LEVERAGING INFORMATION ARCHITECTURE WITHIN UX INTERACTION DESIGN

World IA Day 2025 – SJSU Event

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Semantic Interaction Design is a foundational method for building digital experiences with the **lowest cognitive load** (highest degree of usability)

This method leverages directly maps an applications functional taxonomy into both an information architecture and UX visualization patterns.

What

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)

+

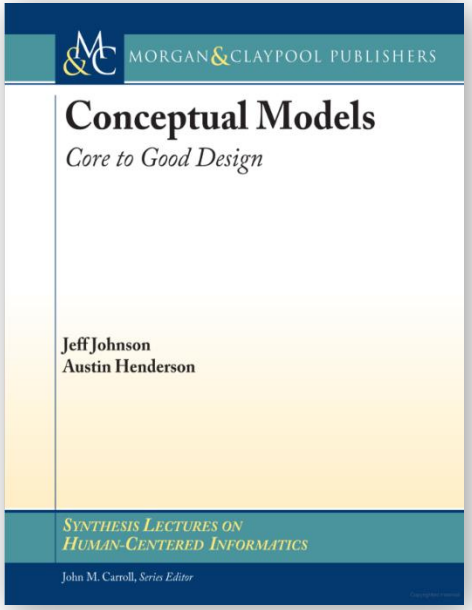
Cognitive Science:
- Stages of Action (Norman 2015)
- Design by Levels (Foley 1995)
- Activity Theory (Nardi 1996)
- Consistency (Shneiderman 1988)

+

Computer Science
- Objected-Oriented UI (Collins 1995)

Science starts here

2012



Practice Foundation

2020

Complete System

Innovative IxD method – value proposition

Deliver designs faster/smarter

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

10X

Efficiency

(your labor)

Deliver optimal UX designs

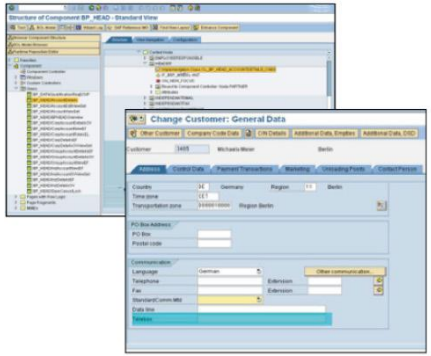
- Minimum number of screens
- Shortest flows
- Lowest cognitive load possible
- Ready to scale for next version

10X

Effectiveness

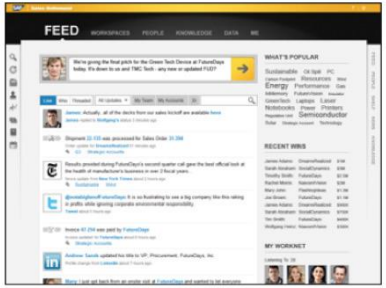
(design quality)

Can you support the 10X claim?



1000's of screens

100's of screens



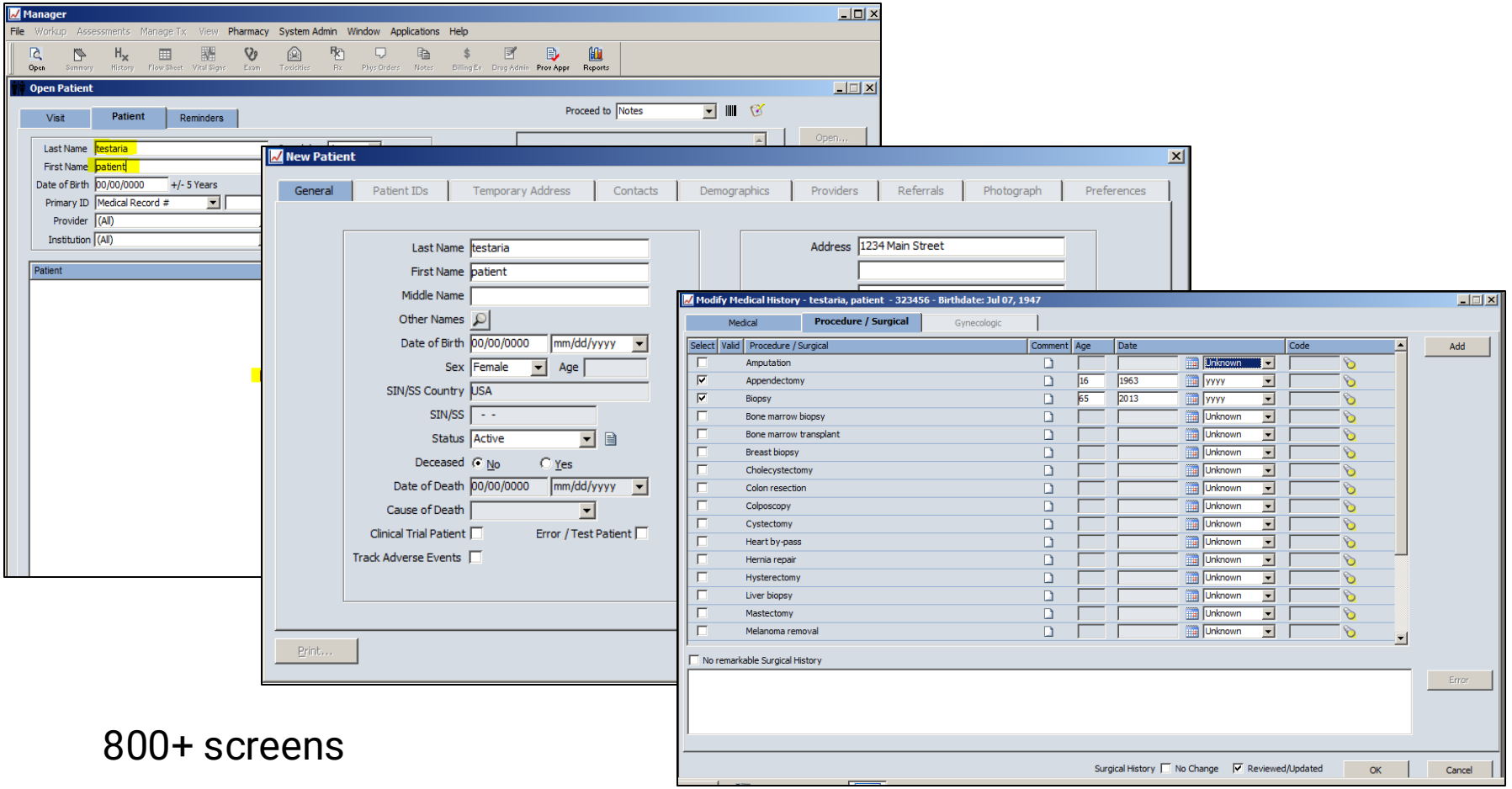
10's of screens

+

5 screens

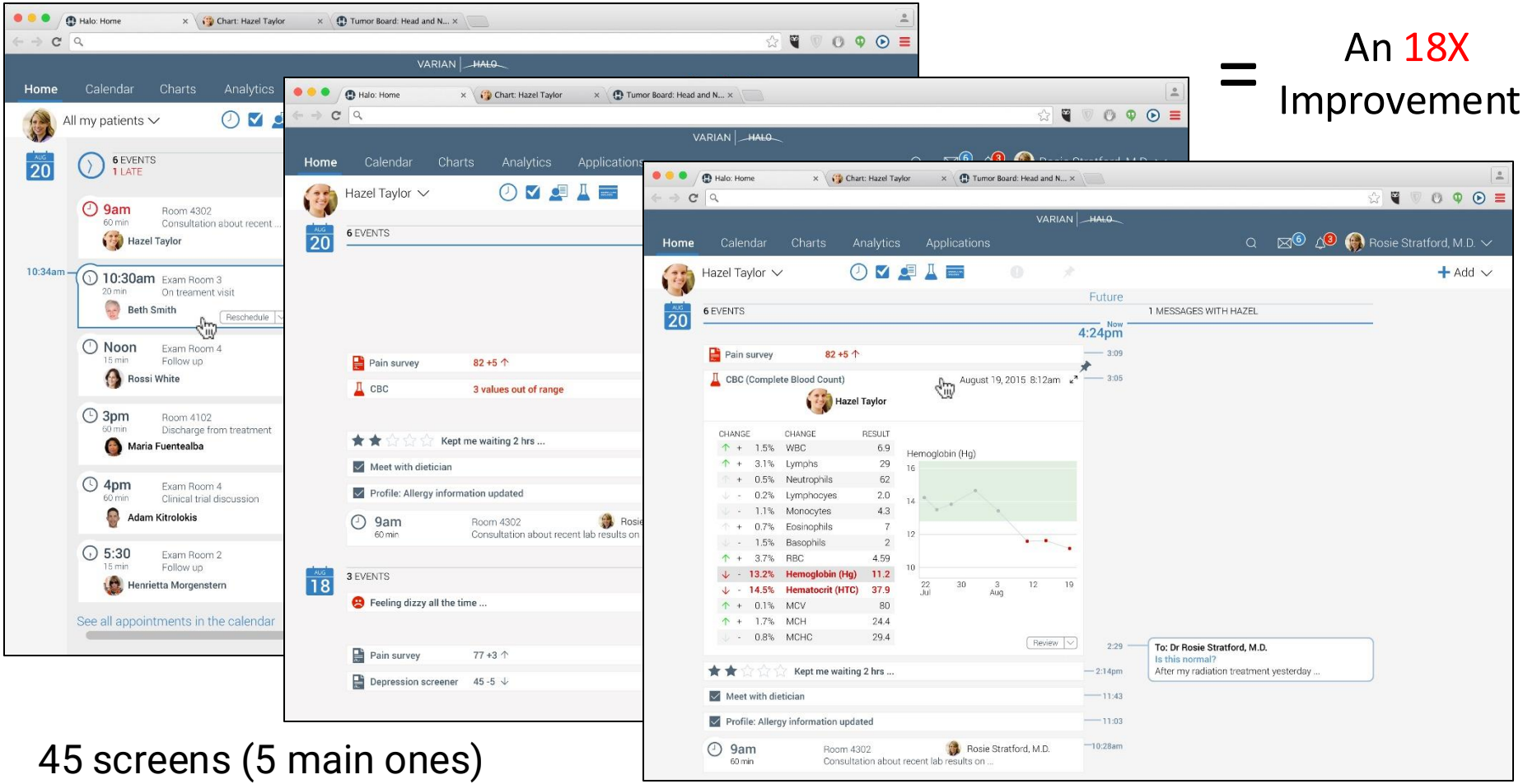
= Over a 100X Improvement!

Before - Can you support this 10x claim?



800+ screens

After - Can you support this claim?



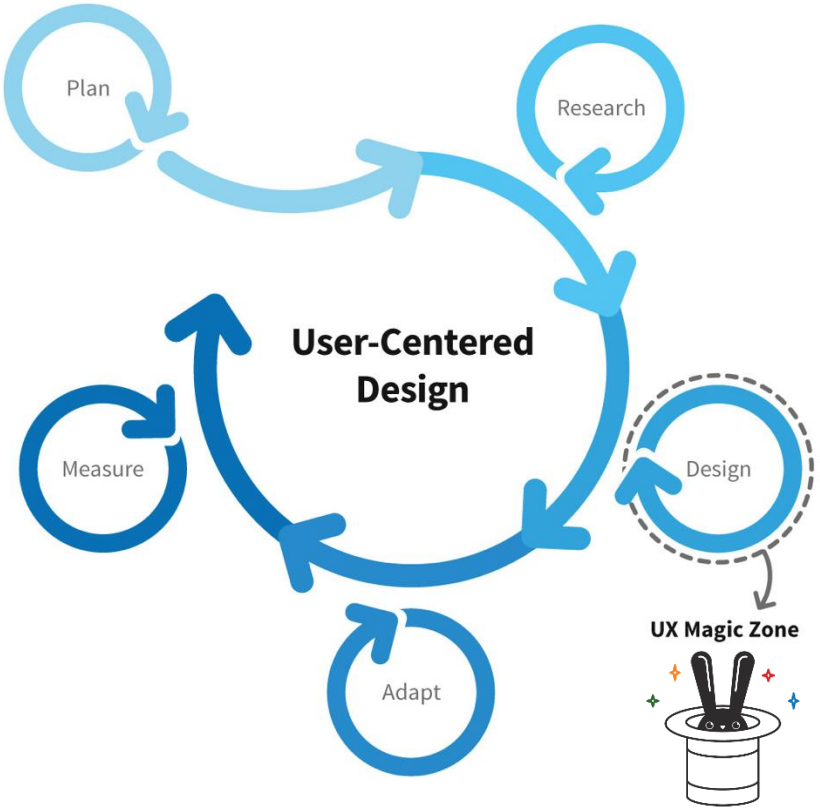
= An 18X Improvement!

45 screens (5 main ones)

When

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

Because Design Darwinism does not work!

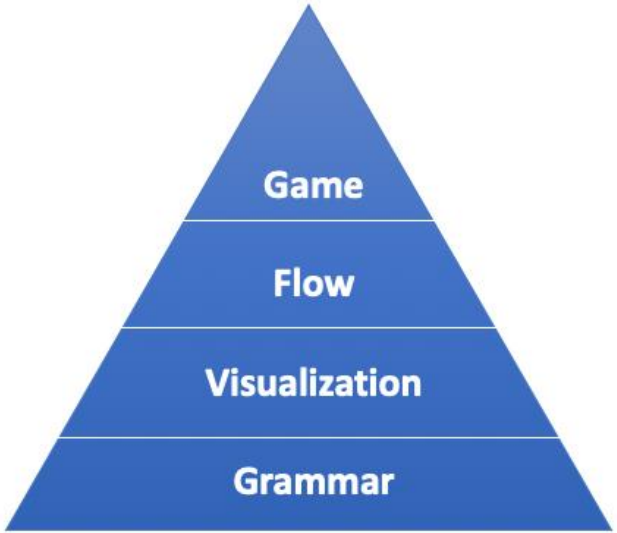
Current design methods don’t scale to complex systems, are inefficient and often lead to product failure at significant expense because

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)

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



Cognitive Science Foundation of Semantic Interaction Design

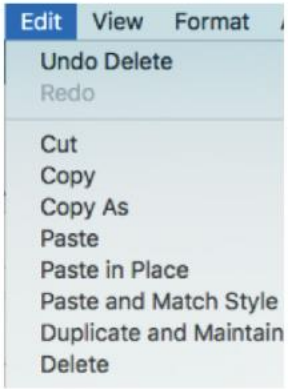
1. Language is the basis of conscious thought

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

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

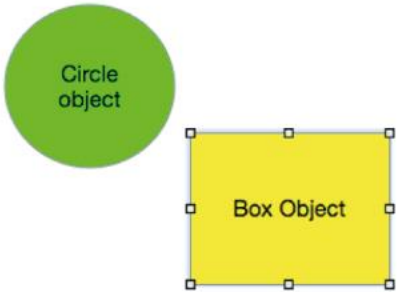
Grammar

Actions



Menu

Objects



Canvas

Attributes

Inspector Dialog Box

Consistency vs. Cognitive Load

Sloppy Application IA

ACTIONS

OBJECTS	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

Best Application IA

ACTIONS

OBJECTS	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

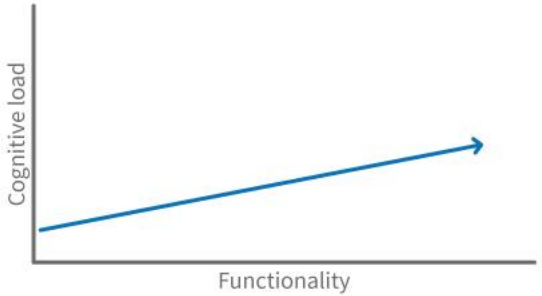
Dense Object-Action Grammar

Consistency vs. Cognitive Load Calculation

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

Actions

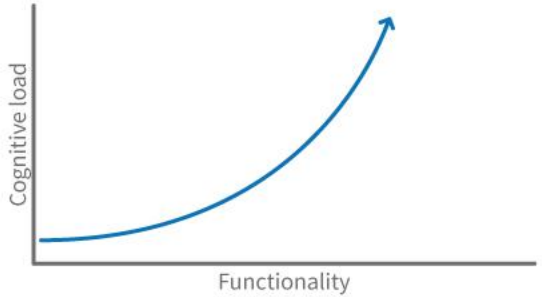
Objects	Cut	Copy	Paste	Print
Character	X	X	X	X
Word	X	X	X	X
Paragraph	X	X	X	X
Page	X	X	X	X
Document	X	X	X	X



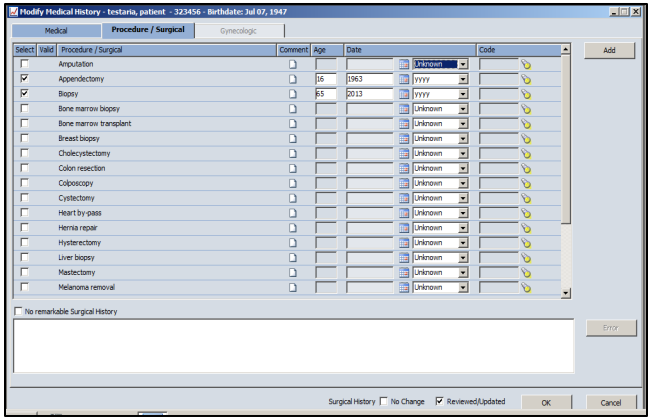
Sparse matrix: Load on human memory = **Actions x Objects**

Actions

Objects	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

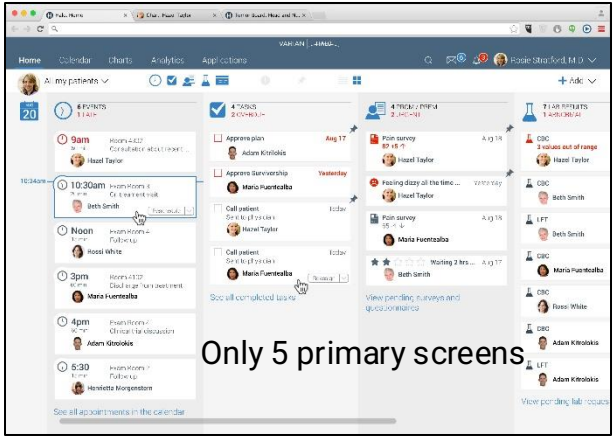


Real Conceptual Model 10x deconstruction in practice!



800 Screens

45 Screens

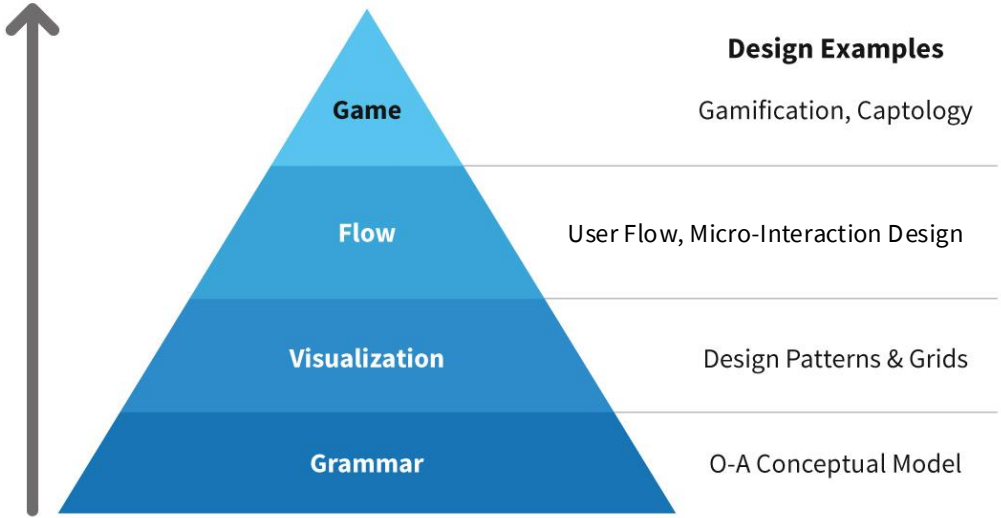


	Create	Update	Void	Accept	Reject	Delegate	Approve	Refer	Transfer
Patient	X	X		X	X			X	X
Medical record	X	X	X	X	X	X	X	X	X
Treatment plan	X	X	X	X	X	X	X		X
Appointment	X	X	X			X		X	
Task	X	X	X	X	X	X	X	X	
Messages	X	X	X			X		X	X
Note	X	X				X		X	X
Care team	X	X				X	X	X	X

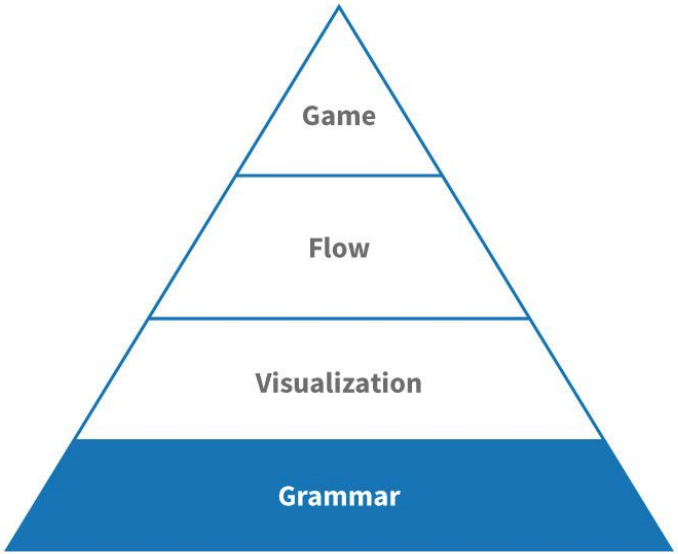
Only 8 objects and 9 actions can describe an entire EMR solution

How (practice)

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

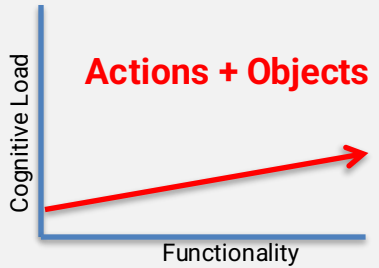
9 divided by 66 is approximately 14% or **7.3X improvement**

Figure out the Object Attributes!

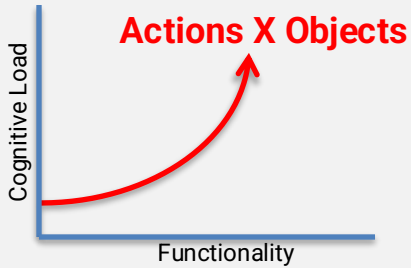
Animal	Money	People	Services	Event
Species	Donation	Employee	Medical	type
Age	Sponsorship	Customer	Adoption	time
Breed	Volunteer	Board M.	Membership	place
Health	Vehicle	Vet	Volunteer	cost
Personality		Volunteer		duration
Exercise				attendees
Kids friendly				
Other pets				

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

Use this knowledge immediately



Versus

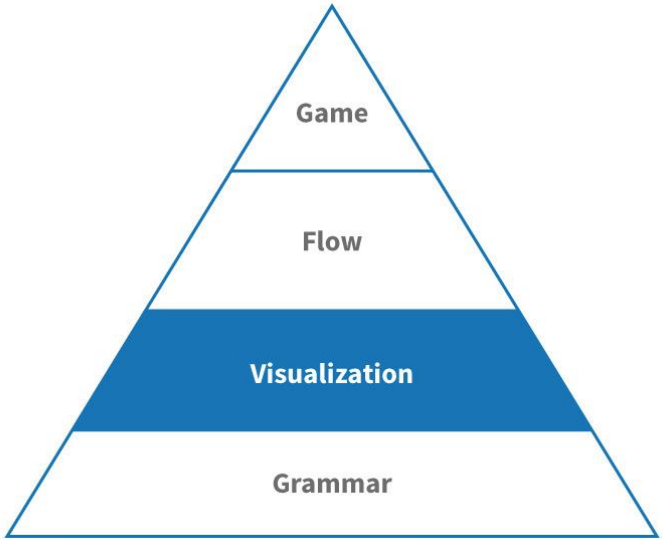


1. Alternative Heuristic **evaluation method**
   - assess cognitive load
   - find mismatches between user mental model and UX

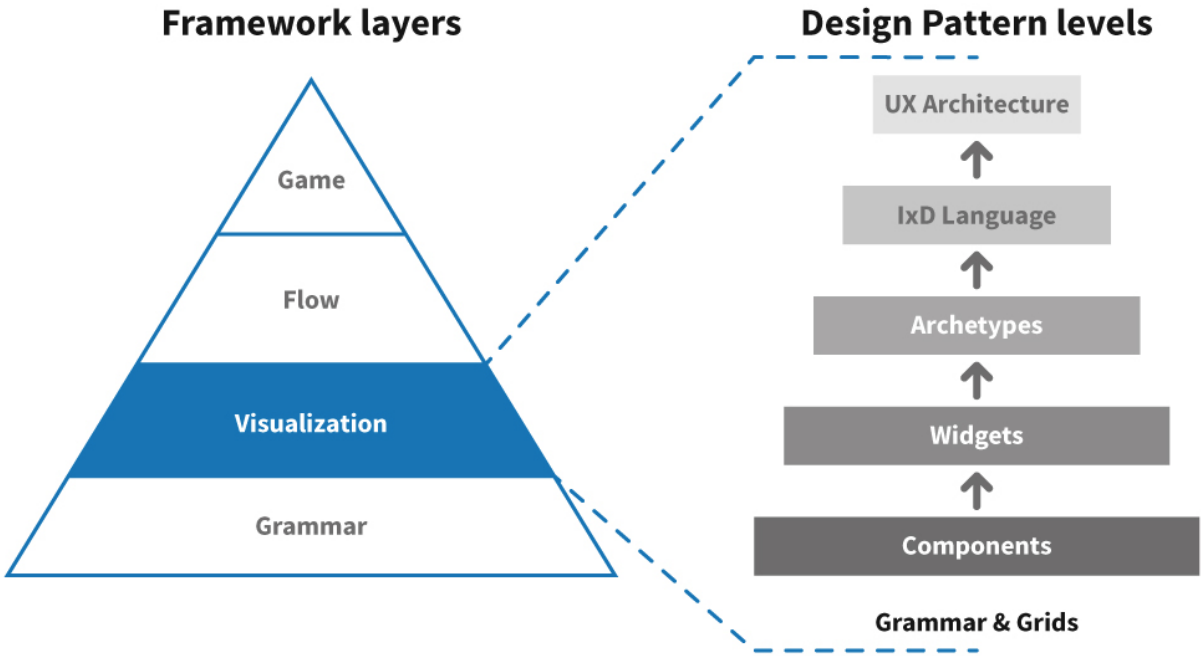
2. UX **Design** method of new projects
   - Minimize screen count and complexity (increase quality)
   - Prioritize tasks before creating mocks (save time)

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)

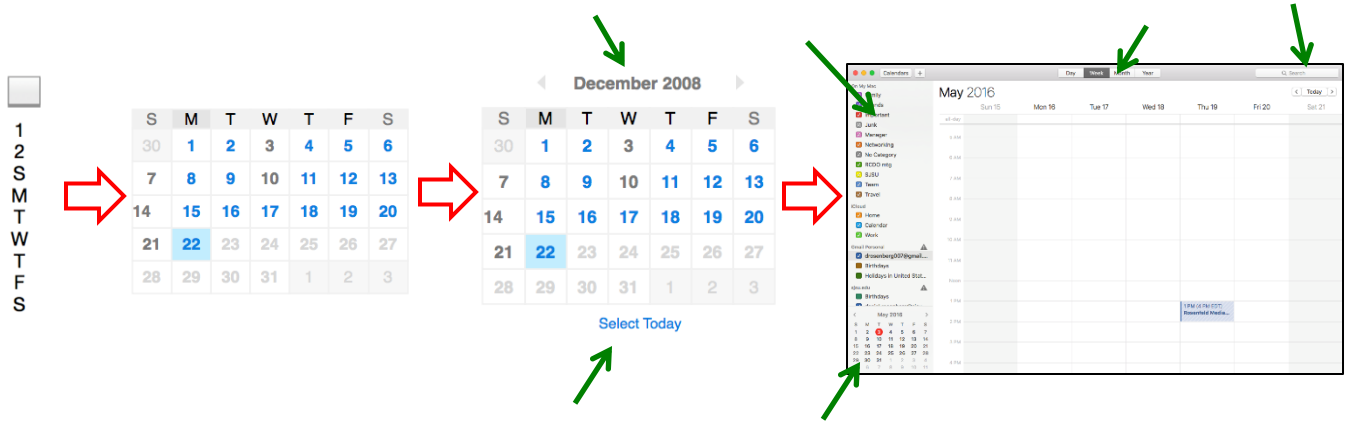
Grid
35 buttons
42 labels

Widget (bigger)

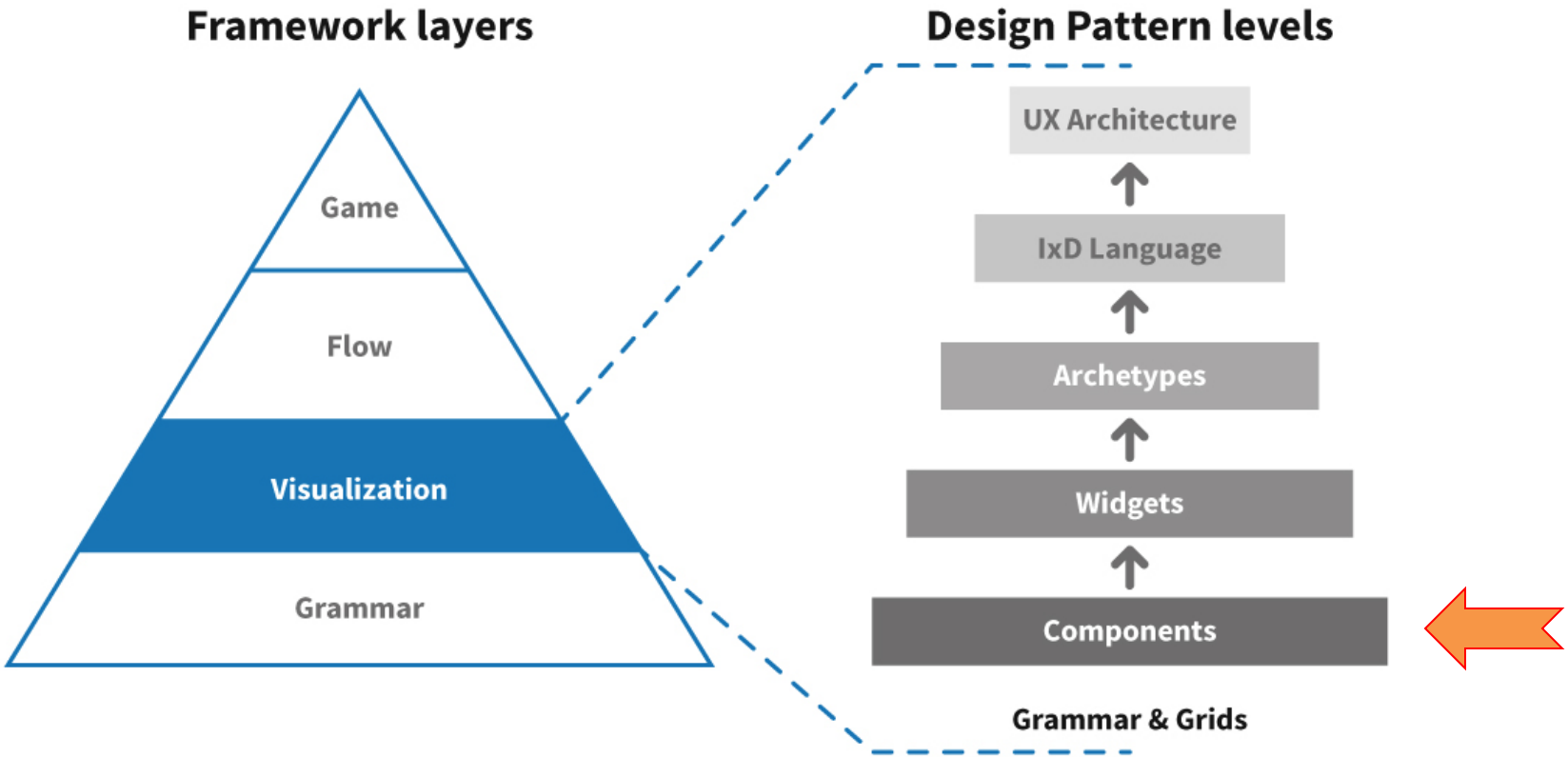
Change month icons
Show selection
“Today” button

Calendar **Archetype** Screen

Day/Week views
Add button
Search box
Color coding



Visualization Deconstruction



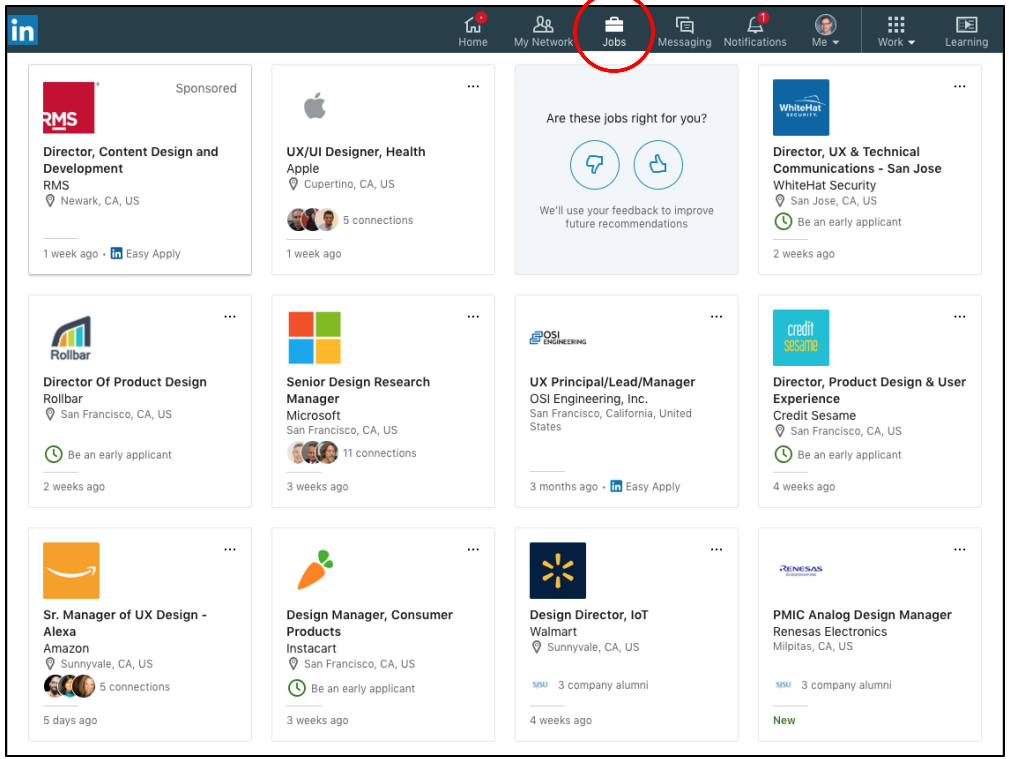
Application IA

Component Patterns

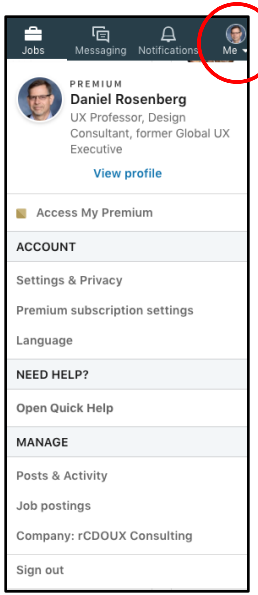
Name	Attribute	Action	Object	Logic/Behavior
Label	x	x	x	The name attribute of anything, in hypertext a navigate action
Radio button	X			Selection of on state within a set of many attributes
Toggle Button	X			On/off state for only one attribute
Checkbox	X			One of many states of given attribute
Drop list	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)

Example – Menu as Actions versus Objects



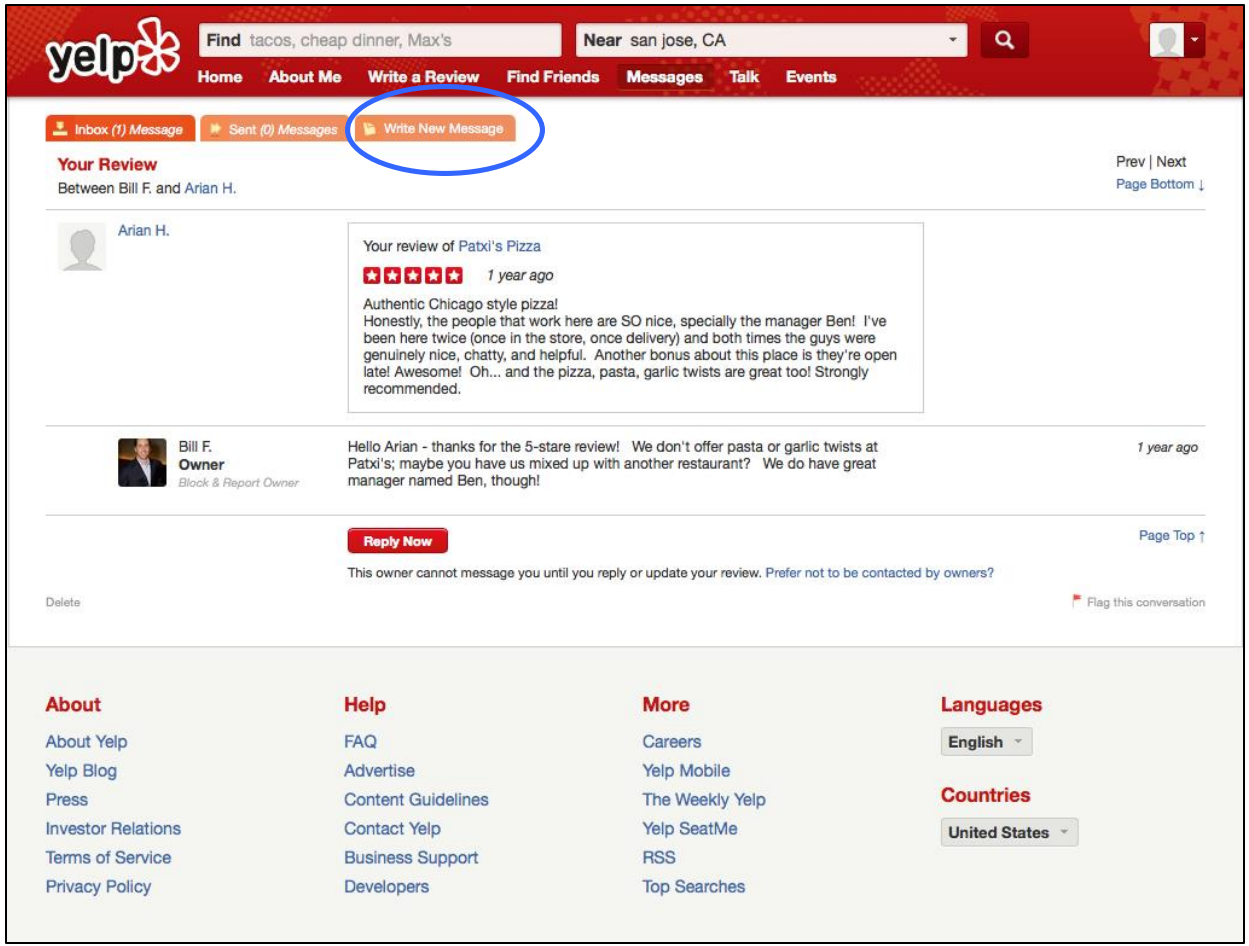
Menu of Jobs (**Objects**)



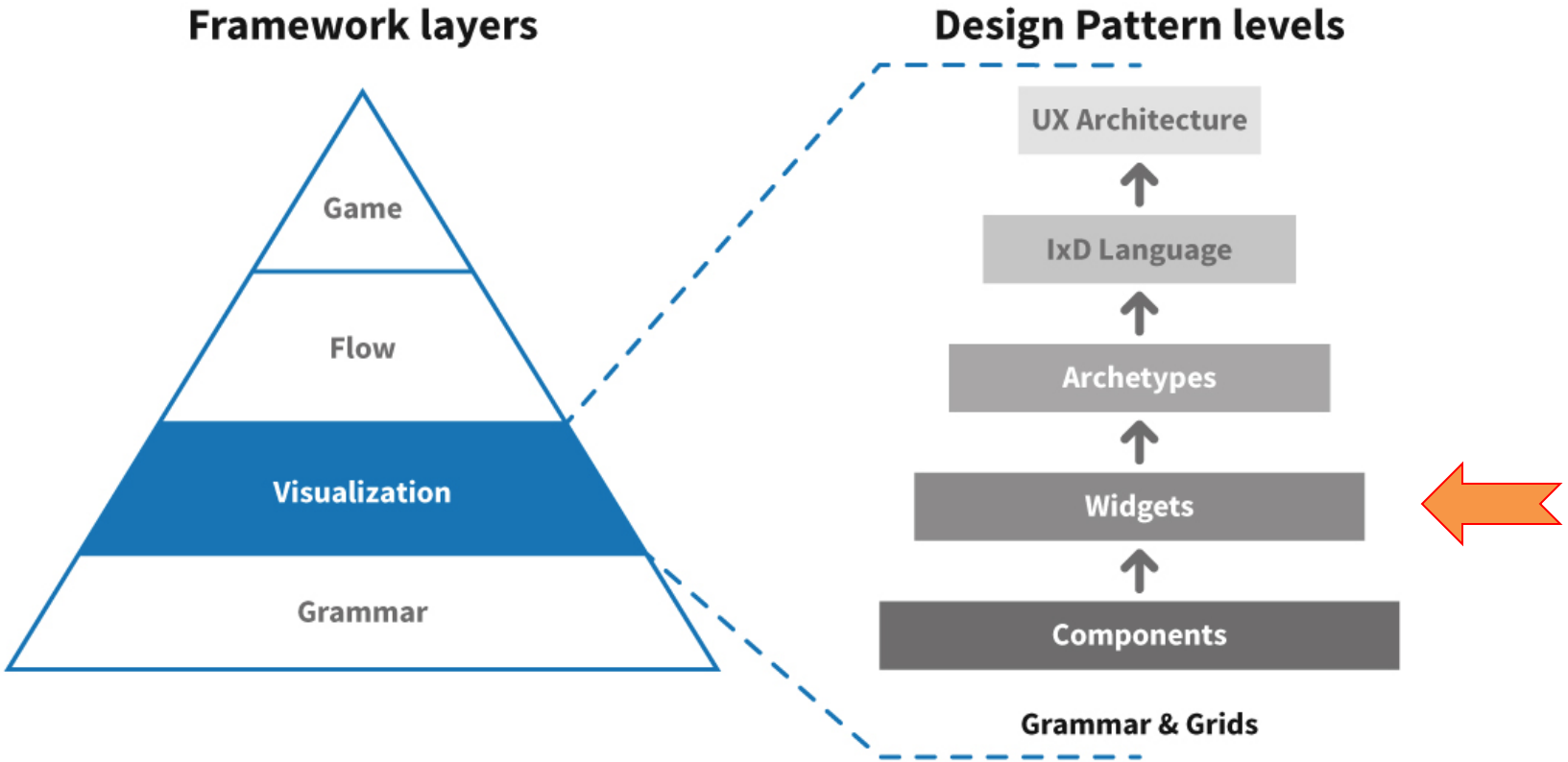
Menu of **Actions** related to profile

Bad Example

Tabs = 2 Attributes and 1 Action



Visualization Deconstruction



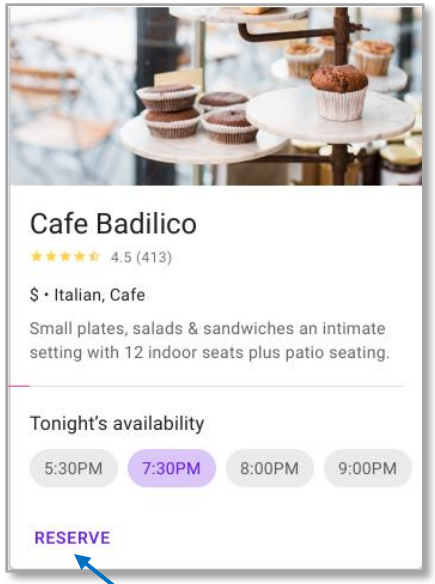
Application IA

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

Legend: X (Primary) | x (Secondary)

Card Control – Semantic error example

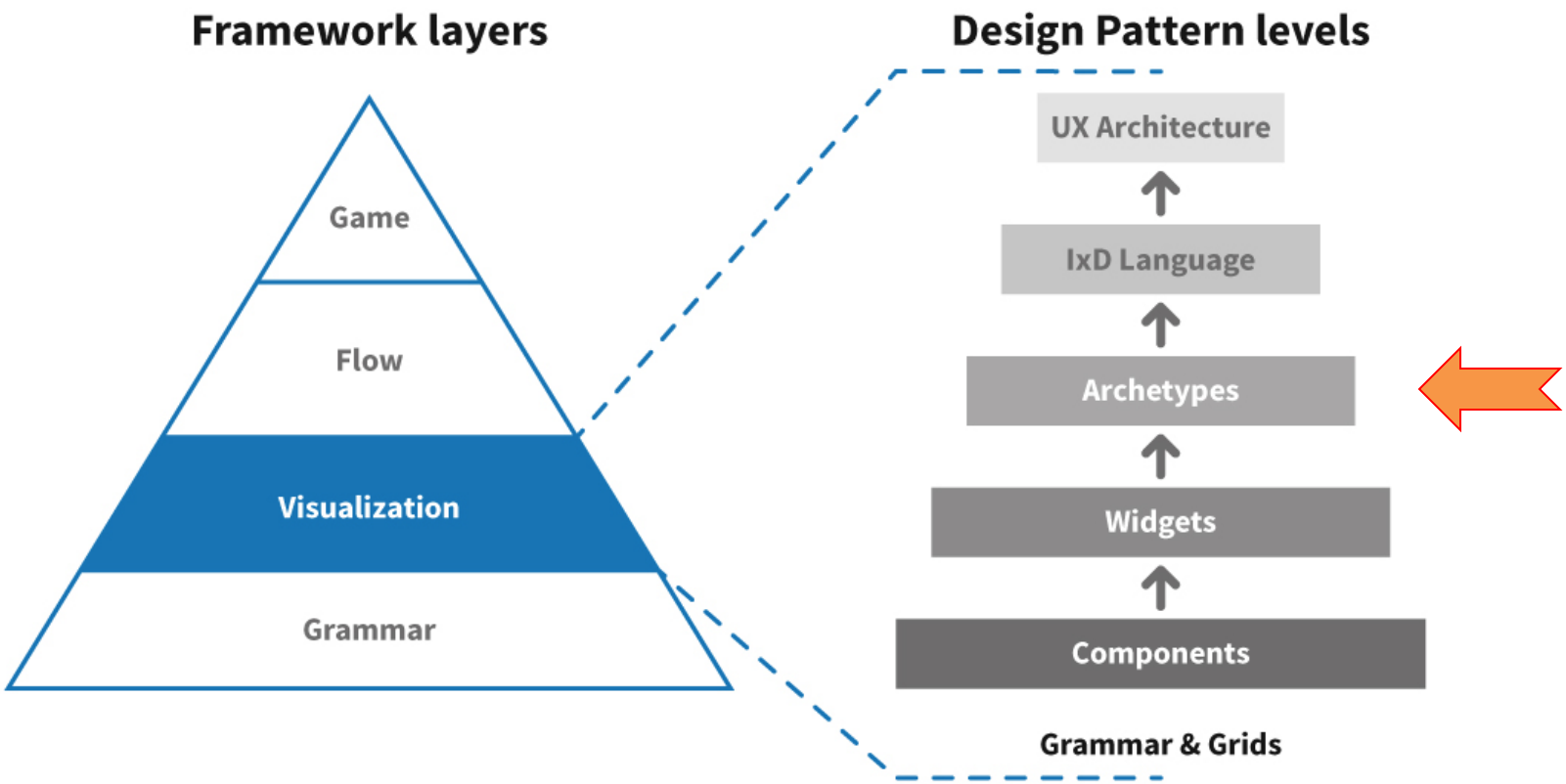


Local action
(CM transactional)

Many attributes inside card

Local action
(not grammar relevant)

Visualization Deconstruction



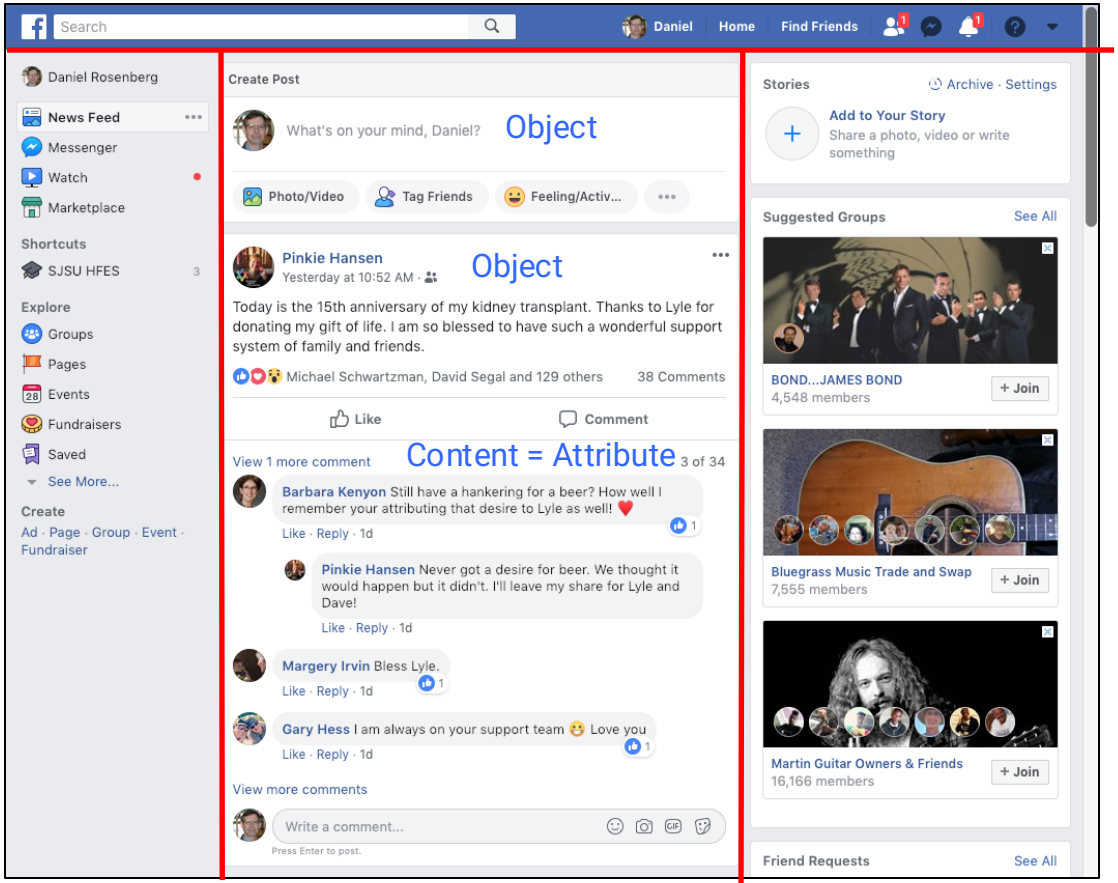
Application IA

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)

Archetype: Social (Feed and suggestions)



Objects

Action

Attribute filters

Actions

Global Actions

Local Actions

Local Actions

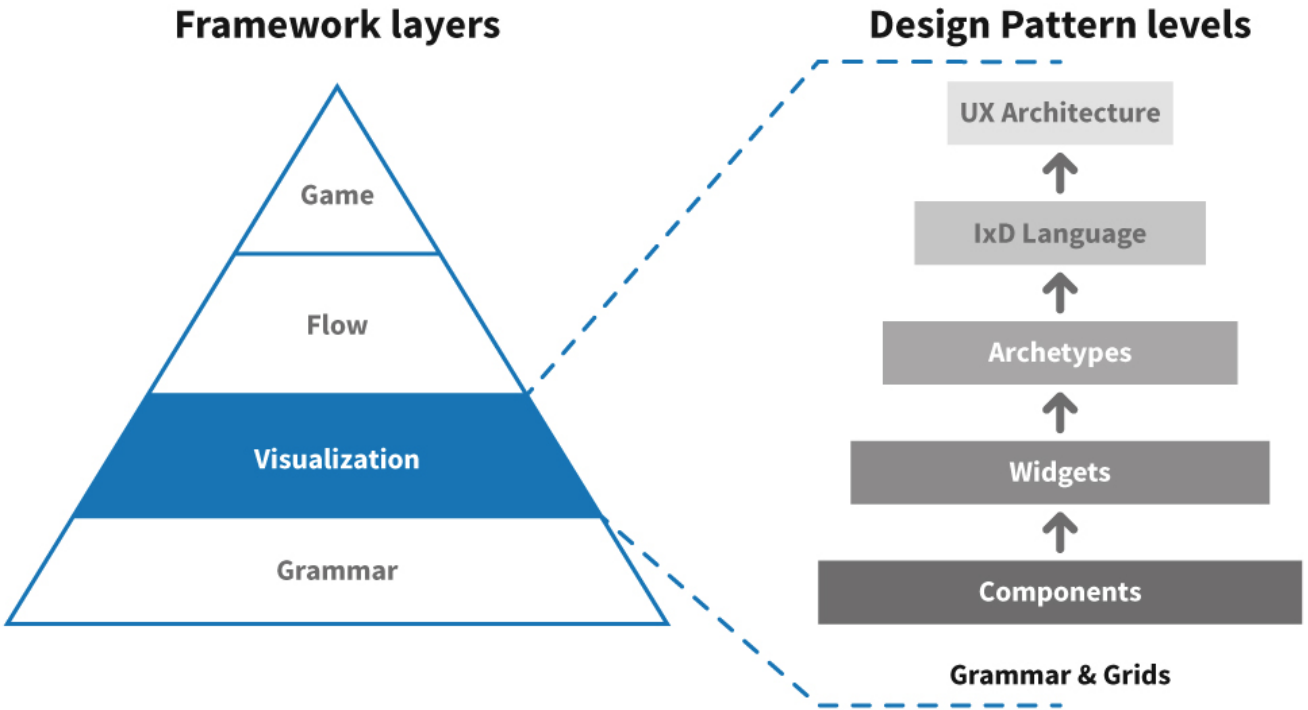
Local Actions

Local Actions

Local Actions

Feed Widget in the center

Visualization Deconstruction



Medical Interaction Design Language examples – IA at multiple UX layer

1. Behavior the Appointment Object inside different archetypes

2. Consistent use of the Void Action to remove errors

A day in the life of…

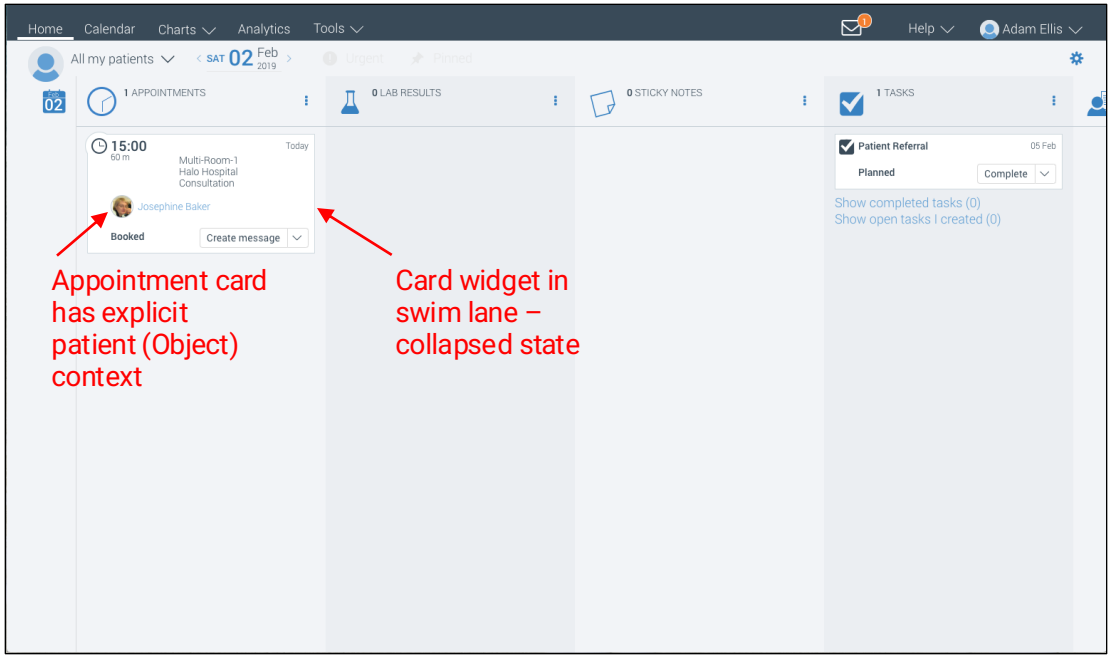
EMR Conceptual Model

Application IA

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

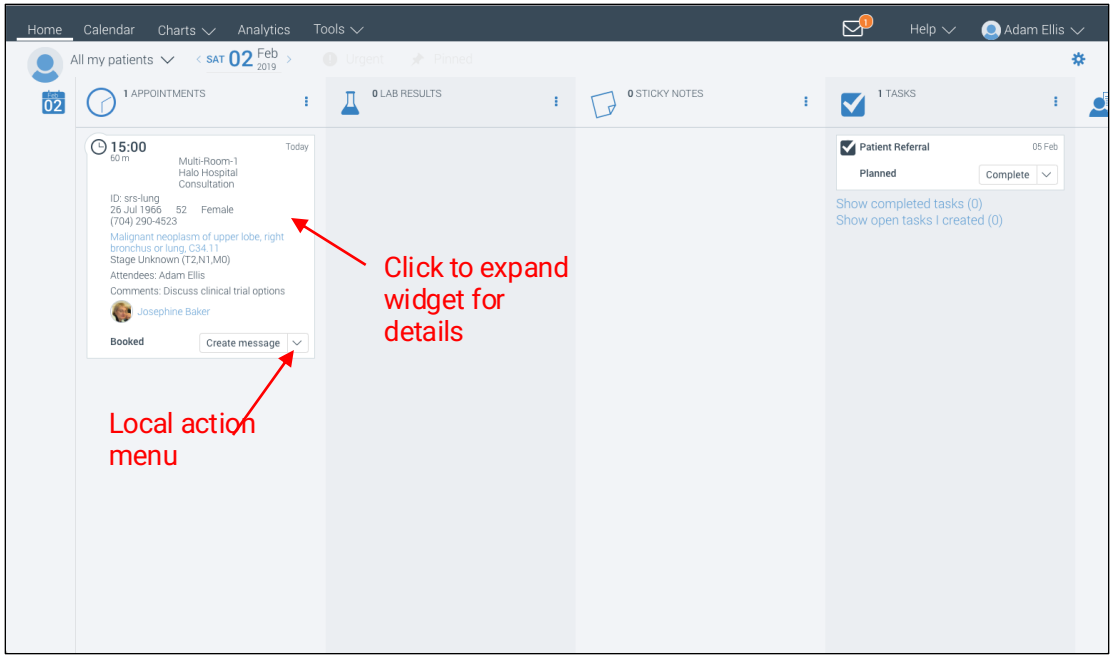
Only 8 objects and 9 actions can describe an entire EMR solution

Interaction Design Language: Object Example - Appointment



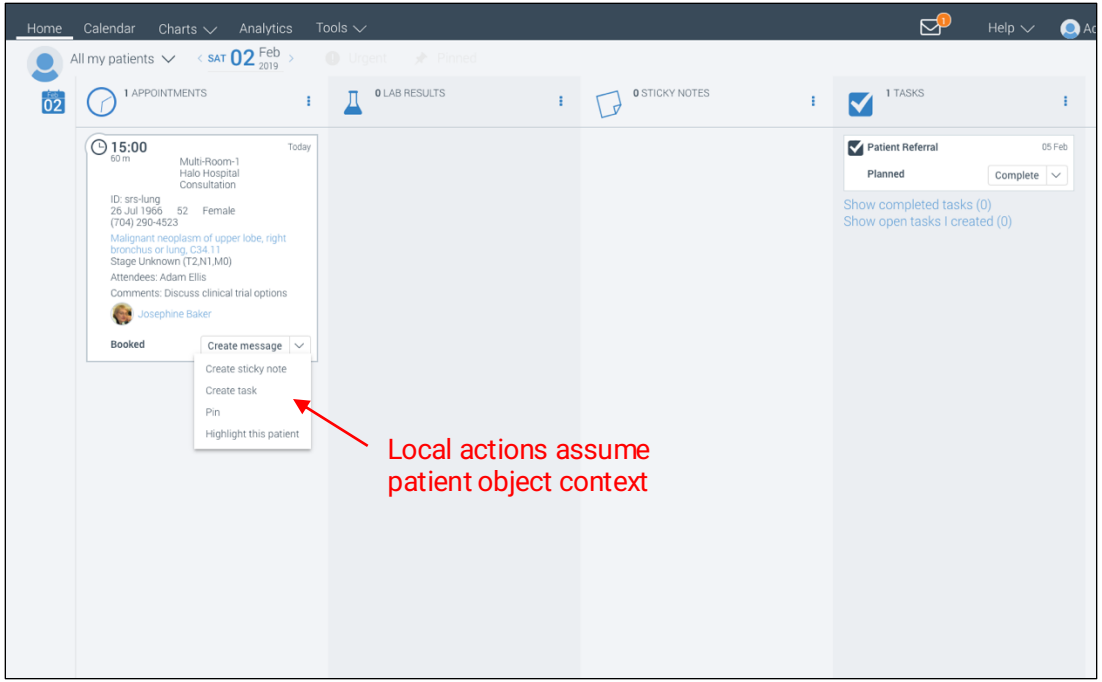
Swimlane Archetype Pattern

Interaction Design Language: Object Example - Appointment



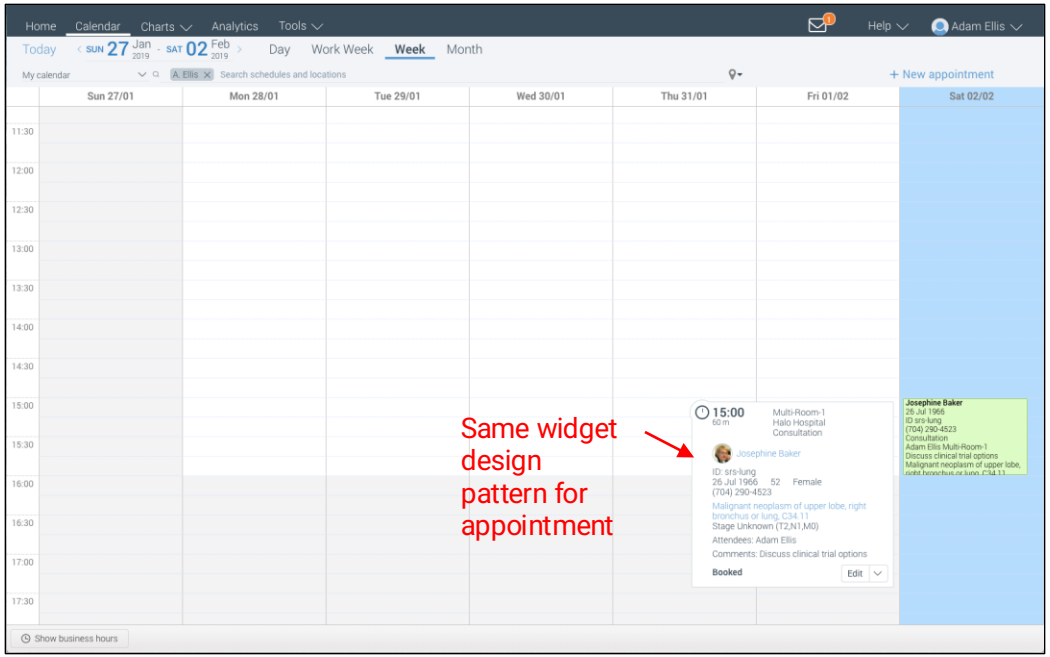
Swimlane Archetype Pattern

Interaction Design Language: Object Example - Appointment



Swimlane Archetype Pattern

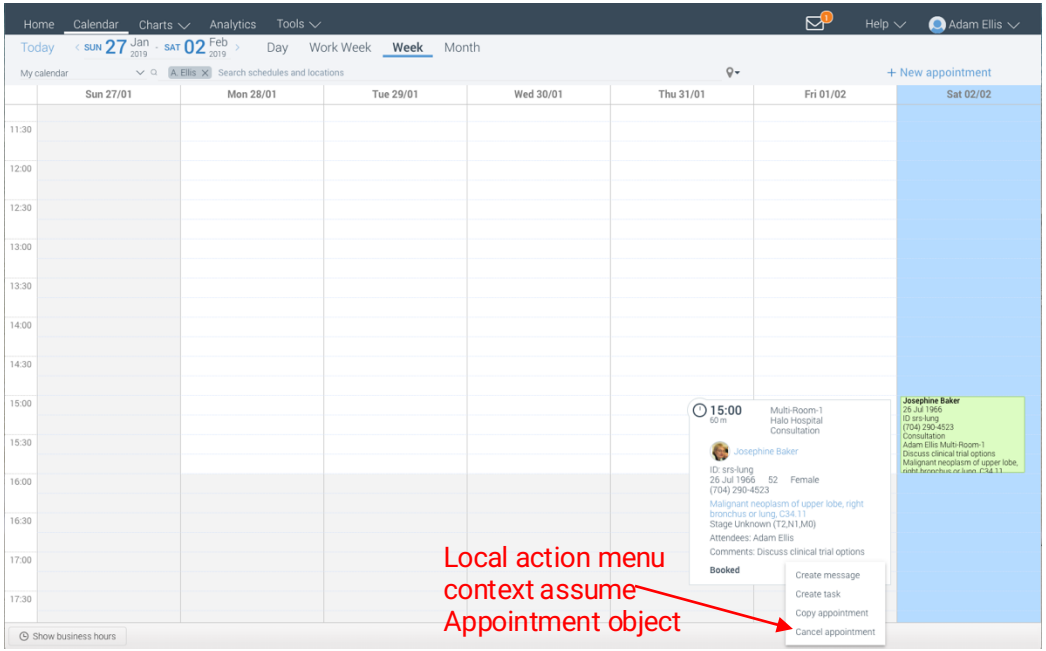
Interaction Design Language: Object Example - Appointment



Same widget design pattern for appointment

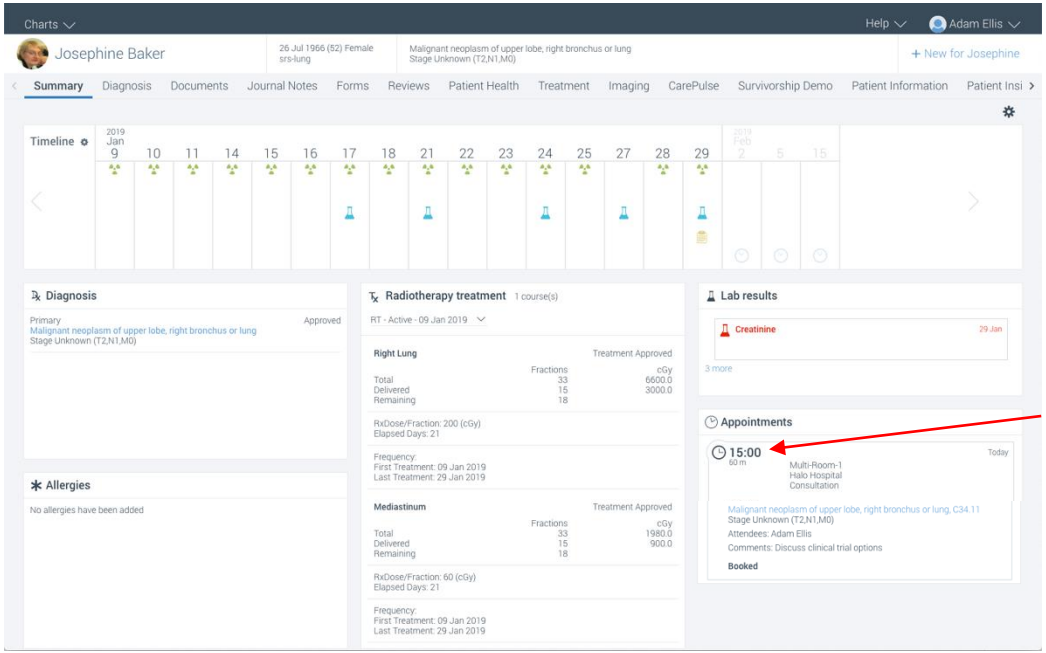
Calendar Archetype Pattern

Interaction Design Language: Object Example - Appointment



Calendar Archetype Pattern

Interaction Design Language: Object Example - Appointment



Next upcoming appointment summary in widget

Portal Archetype Pattern

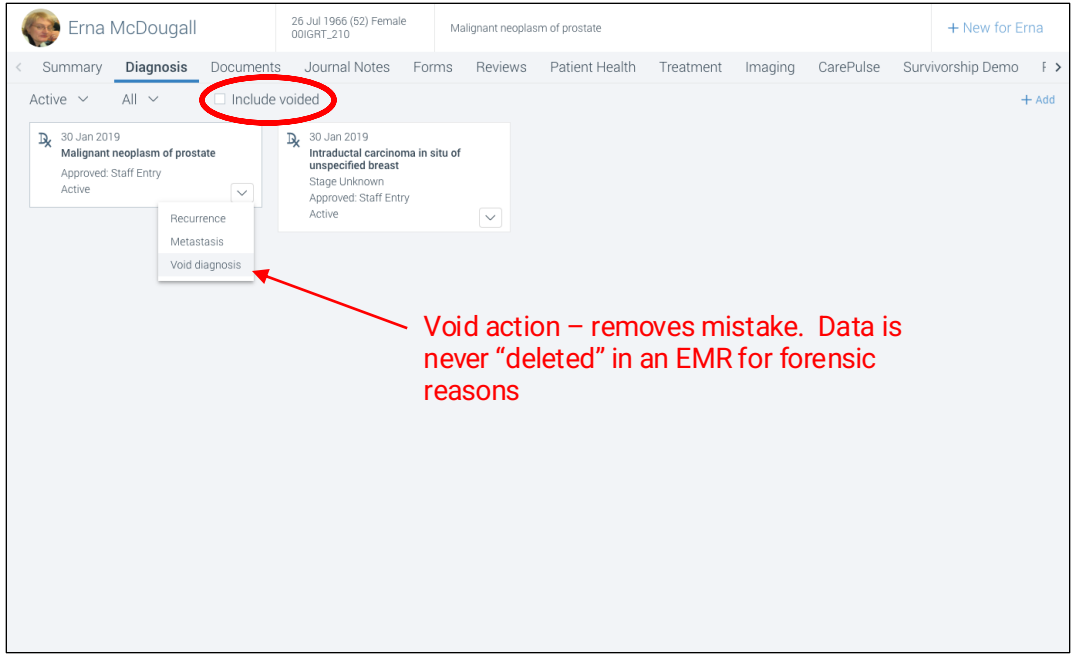
Conceptual model

Application IA

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

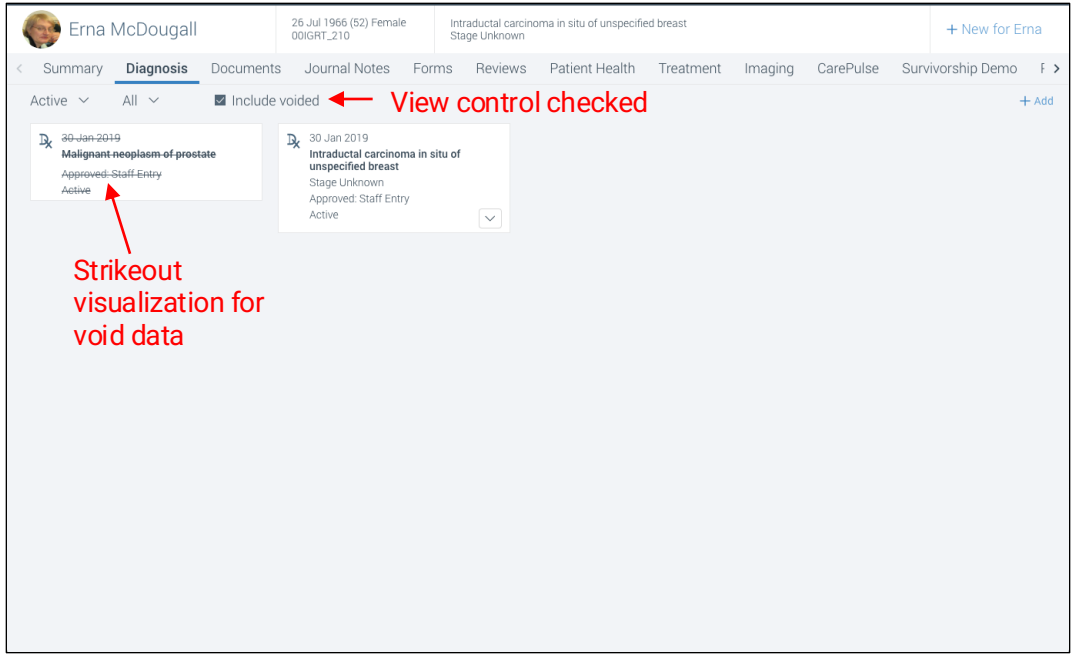
Only 8 objects and 9 actions can describe an entire EMR solution

Interaction Design Language: Action Example – Void Data



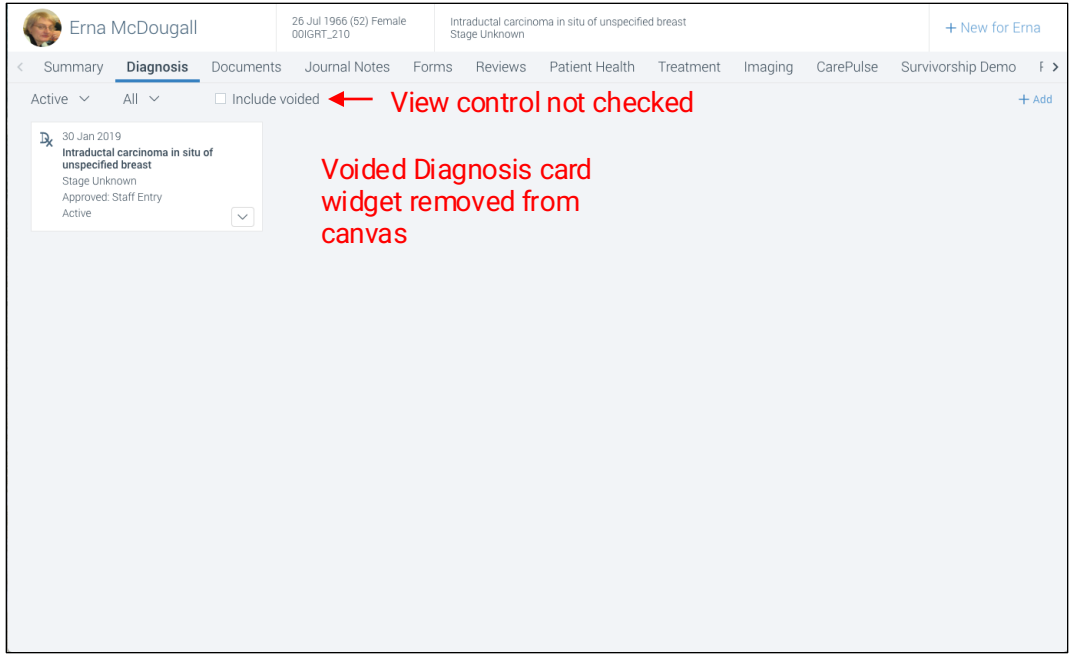
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



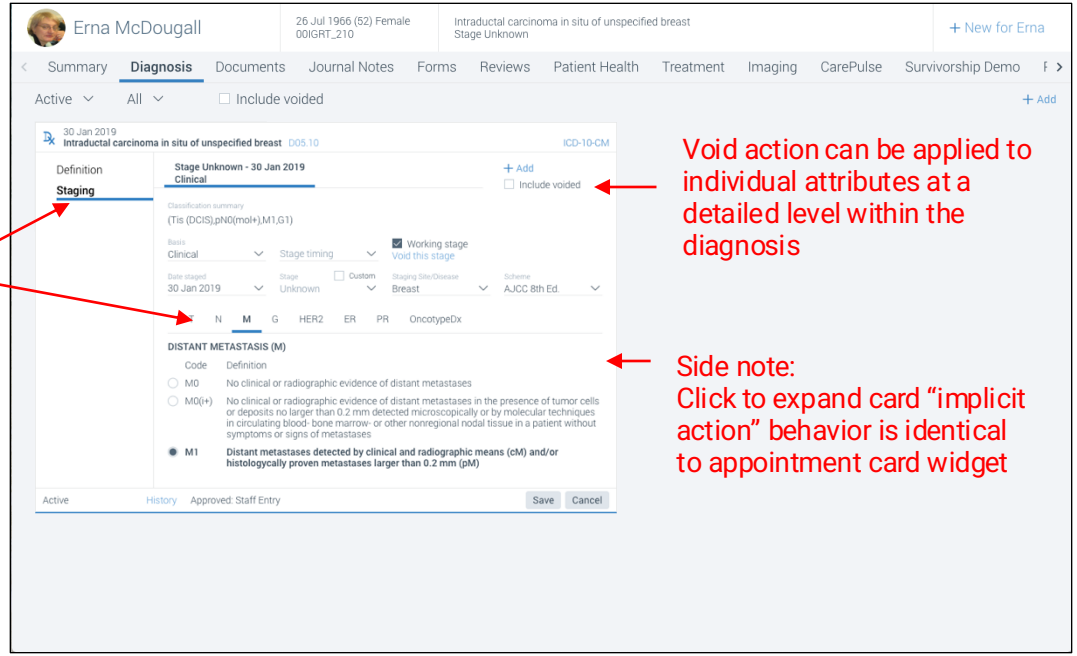
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



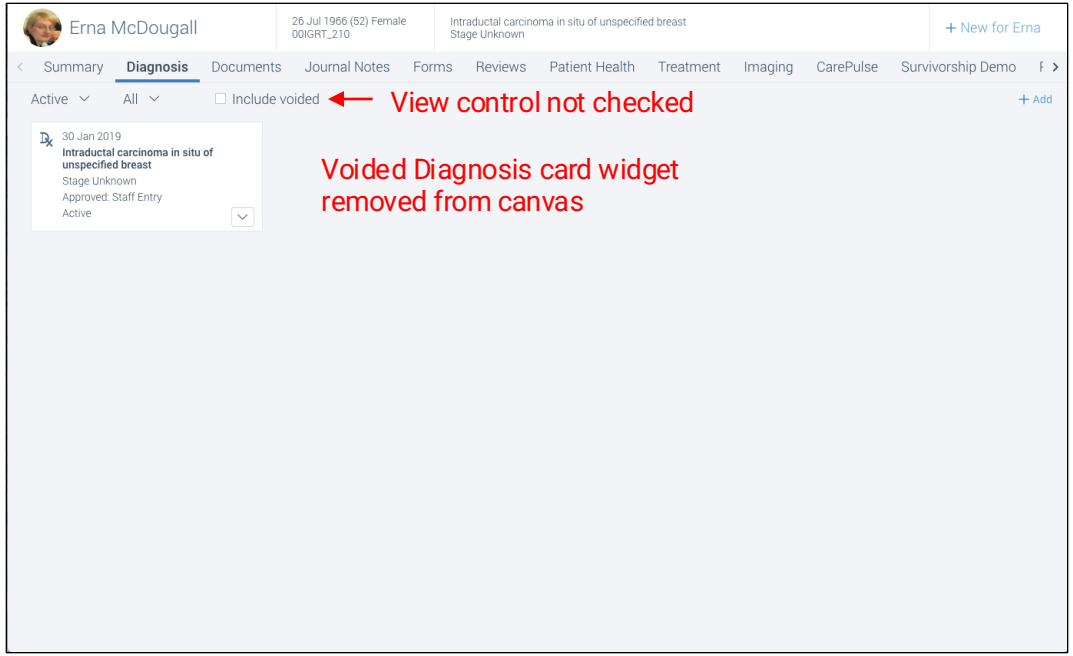
Two level tab widget embedded inside card widget

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

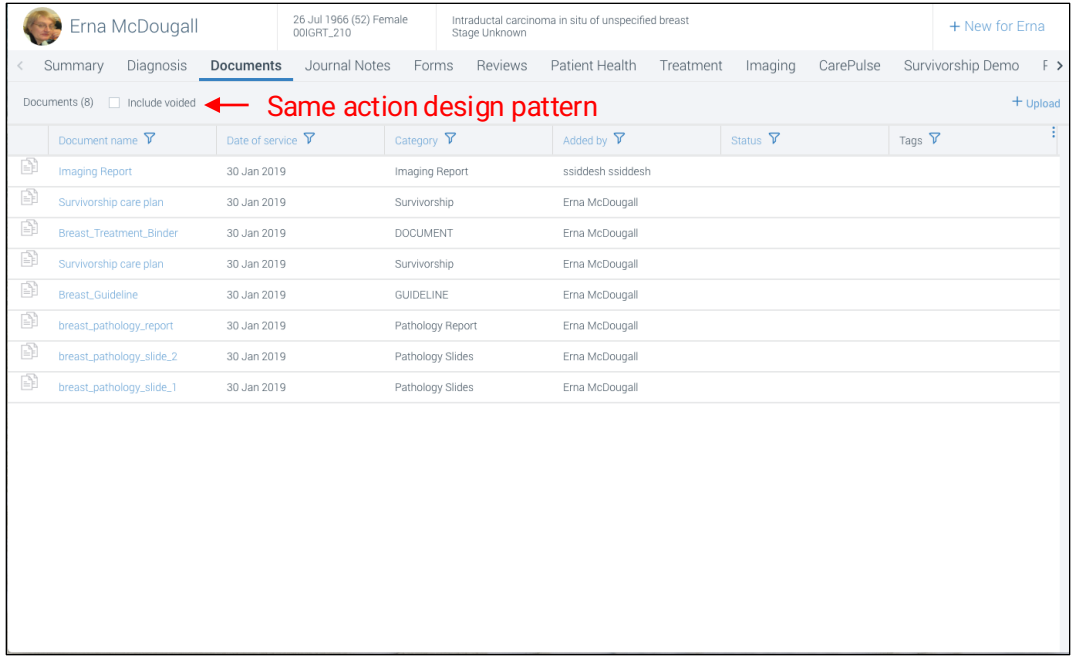
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



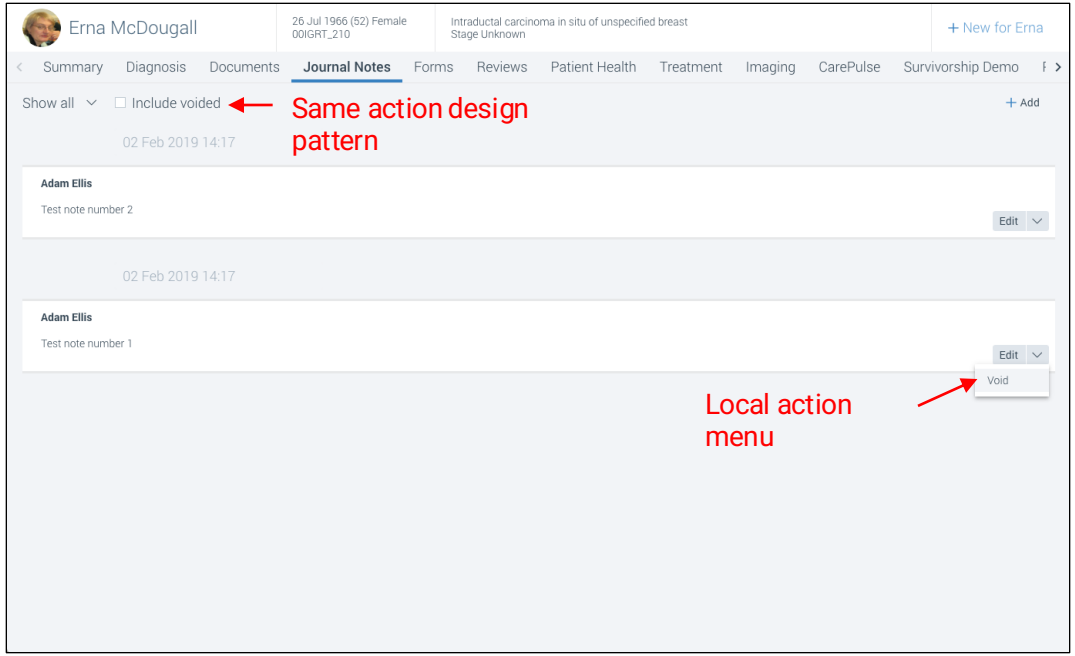
Canvas Archetype Pattern

Interaction Design Language: Action Example – Void Data



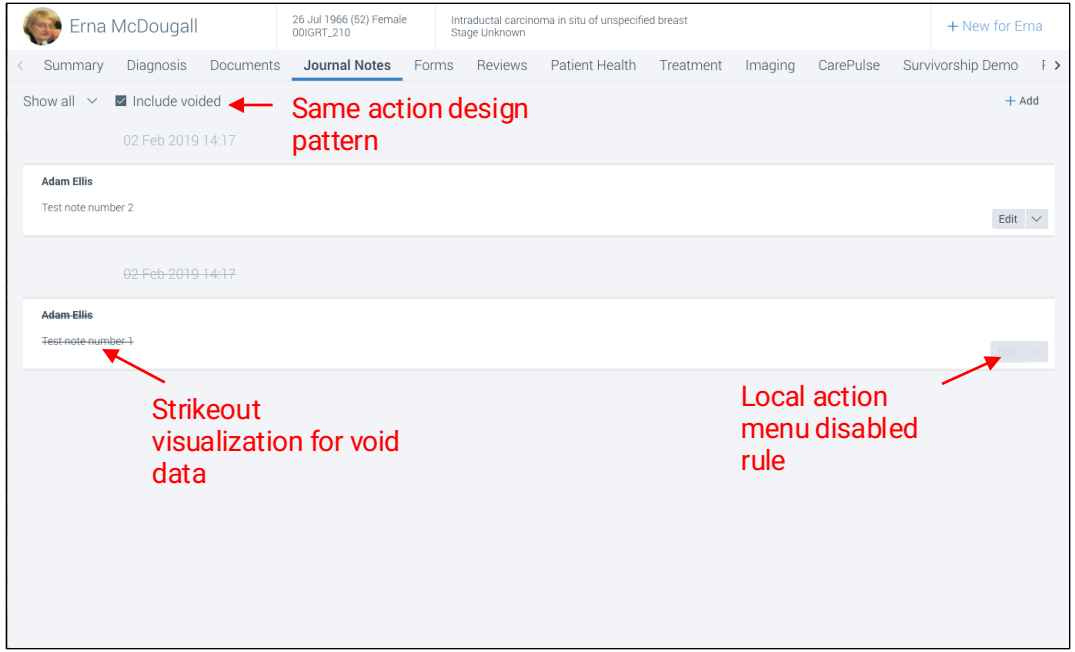
Menu (list) Archetype Pattern

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

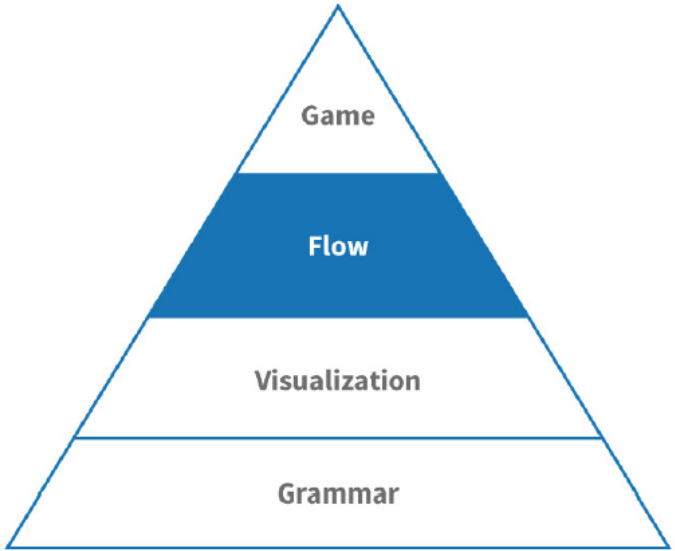
Who: Digital Natives recognize Interaction Design patterns

- 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

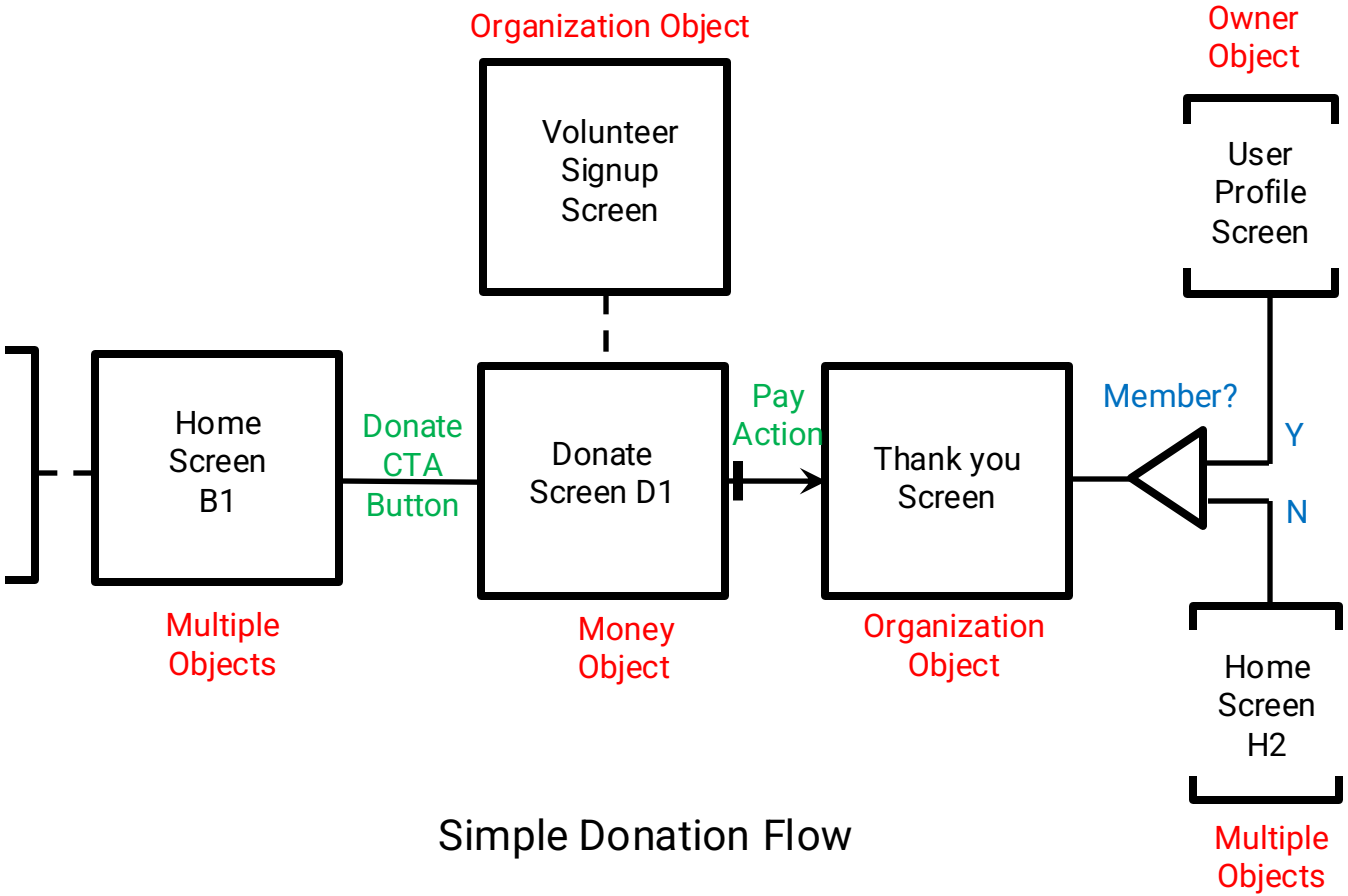
Actions

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

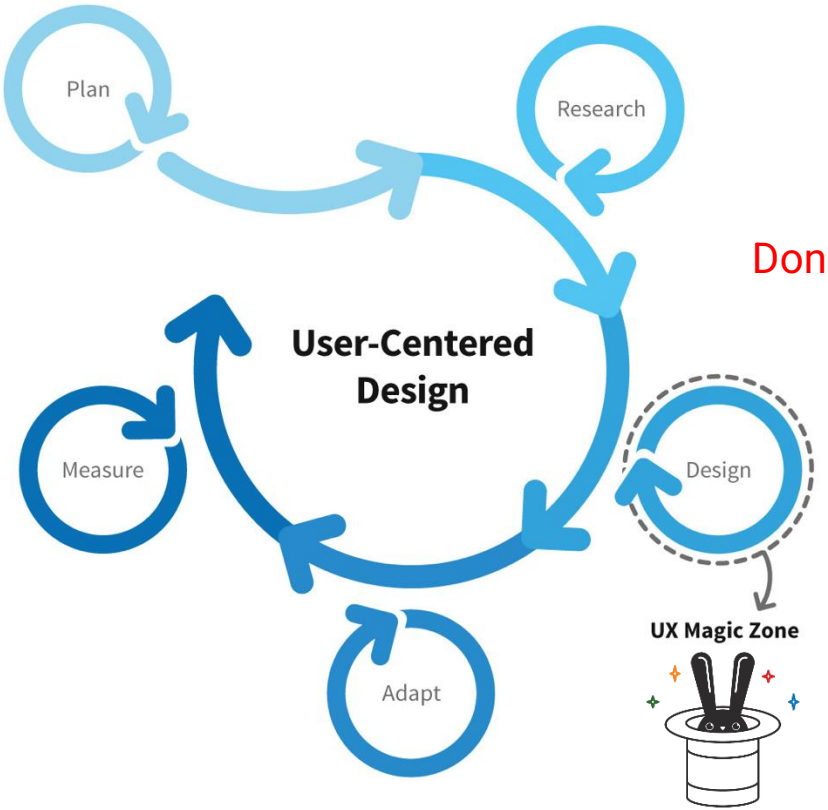


Simple Donation Flow

Semantic Interaction Design is a foundational method for building digital experiences with the **lowest cognitive load** (highest degree of usability)

This method leverages directly maps an applications functional taxonomy into both an information architecture and UX visualization patterns.

Semantic IxD – Only Interaction Design step



Don’t forget to do the other UCD Steps!

The End – Q&A