Designing APIs: The Other User Interface

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And now for something completely different…

M-A-C-D-O-N-A-L-D

M-A-C-I-N-T-O-S-H

M-A-C-H-I-N-E-S

Credentials

- Tech reviewer: “Sun SCJP 6 Study Guide”
  “Burk fixed more code than we care to admit.”
  — Kathy Sierra and Bert Bates

- Sun Certified Java Programmer, Developer and Enterprise Architect for JEE5

- Speaker at JavaOne, DevNexus, AJUG

- Contributing author to “97 Things Every Software Architect Should Know” and “97 Things Every Programmer Should Know”

Key Points

- You are an API designer

What's an API?

From wikipedia.org:

An application programming interface (API) is a set of routines, protocols, and tools for building software applications. An API expresses a software component in terms of its operations, inputs, outputs, and underlying types. An API defines functionalities that are independent of their respective implementations, which allows definitions and implementations to vary without compromising each other. A good API makes it easier to develop a program by providing all the building blocks. A programmer then puts the blocks together.

What's an API?

- An API is a set of services, protocols, and tools for building software applications.
- An API describes a software component in terms of its operations, inputs, outputs, ~~and underlying types~~.
- Service definitions are independent of their implementations, so they can vary independently.
- Programmers use APIs when writing programs to include pre-built services with their code.

API Example (Web Service)

Google Books API:
Docs/examples at: developers.google.com/books/
API base URL: https://www.googleapis.com

/books/v1/volumes

/books/v1/volumes/volumeId

/books/v1/mylibrary/bookshelves

/books/v1/mylibrary/bookshelves/shelf

/books/v1/mylibrary/bookshelves/shelf/volumes

Class == API ?

1) An API is an interface used to access services.

2) The public methods of a Class provide services to users of the Class.

3) JavaDoc and sample code are the tools a programmer uses to understand how to use the API.

4) Therefore, the act of creating a Class with public methods IS an act of API design.

Key Points

- You ARE an API designer
- APIs are user interfaces, so think about your users and what they're trying to accomplish

What's a User Interface

From wikipedia.org:

The user interface is the space where interactions between humans and machines occur. The goal is to allow effective operation and control of the machine from the human end, whilst the machine simultaneously feeds back information that aids the operator's decision making processes.

Generally, the goal of user interface design is to produce a user interface which makes it easy (self explanatory), efficient, and enjoyable (user friendly) to operate a machine in the way which produces the desired result. This generally means that the operator needs to provide minimal input to achieve the desired output, and also that the machine minimizes undesired outputs to the human.

What's a User Interface

- UI is where interactions between humans and things occur.
- UIs have two main goals:
- 1) Help the user get something done.
- 2) Let the user know what's going on so they can decide what to do next.

UI Example

UI Example

UI Example

User Experience

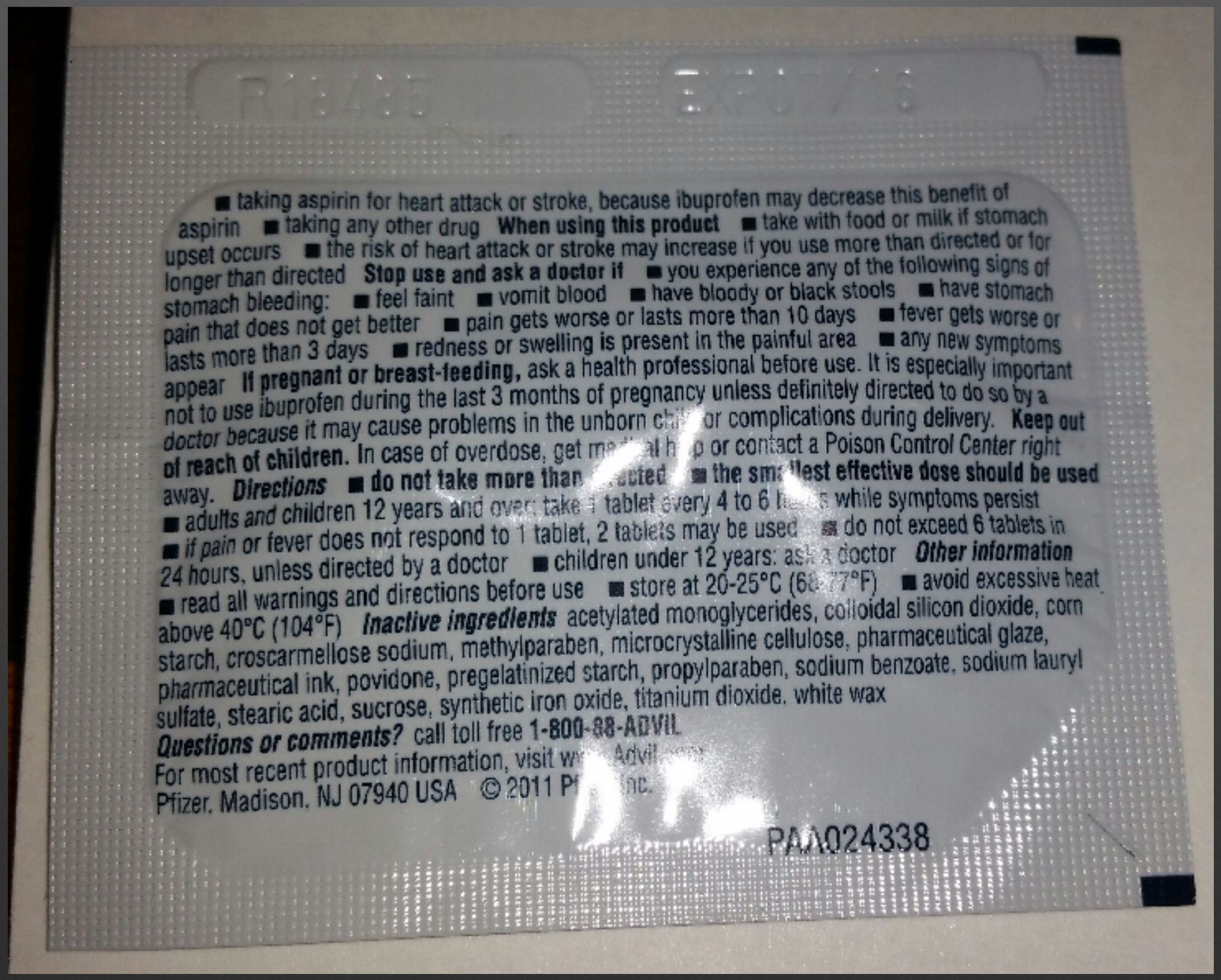
User Experience (UX) involves a person's behaviors, attitudes, and emotions about using a particular product, system or service.

User experience includes the practical, experiential, affective, meaningful and valuable aspects of human–computer interaction and product ownership. Additionally, it includes a person's perceptions of system aspects such as utility, ease of use and efficiency. User experience may be considered subjective in nature to the degree that it is about individual perception and thought with respect to the system. User experience is dynamic as it is constantly modified over time due to changing usage circumstances and changes to individual systems as well as the wider usage context in which they can be found.

User Experience

- UX focuses on how the user **feels** when interacting with something.
- UX includes a person's perceptions of system aspects such as ***usefulness***, ***ease of use***, and ***efficiency***.
- UX is ***subjective*** and can change over time.

UX Example


■ taking aspirin for heart attack or stroke, because ibuprofen may decrease this benefit of aspirin ■ taking any other drug **When using this product** ■ take with food or milk if stomach upset occurs ■ the risk of heart attack or stroke may increase if you use more than directed or for longer than directed **Stop use and ask a doctor if** ■ you experience any of the following signs of stomach bleeding: ■ feel faint ■ vomit blood ■ have bloody or black stools ■ have stomach pain that does not get better ■ pain gets worse or lasts more than 10 days ■ fever gets worse or lasts more than 3 days ■ redness or swelling is present in the painful area ■ any new symptoms appear **If pregnant or breast-feeding,** ask a health professional before use. It is especially important not to use ibuprofen during the last 3 months of pregnancy unless definitely directed to do so by a doctor because it may cause problems in the unborn child or complications during delivery. **Keep out of reach of children.** In case of overdose, get medical help or contact a Poison Control Center right away. ***Directions*** ■ **do not take more than directed** ■ **the smallest effective dose should be used** ■ adults and children 12 years and over: take 1 tablet every 4 to 6 hours while symptoms persist ■ if pain or fever does not respond to 1 tablet, 2 tablets may be used ■ do not exceed 6 tablets in 24 hours, unless directed by a doctor ■ children under 12 years: ask a doctor ***Other information*** ■ read all warnings and directions before use ■ store at 20-25°C (68-77°F) ■ avoid excessive heat above 40°C (104°F) ***Inactive ingredients*** acetylated monoglycerides, colloidal silicon dioxide, corn starch, croscarmellose sodium, methylparaben, microcrystalline cellulose, pharmaceutical glaze, pharmaceutical ink, povidone, pregelatinized starch, propylparaben, sodium benzoate, sodium lauryl sulfate, stearic acid, sucrose, synthetic iron oxide, titanium dioxide, white wax
Questions or comments? call toll free **1-800-88-ADVIL**
For most recent product information, visit www.Advil.com
Pfizer, Madison, NJ 07940 USA © 2011 Pfizer Inc.
PAA024338

UX Example


Advil®
Ibuprofen Tablets, 200 mg
Pain Reliever/Fever Reducer (NSAID)
2 Coated Tablets
Active ingredient (in each tablet)
Purpose
Ibuprofen 200 mg (NSAID)* ... Pain reliever/Fever reducer
*nonsteroidal anti-inflammatory drug
Uses ■ temporarily relieves minor aches and pains due to: ■ headache ■ toothache ■ backache ■ menstrual cramps ■ the common cold ■ muscular aches ■ minor pain of arthritis ■ temporarily reduces fever
Warnings Allergy alert: Ibuprofen may cause a severe allergic reaction, especially in people allergic to aspirin. Symptoms may include: ■ hives ■ facial swelling ■ asthma (wheezing) ■ shock ■ skin reddening ■ rash ■ blisters If an allergic reaction occurs, stop use and seek medical help right away. Stomach bleeding warning: This product contains an NSAID, which may cause severe stomach bleeding. The chance is higher if you ■ are age 60 or older ■ have had stomach ulcers or bleeding problems ■ take a blood thinning (anticoagulant) or steroid drug ■ take other drugs containing prescription or nonprescription NSAIDs [aspirin, ibuprofen, naproxen, or others] ■ have 3 or more alcoholic drinks every day while using this product ■ take more or for a longer time than directed Do not use ■ if you have ever had an allergic reaction to any other pain reliever/fever reducer ■ right before or after heart surgery Ask a doctor before use if ■ stomach bleeding warning applies to you ■ you have problems or serious side effects from taking pain relievers or fever reducers ■ you have a history of stomach problems. such as heartburn ■ you have high blood pressure heart disease, liver cirrhosis, kidney disease, or asthma ■ you are taking a diuretic Ask a doctor or pharmacist before use if you are ■ under a doctor's care for any serious condition
PAA024337
TO OPEN: FOLD BACK ON DOTTED LINE.
TEAR ON ARROW OR USE SCISSORS.
Do Not Use if the pouch is broken or torn.

UX Example

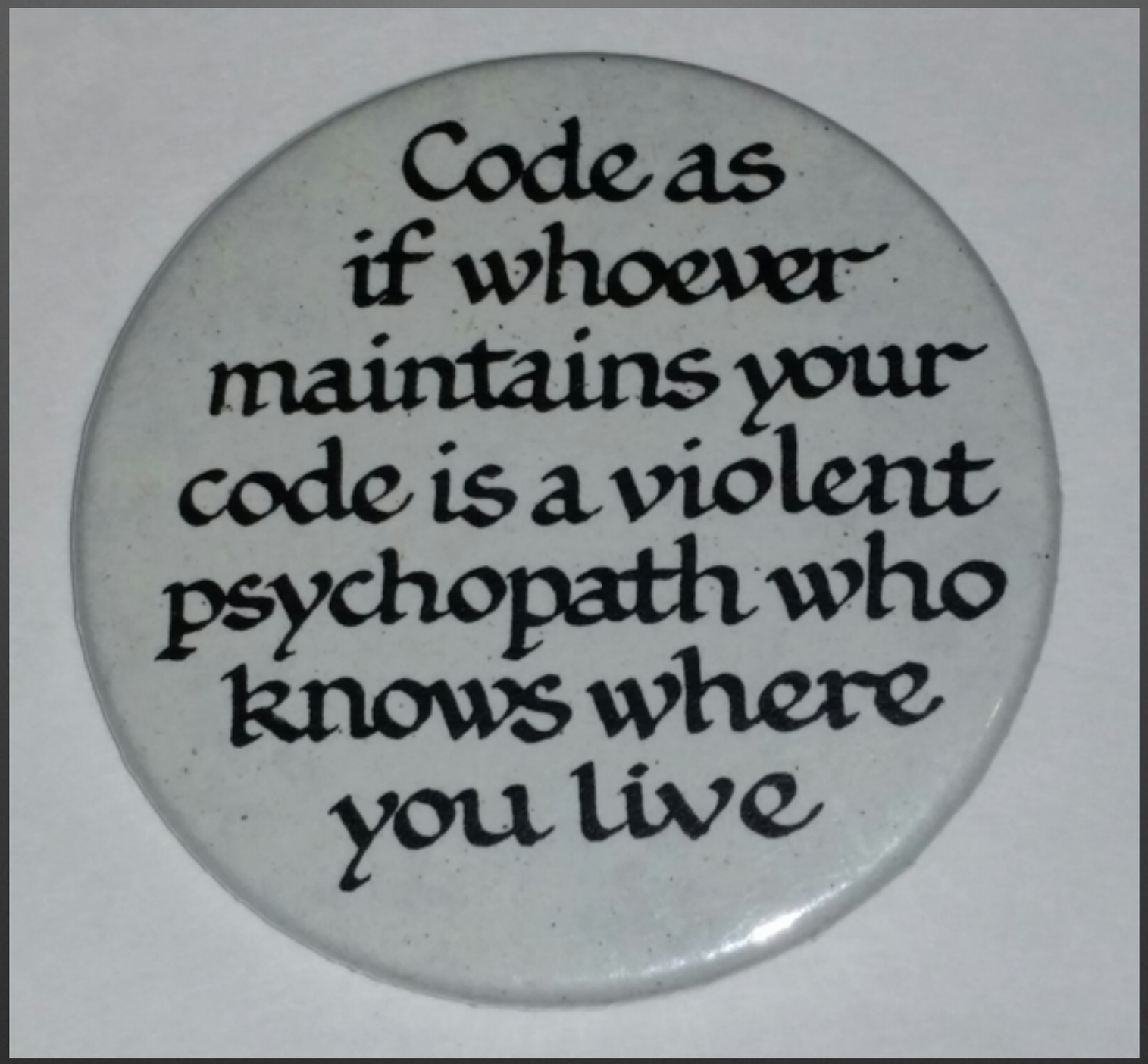
Key Points

- You ARE an API designer
- APIs are user interfaces, so think about your users and what they're trying to accomplish
- UI/UX principles can help you design better APIs for your users

UI/UX Principles

- Names have power. Pick good ones.
- Make it easy to use, and hard to misuse
- Minimize mental friction:
- Leverage pre-existing knowledge, follow existing standards, etc.
- Principle of least surprise
- Principles of grouping and chunking

Programmer Safety Announcement



Grouping and Chunking

Method parameters

Street Number Subscriber Number City

Area Code First Name State

Street Name Exchange Code Zip Code

Apartment Number Extension Last Name

Grouping and Chunking

Method parameters

int	int	String
Int	String	String
String	int	int
int	int	String

Grouping and Chunking

Method parameters

Street Number Subscriber Number City

Area Code First Name State

Street Name Exchange Code Zip Code

Apartment Number Extension Last Name

Grouping and Chunking

Method parameters

Street Number Subscriber Number City

Area Code First Name State

Street Name Exchange Code Zip Code

Apartment Number Extension Last Name

Grouping and Chunking

Method parameters

Street Number Extension City Zip Code

Street Name Apartment Number State

Area Code Exchange Code Subscriber Number

Last Name First Name

Grouping and Chunking

Method parameters

Street Number Street Name Apartment Number

City State Zip Code Extension

Area Code Exchange Code Subscriber Number

First Name Last Name

Grouping and Chunking

Method parameters

Address

Area Code Exchange Code Subscriber Number

First Name Last Name

Grouping and Chunking

Method parameters

Address

Phone Number

First Name Last Name

Grouping and Chunking

Method parameters

Address

Phone Number

Person Name

Grouping and Chunking

Method parameters

PersonName

Address

PhoneNumber

Now what?

1) APIs are user interfaces that allow programmers to access classes, libraries, frameworks, and systems.

2) Good APIs are easy to use and understand, and thereby deliver a good user experience.

3) Since APIs are user interfaces, we can use UI design approaches to improve our APIs

Think Like an API User

- Think about who would use your API.
- Think about what they want to do.
- From that viewpoint, write code accessing the API as if it already existed.
- Look for patterns in the client code indicating things the API should do for the client

API Design Example

Java Date class

```
/* Return true if date is February 14th, else returns false.
 */
public boolean isValentinesDay( Date date ) {
    return( (date.getMonth() == 2) &&
            (date.getDay() == 14) );
}
```

Looks good, but it doesn't work.

Months are zero-based so '2' is March, and getDay() returns day of the week from 0 to 6 - use getDate() instead.

Bad API Design

Java Date class

```
/* Return true if date is February 14th, else returns false.
 */
public boolean isValentinesDay( Date date ) {
    return( (date.getMonth() == 1) &&
            (date.getDate() == 14) );
}
```

The call getDate() looks like it should return *this.*

Bad API Design

Date exists because Sun promised not to break old code
Other than the constructor, almost all methods are deprecated in favor of using Calendar

But, Calendar is a bad name for a class dealing with dates.
A calendar is a year long, so adding time to it seems odd:

```
calendar.add( Calendar.MONTH, 2 );
```

Good API Design

JodaTime DateTime class

```
/* Return true if date is February 14th, else returns false.
 */
public boolean isValentinesDay( DateTime date ) {
    return( (date.getMonthOfYear() == 2) &&
            (date.getDayOfMonth() == 14) );
}
```

Looks good and works.

Bonus: Use DateTimeConstants.FEBRUARY instead of 2, to make it even clearer that we're testing for February 14th.

Recommendations

- Write client code before defining the API - lots of it.
  - Three different types to ensure it works well.
- Don’t make users do things the API could do.
  - Example creating a java.sql.Date:

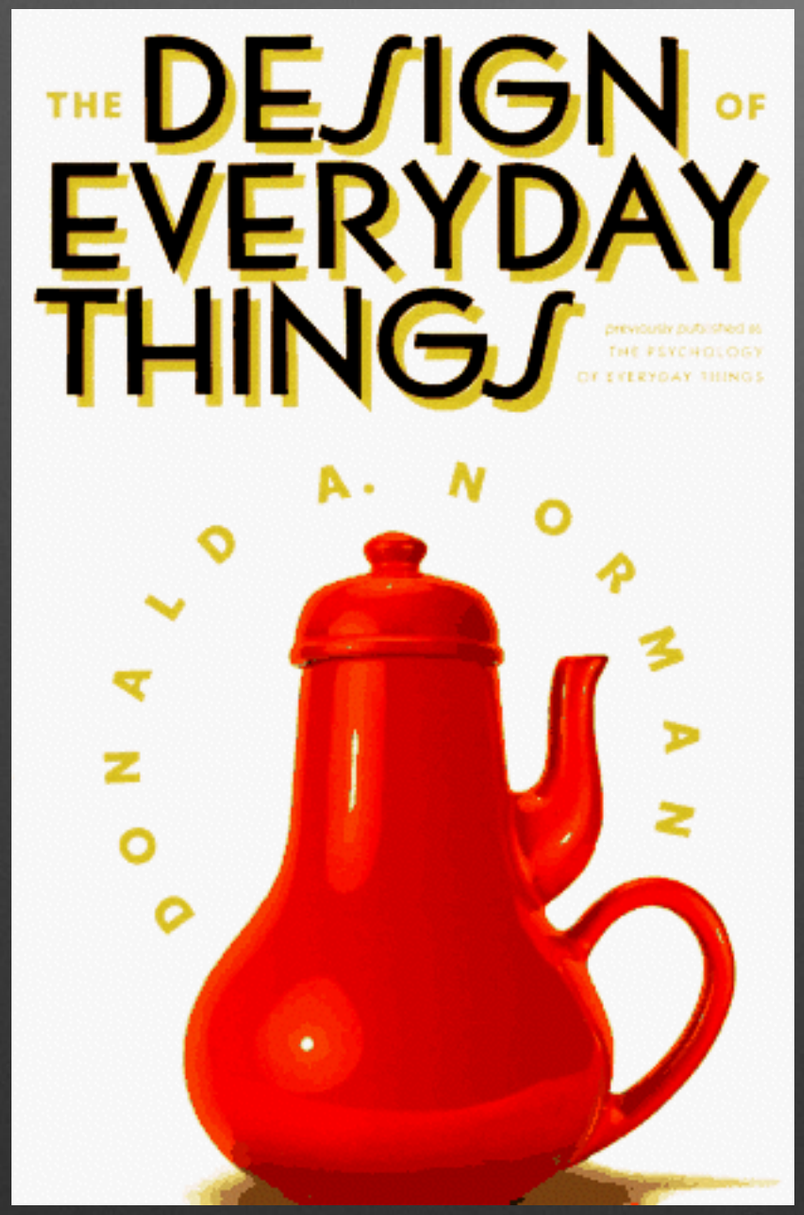
```
Date date = new Date( javaUtilDate.getTime() );
```

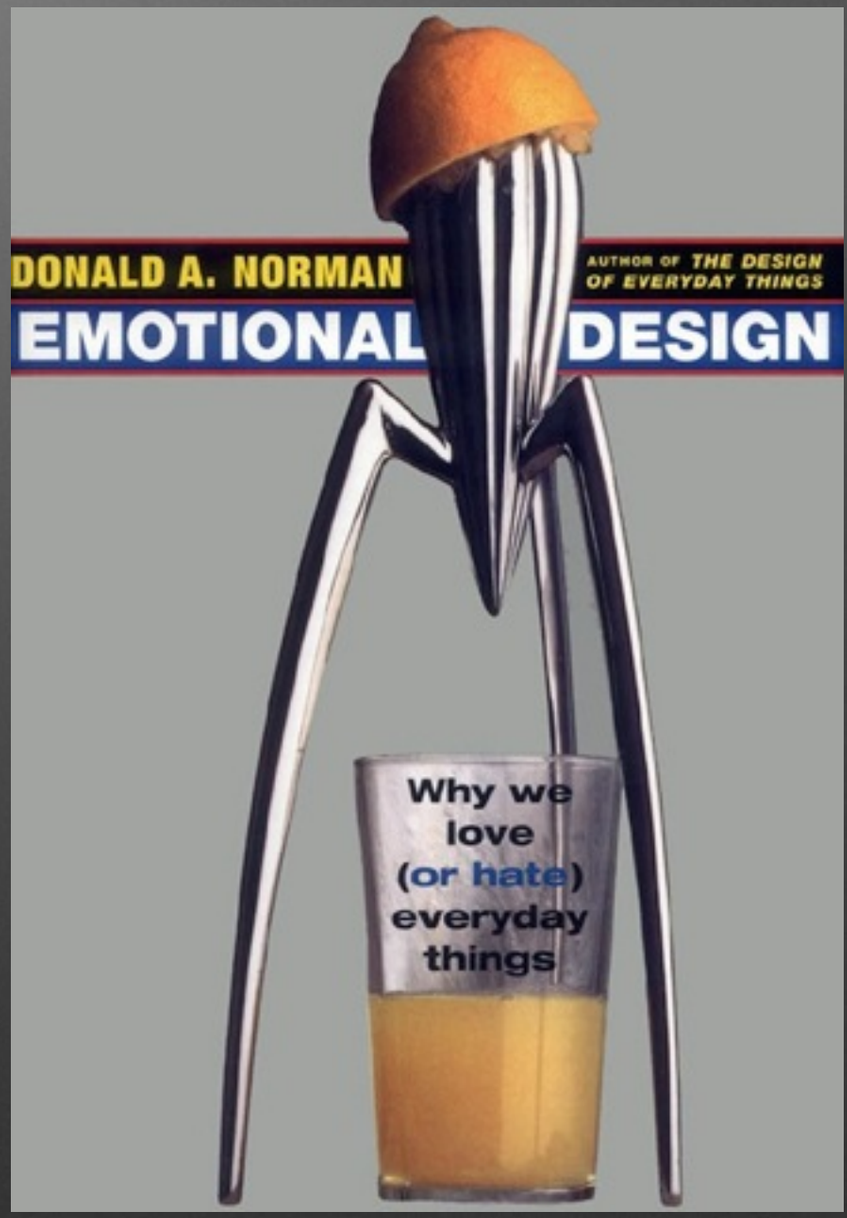
Final Take-aways

- You ARE an API designer
- APIs are user interfaces, so think about your users and what they're trying to accomplish
- UI/UX principles can help you design better APIs for your users

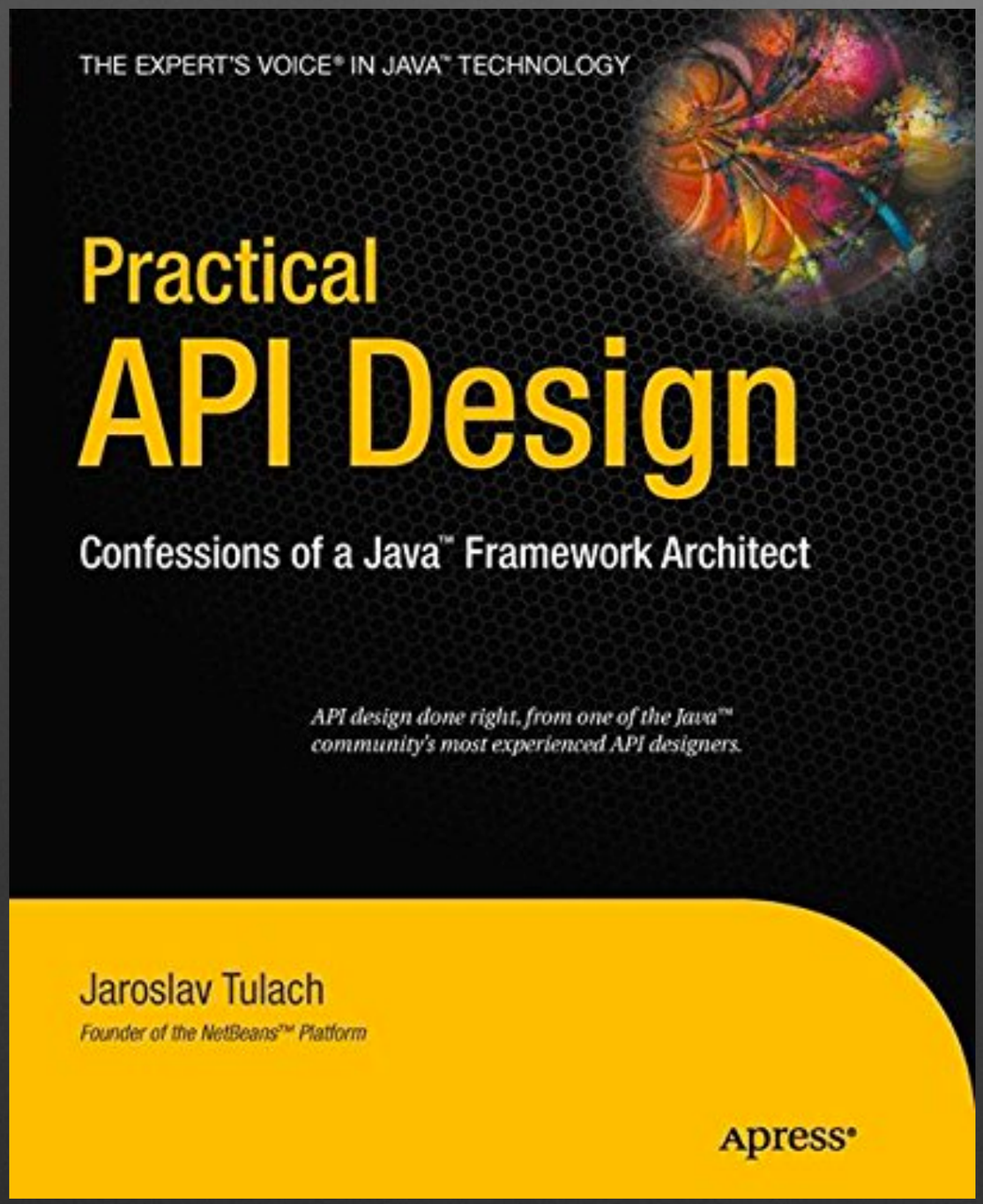
Write your code as if…

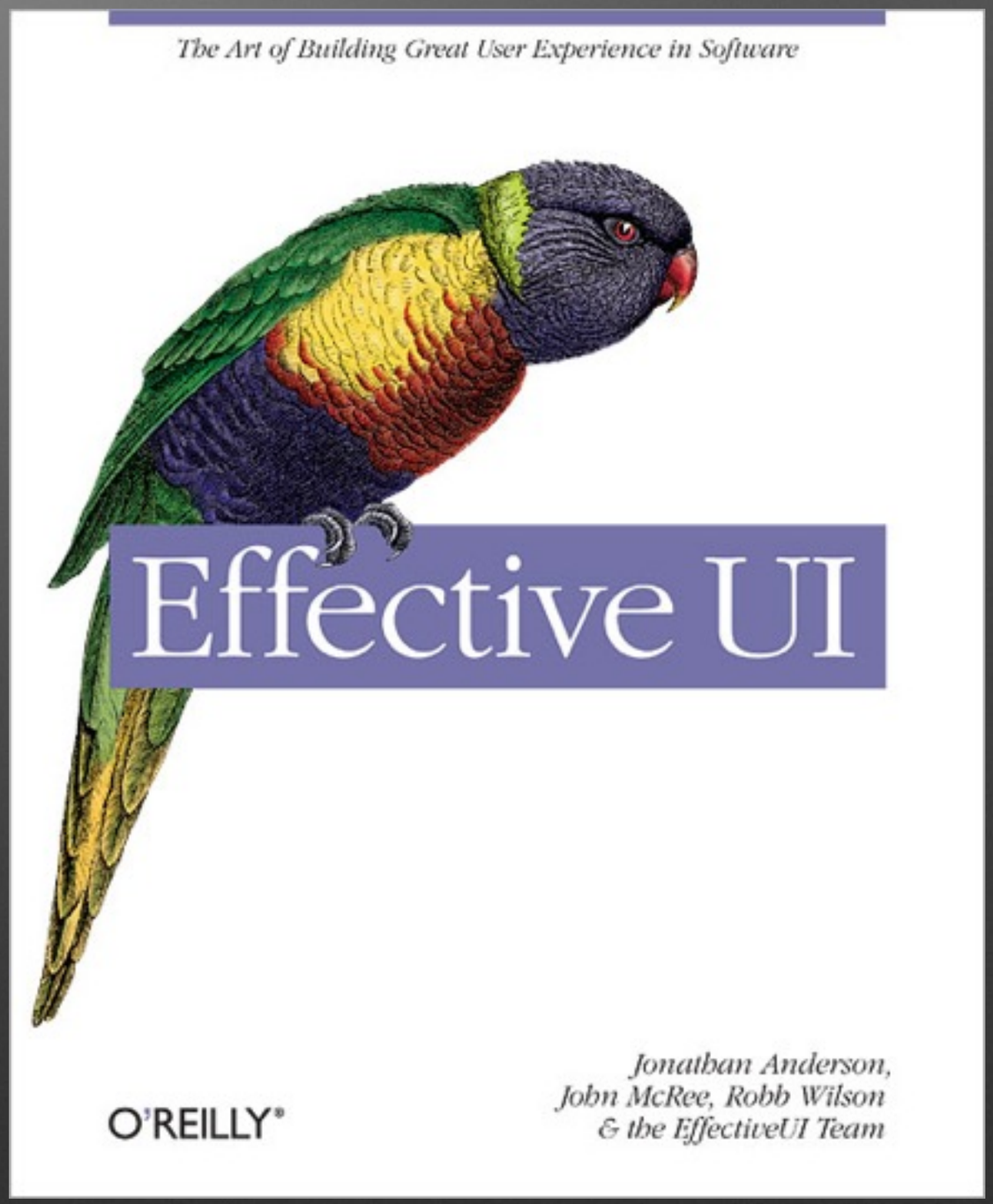
Resources


THE DESIGN OF EVERYDAY THINGS
previously published as THE PSYCHOLOGY OF EVERYDAY THINGS
DONALD A. NORMAN


DONALD A. NORMAN
AUTHOR OF THE DESIGN OF EVERYDAY THINGS
EMOTIONAL DESIGN
Why we love (or hate) everyday things

Resources


THE EXPERT'S VOICE® IN JAVA™ TECHNOLOGY
Practical
API Design
Confessions of a Java™ Framework Architect
API design done right, from one of the Java™ community's most experienced API designers.
Jaroslav Tulach
Founder of the NetBeans™ Platform
Apress®


The Art of Building Great User Experience in Software
Effective UI
O'REILLY®
Jonathan Anderson,
John McRee, Robb Wilson
& the EffectiveUI Team

Resources

How To Design A Good API and Why it Matters
by Josh Bloch

https://www.youtube.com/watch?v=aAb7hSCtvGw

Effective Java - 2nd Edition - by Josh Bloch

“May you live long and prosper.”

Spock