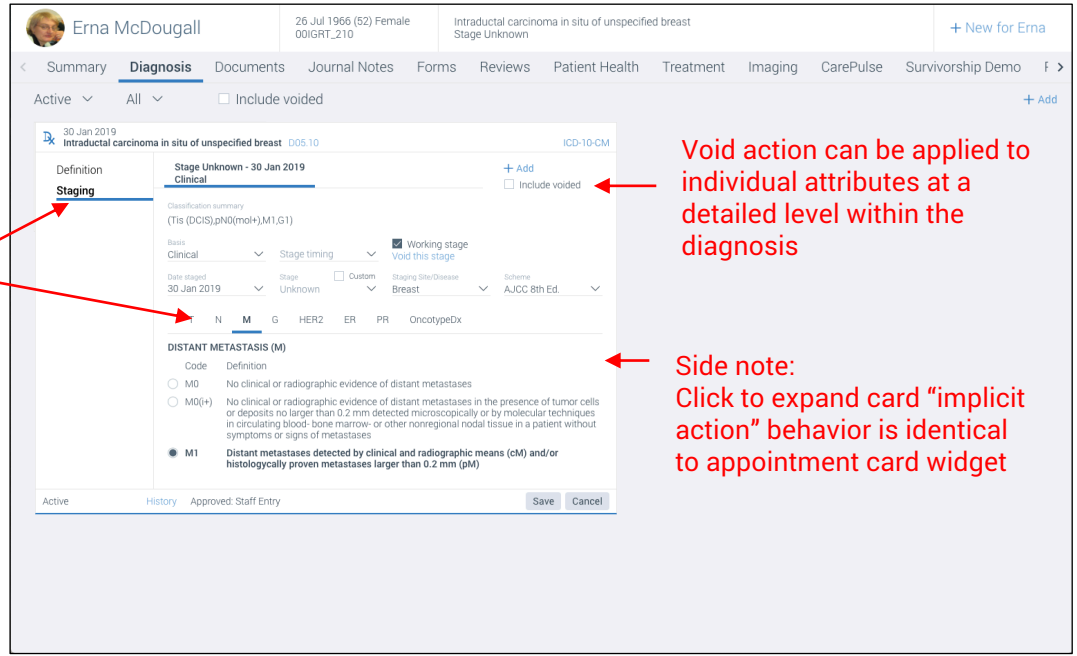
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



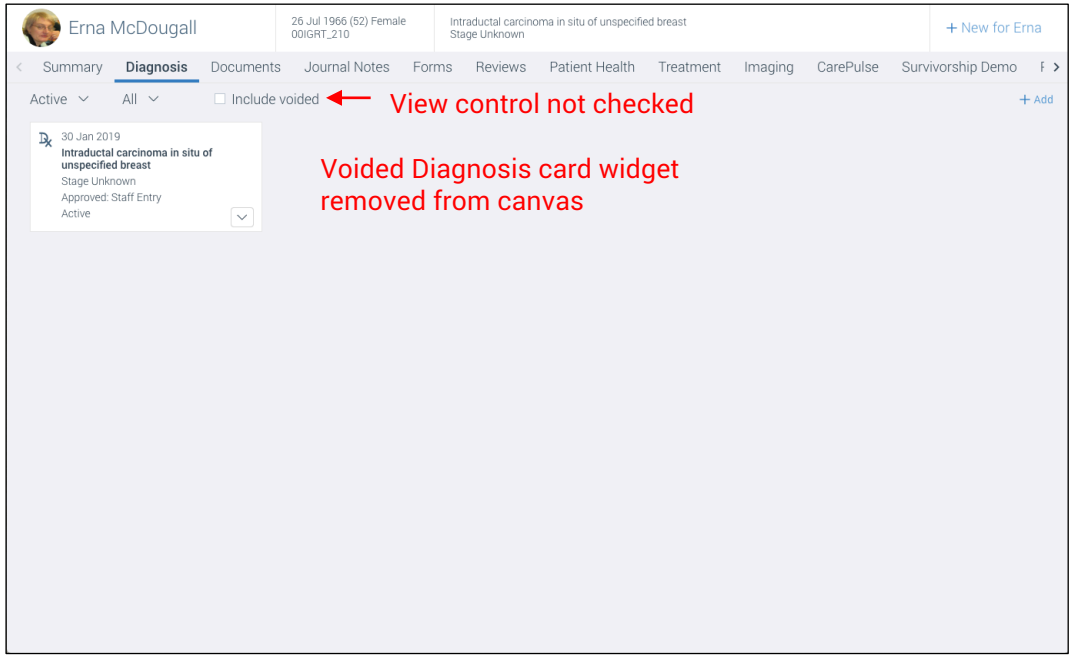
Two level tab widget embedded inside card widget

Void action can be applied to individual attributes at a detailed level within the diagnosis

Side note:
Click to expand card “implicit action” behavior is identical to appointment card widget

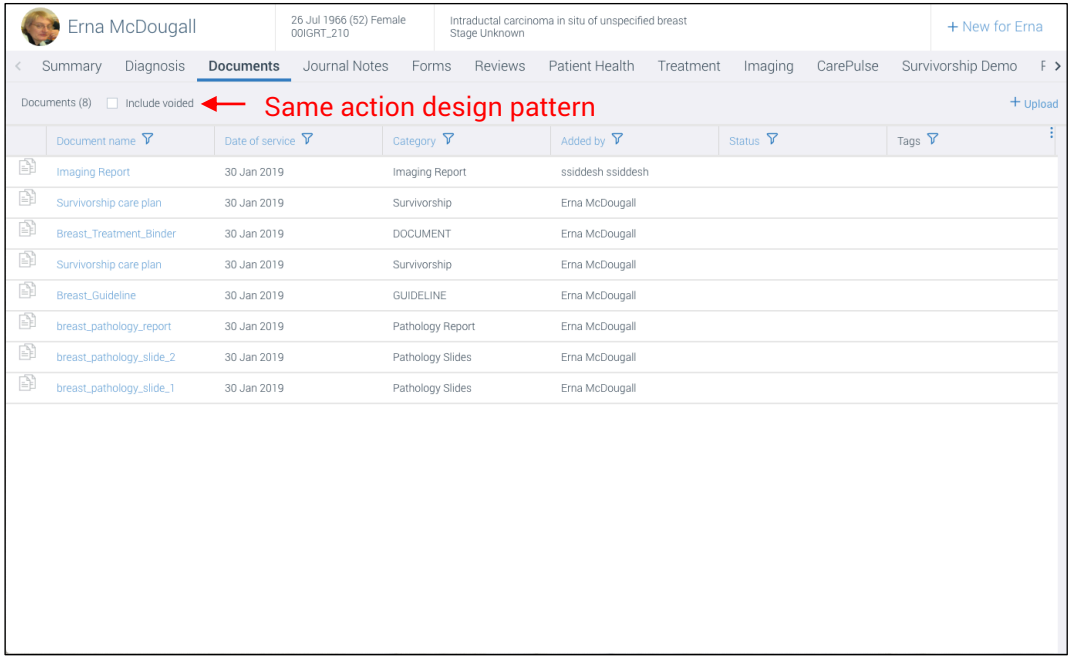
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



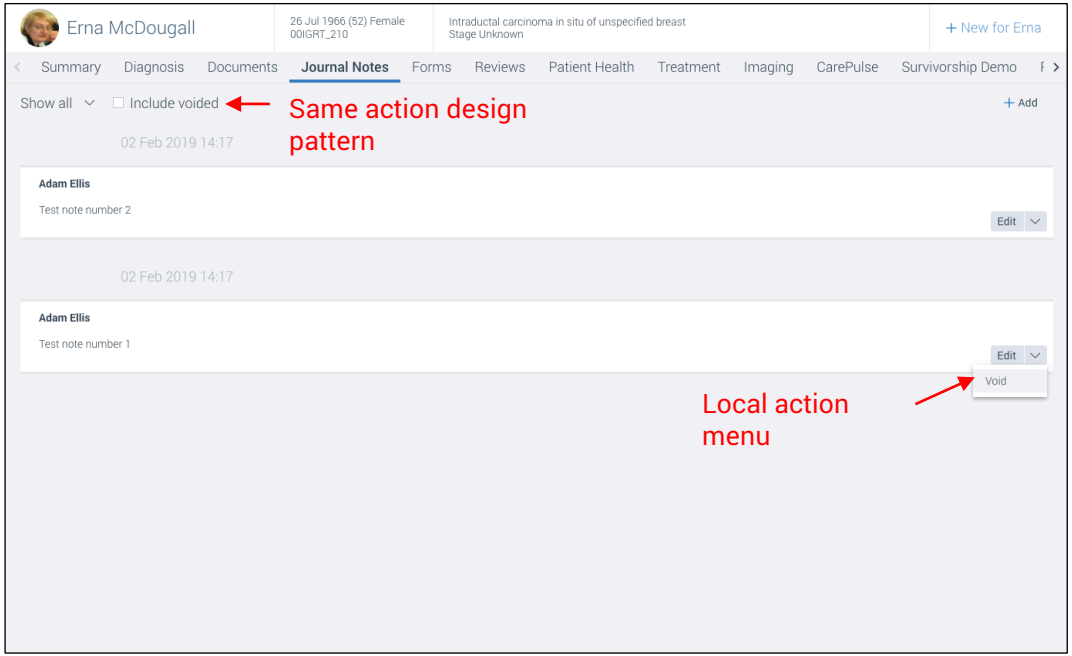
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



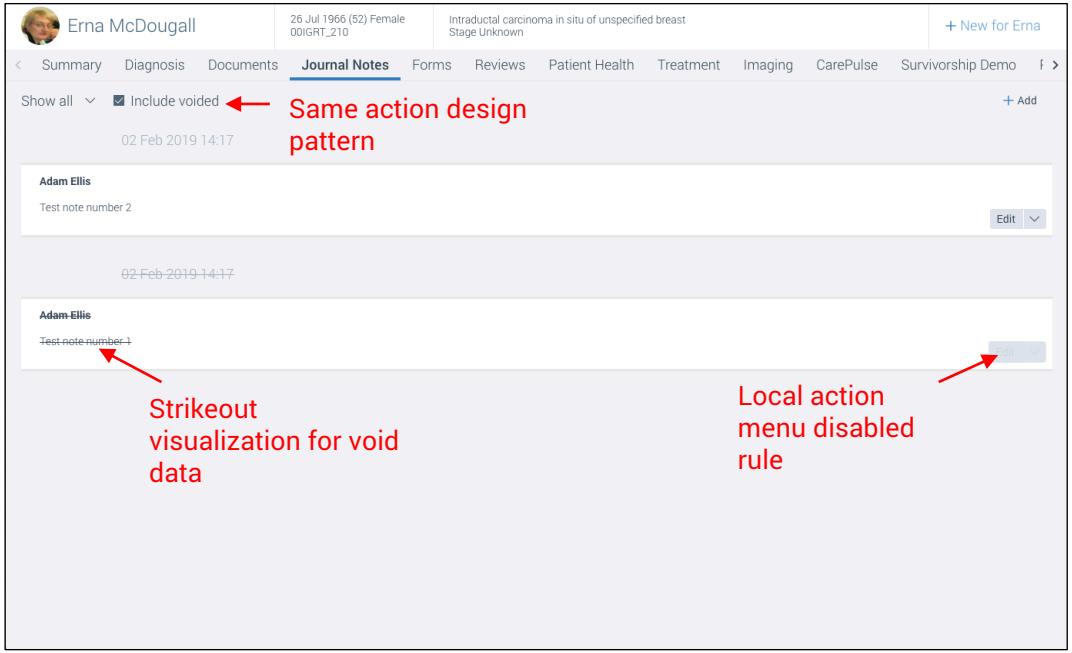
Menu (list) Archetype Pattern

Interaction Design Language: Action Example – Void Data



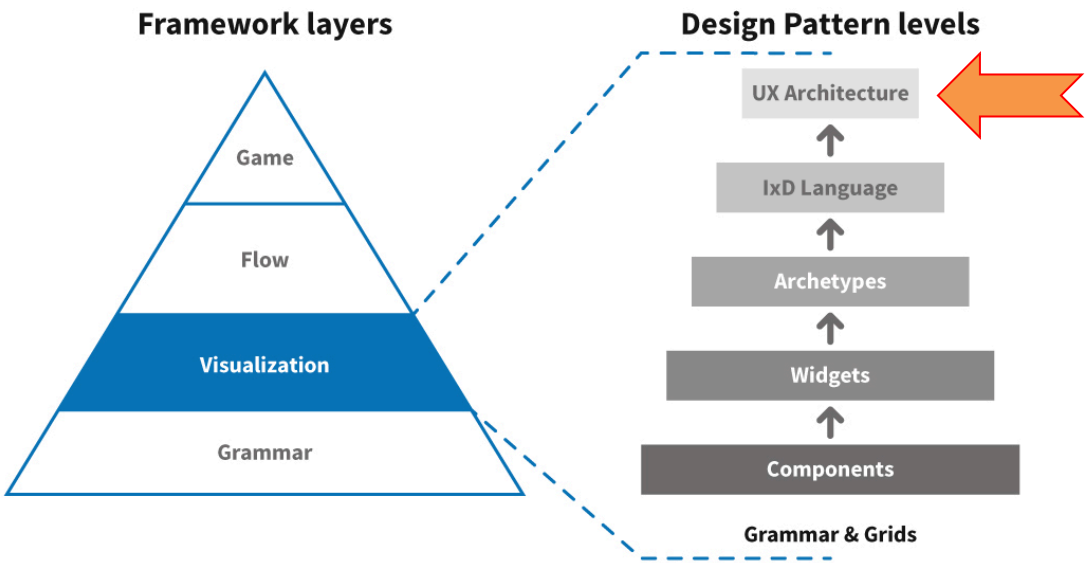
Social (Clinical Notes - Feed) Archetype Pattern

Interaction Design Language: Action Example – Void Data



Social (Clinical Notes - Feed) Archetype Pattern

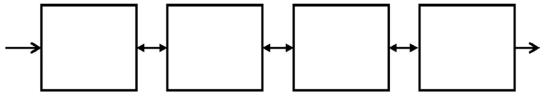
Visualization Deconstruction



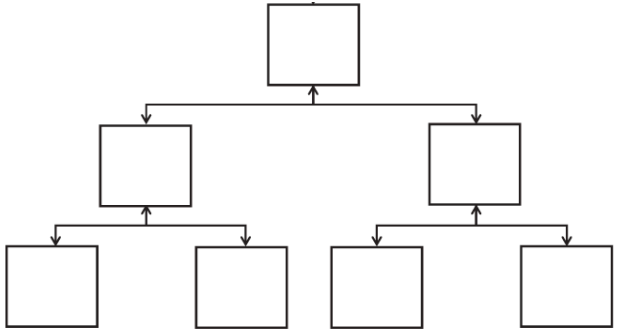
Use today:

Have you chosen the most effective UX architecture to navigate across all your primary objects?

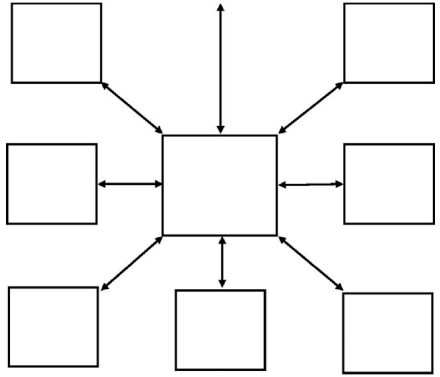
UX Architecture



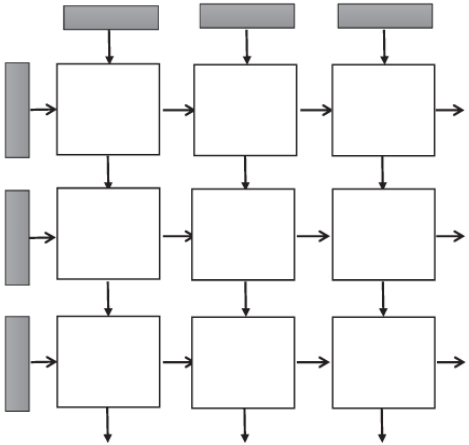
Sequential



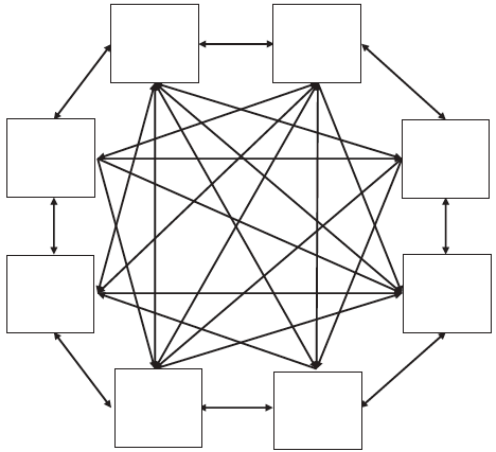
Hierarchical



Hub & Spoke

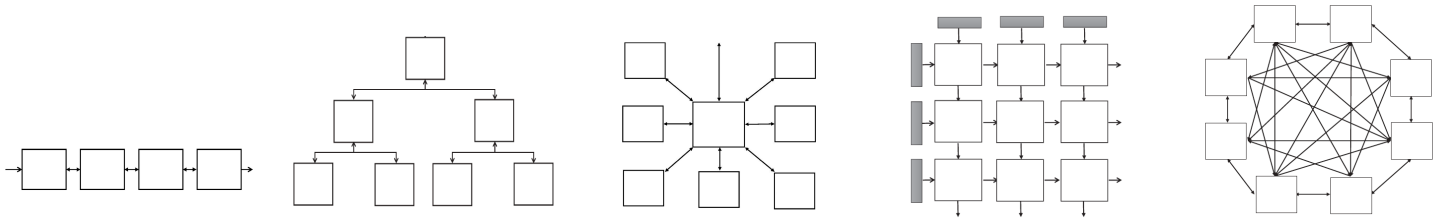


Matrix



Network

UX Architecture – Performance characteristics



	Sequential	Hierarchical	Hub & Spoke	Matrix	Network
Location Awareness	High	Medium	Medium	Medium	Low-Med
Visual Search Effectiveness	High	High	High	Medium	Med-High
Task Speed	Low	Low	Low	Low-Med	Low-Med
Working Memory Load	Low	Medium	Medium	Medium	Med-High
Learnability	Easy	Fast & Easy	Fast & Easy	Medium	Low-Med
Effectiveness	High	High	High	Medium	Med-High
Efficiency	Low	Low	Low	High	High
Satisfaction	Medium	Med-High	Med-High	Low-Med	Medium

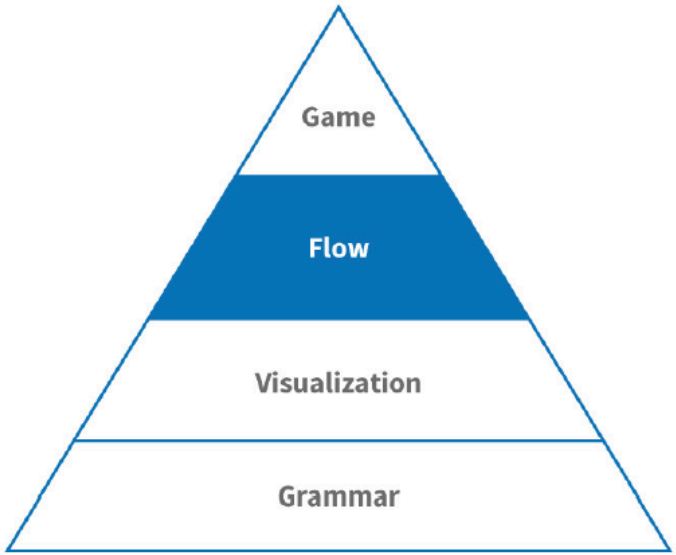
Who: Digital Natives recognize Interaction Design patterns

- 5B of the 7.7B people on earth interpret GUI design patterns as Actions and Objects (Interaction Design Grammar)
  - Thanks to the internet and smart phone global penetration

- The other 2.7B whether literate or not…
  - Must linguistically associate physical world metaphors with on screen objects and actions to participate in HCI
  - They will be (self) taught based on their own natural language of nouns and verbs to understand what any new tool can do

99% of the digital product and service economy are in the first 5 Billion

Layer 3 - **Flow**



Use today:

Are you minimizing the number of steps and screens across all your entire product system?

Actions propel Objects through Flow

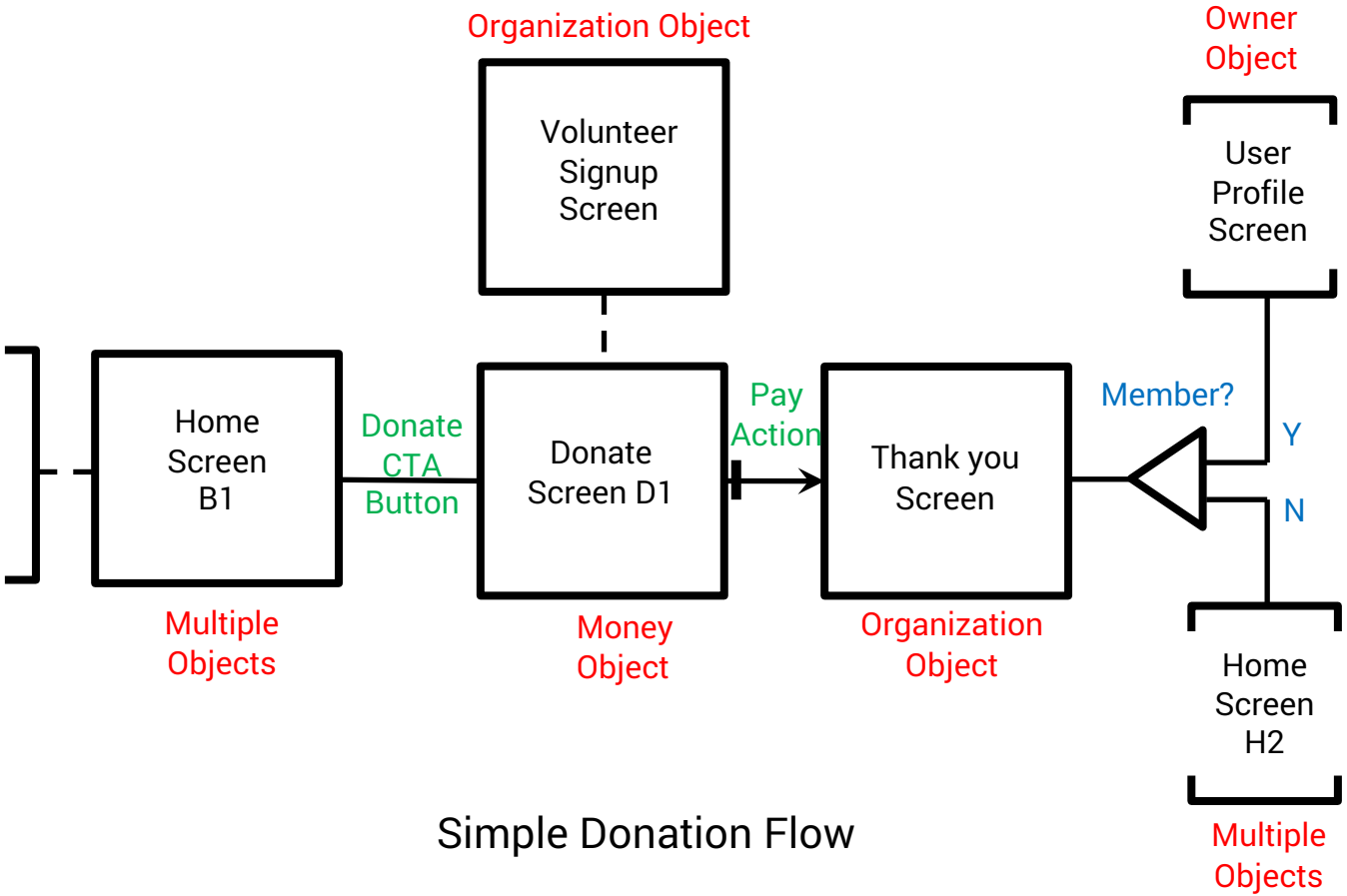
Actions

Objects	Donate	Adopt	Schedule	Share	Learn
Dog	X	X	X	X	X
Owner	X	X	X	X	X
Organization	X		X	X	X
Money	X		X		

Most BOXES will represent OBJECTS
Most LINES will represent ACTIONS

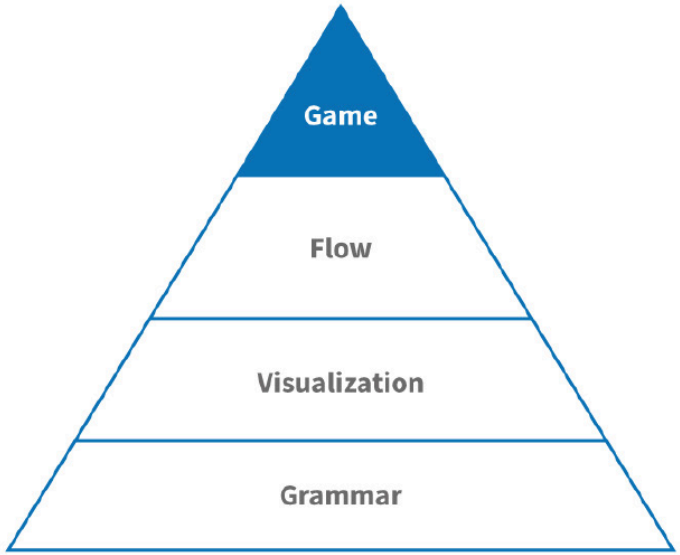
Simple Donation Flow

Actions propel Objects through Flow



Simple Donation Flow

Layer 4 - **Game Theory**



Use today:

Can you motivate and guide human behavior to favor specific **object-action pairs (aka tasks)?**

Game Theory for Interaction Design is part of UX Magic

Pure Games
- Entertainment
- Learning/Education (war)
- Voluntary engagement
- Rules and competition (not free play)
- Lack of consequences
- **Compelling narrative!**

Gamification
- Addition of **reward elements** to incentivize productive work

Gameful Interaction Design
- Substitution of a game as a proxy for a transactional task
- Intrinsically fulfilling
- Generate feeling of competence & autonomy

Captology
- Using technology to persuade user to change behavior

Mapping to UX Magic – Conceptual Models

- **Gamification** - provides **Action** incentives
- **Gameful Interaction Design** - utilizes **Object** substitution
- **Captology** focuses on **Attribute** manipulation
  - When used in tools and online services

Reasons to Apply Game Theory in Interaction Design

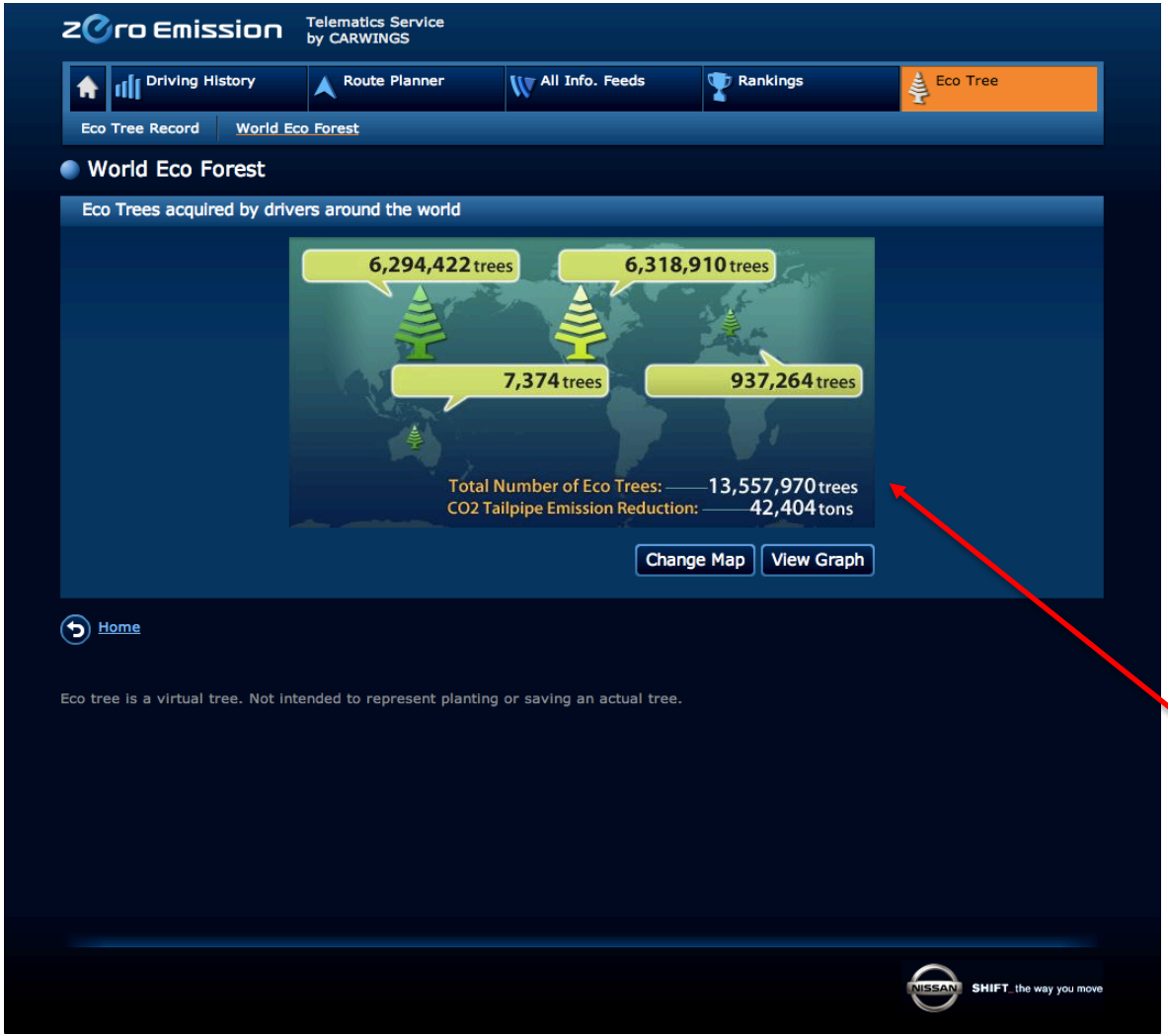
Increasing	Decreasing
Productivity	Errors
Performance	Boredom during repetitive tasks
Satisfaction	Unsafe behavior
Sales/Revenue	Energy consumption
Community size	Gambling
Health and well-being	Conflict
Sustainability	Absenteeism

Incentivizing user tasks (object-action pair)

Human Motivators to target

Intrinsic	Extrinsic
Autonomy	Benefits
Belonging	Bonus/Reward
Creativity	Competition
Curiosity	Fear of failure
Learning	Fear of loss
Love	Fear of punishment
Mastery	Greed
Meaning	Praise
Pleasure	Status

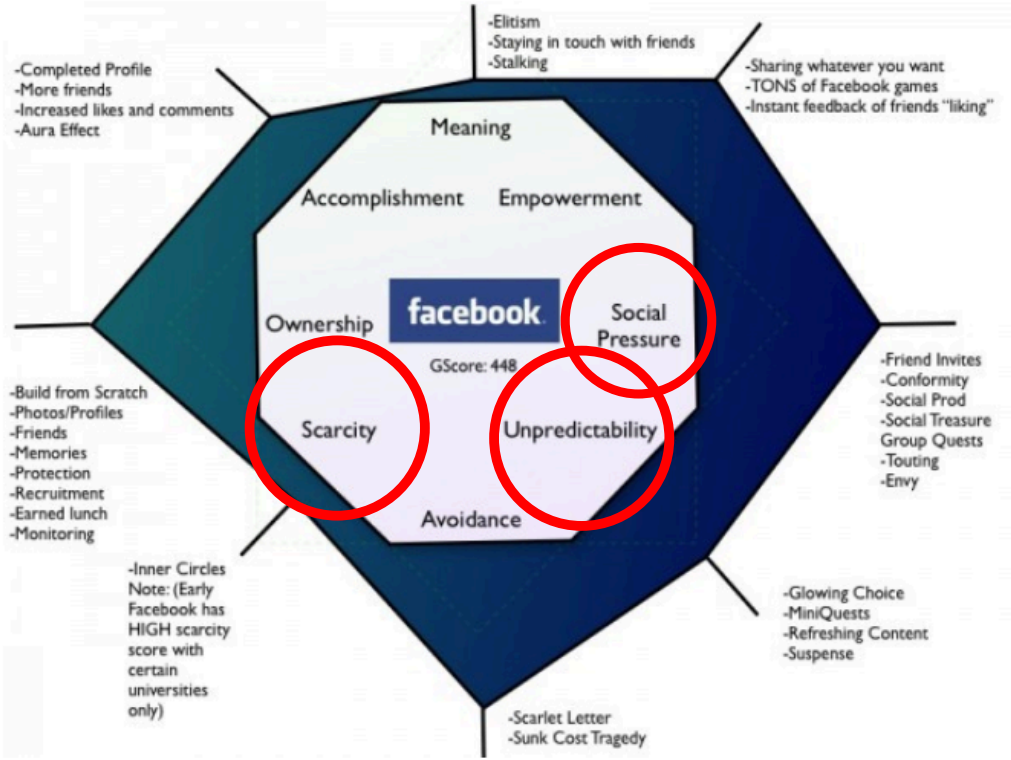
Game Mechanics
Achievement
Connection
Constraints
Feedback
Narrative
Ownership
Privilege
Reciprocity
Recognition
Role play
Self Expression
Sports
Urgency



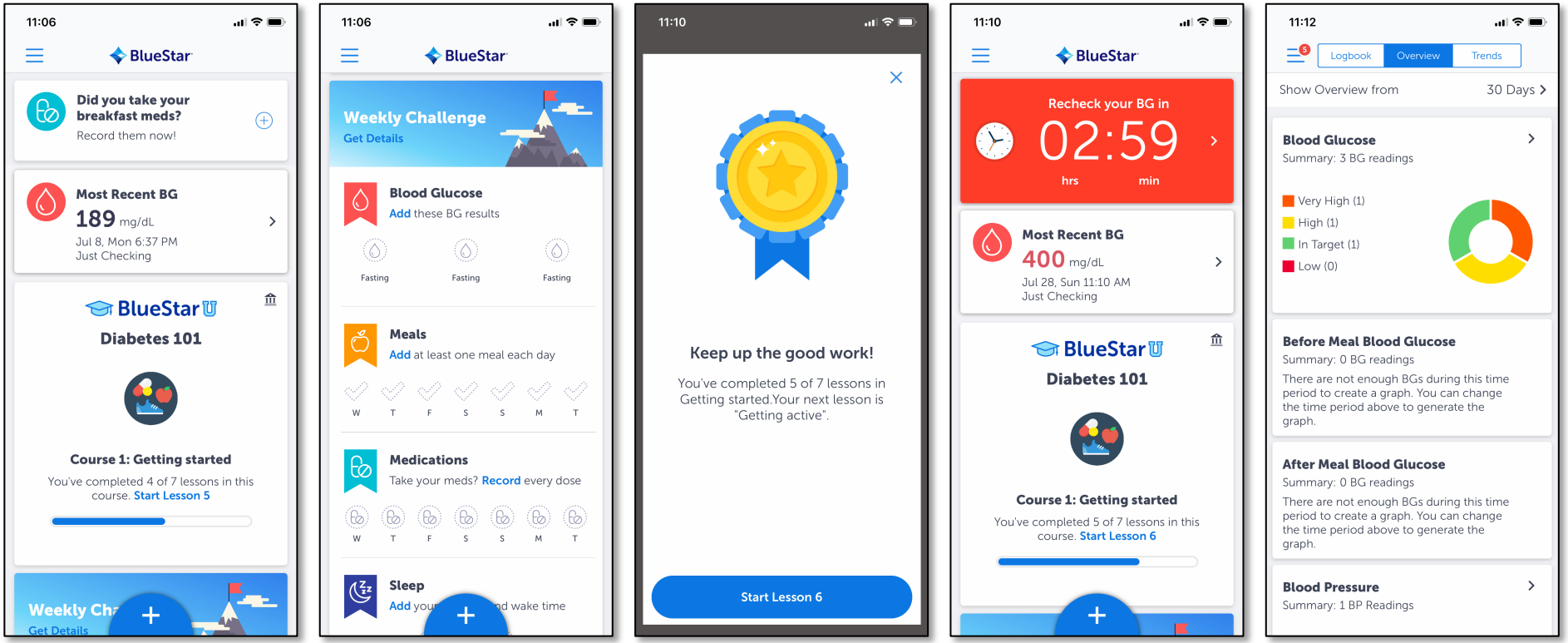
Intrinsic	Extrinsic
Autonomy	Benefits
Belonging	Bonus/Reward
Creativity	Competition
Curiosity	Fear of failure
Learning	Fear of loss
Love	Fear punishment
Mastery	Greed
Meaning	Praise
Pleasure	Status

Team competition (Social connection)

Game Theory is everywhere



Interaction Design can outperform medication



BlueStar – Diabetes Solution from WellDoc Inc.

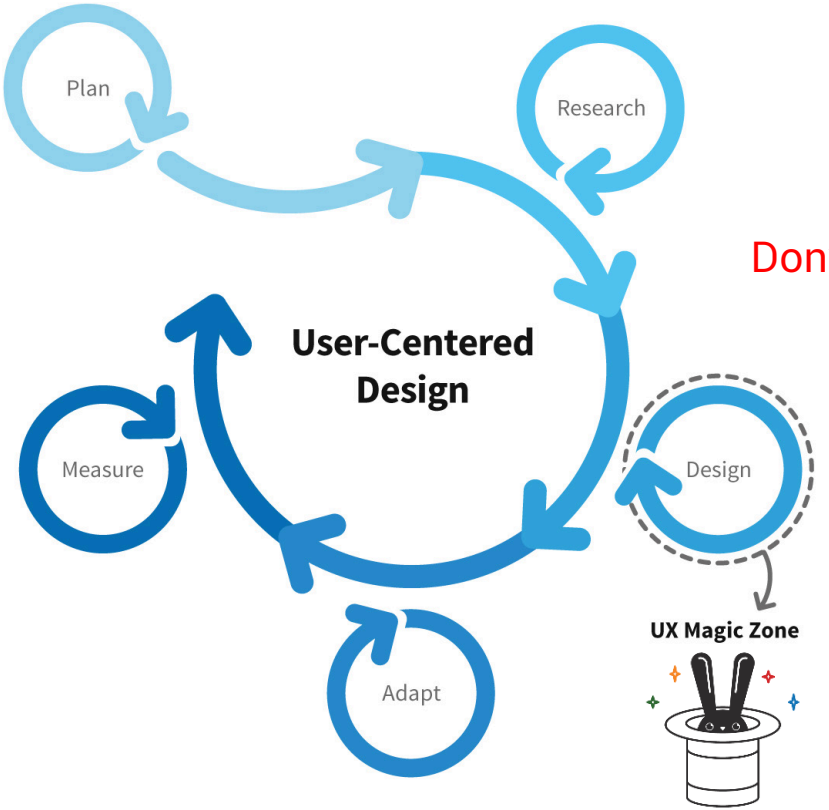
dan@rCDOUX.com

End of Preview

- What
- When
- Why
- How

Semantic Interaction Design

Semantic IxD – Only Interaction Design step

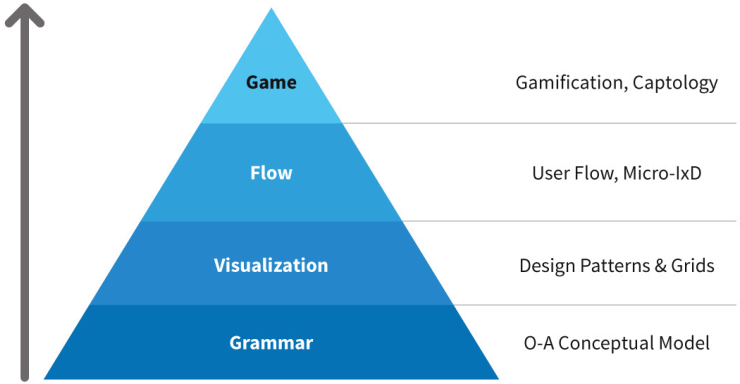


Don’t forget to do the other UCD Steps!

Semantic Interaction Design Framework

We have completed our preview of the Semantic Interaction Design core – but there is much more….

Chapter 10 – **Chess** (future of UX design & designers)
Chapter 9 – **Myth** (UI style guide applicability)
Chapter 8 – **Elegance** (graphic design for Semantics)



Preview Chapters 4–7

Preview Chapters 1–3

UX Magic – Book by the Interaction Design Foundation

We only scratched the surface of the Semantic Interaction Design topic.

To dig in deep:

- Get the book
- Study it
- Do the related exercises
- Teach the method to others…

You can purchase this new book from the Interaction Design Foundation on **Amazon**

Addendum

For individuals:

- If you found this new Semantic IxD approach compelling please **tell your UX colleagues** at other companies about it. **Post on social media** and help spread the word within the global UX design community.

- Join the Interaction Design Foundation (the publisher) and learn more about IxD in general…

For UX leaders/manager:

- I have been giving corporate training classes on this the Semantic IxD method for years
- It includes how it integrates into Data Visualization and Information Architecture which are not covered in the book.

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INTERACTION DESIGN FOUNDATION

The End – Q&A

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