

# *The Market for Intellect*

*a.k.a.*

*What should I learn next? Discovering economically-rewarding education paths*

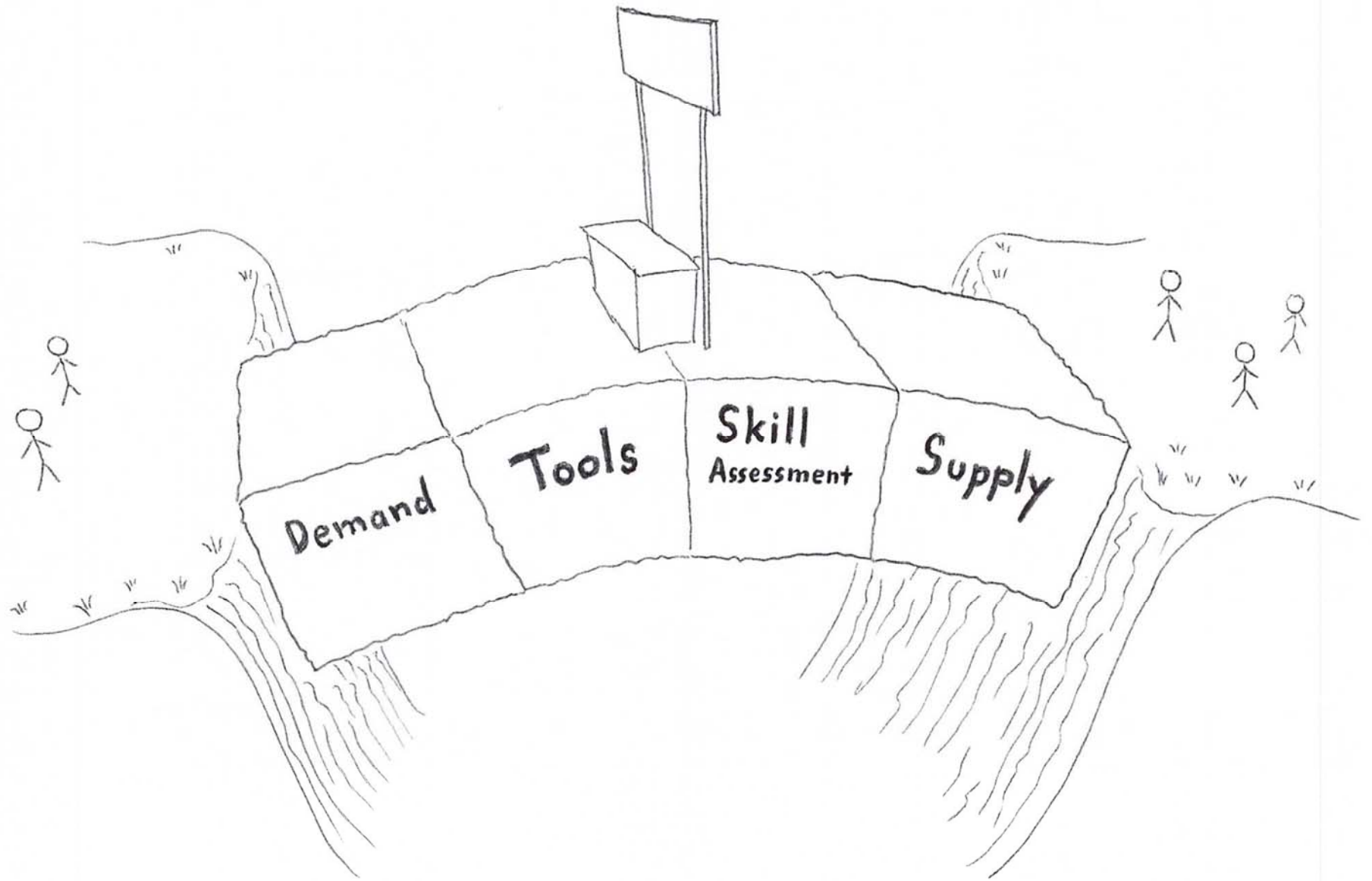
Panos Ipeirotis

oDesk Research

Stern School of Business, New York University

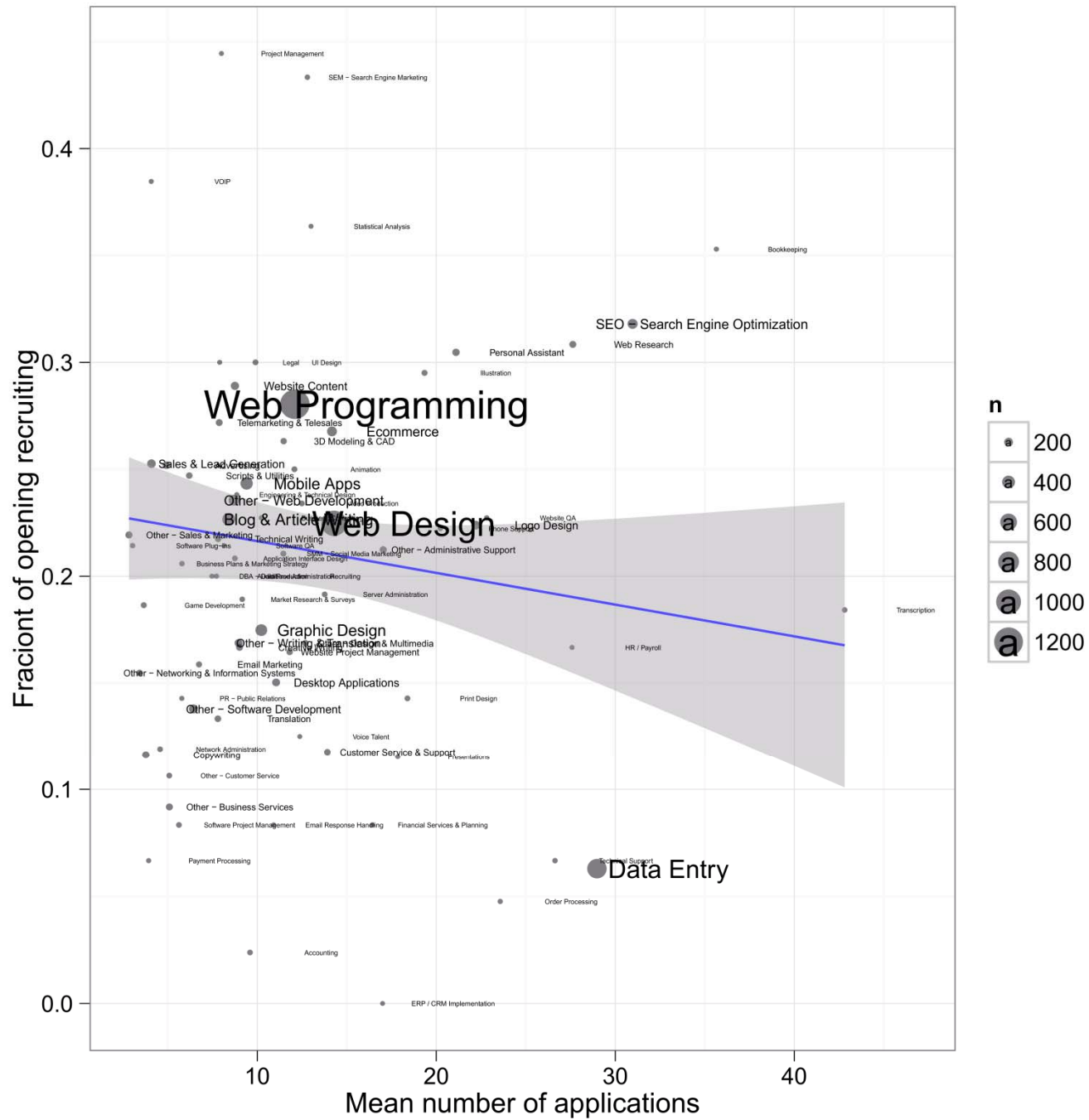


*Warning: Description of research in progress follows. Those offended by obvious mistakes are advised to leave the room*



# The (business) problem

- Demand does not match supply
- Oversupply of **basic** skills
- Demand for *skilled* workers exceeds supply



# Prices fix everything, right?

- Marketplace not a closed system
- Unmet demand will go elsewhere
- Unmet supply will go elsewhere

Marketplace's best interest

**Get contractors to learn new skills**

# Question #1

What skills are in demand?

## Server, Database, Admin Panel Guru needed

Hourly - Est. Time: More than 6 months, Full-time - 30+ hrs/week - Posted 8 hours ago

### Job Description

I am looking for someone to help build a few back end web servers/databases/admin panels for some mobile apps. I am looking for the following:

Developer must work on milestone payments (Although I will allow the job to show as hourly, all hourly time will either be added via workview in a way we agree in advance, or added manually after milestones are given)

Developer must be able to create a web server from scratch (PHP/MySQL on an Amazon EC2 instance)  
Developer must be familiar with 'easy to use' mobile back end services like Stackmob, Parse and  
be able to create a web back end from these services using REST API

## Android Developer Needed

Hourly - Est. Time: Less than 1 month, Full-time - 30+ hrs/week - Posted 7 hours ago

### Job Description

I have a couple of Android projects that I need developed quickly. I would like to work with someone who can agree to the following:

Work View Time logging (with weekly limit) with Milestone payments  
Source code updated on GitHub

## Fun IOS Game needed - Turn Based like Words With Friends

Fixed-Price - Est. Budget: \$1,000.00 - Posted 11 hours ago

### Job Description

Hi,

Notice - If you have ever developed any type of "board game" app this project may be for you ;-)

We are looking for an expert developer to join our team. We have a small team of 5 that have a passion for making games and quality apps. We are busy with a number of projects and need an extra man/woman to join the team and develop our latest game.



# Controlled Skilled Vocabulary

ient **iphone-development** opengl

opme

The iPhone is a line of smartphones designed and marketed by Apple Inc. It supports third party applications called apps. These apps have diverse functions, including games, reference, GPS navigation, social networking, security, and advertising for television shows, films, and celebrities. [wikipedia.org](http://wikipedia.org)

Jobs: [1,336](#) | Contractors: [6,649](#)

iphone-app-development game-design game-deve

**unity-3d** android-development mobile-application-d

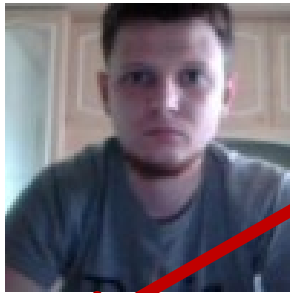
Unity is an integrated authoring tool for creating 3D video games or other interactive content such as architectural visualizations or real-time 3D animations. [wikipedia.org](http://wikipedia.org)

Jobs: [211](#) | Contractors: [845](#)

Interviewing: 0

<http://81.171.104.157/wikisyno/index.php?action=search>

# Worker Skills



**Michael Arshinov**

J2EE D2+ level dev., Android dev., web-designer,  
selenium, glassfish

**\$33.56/hr**

★★★★★ (4.89)

jee xhtml database-modeling android-development jboss glassfish ejb jquery selenium  
spring-framework apache-struts web-services hibernate jasperreports

Self-selected and entered

# Question #2: Skill Assessment

But are contractors truthful?



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# English Skills/Grammar: Basic grammar knowledge

## Example question:

It is not only important to be on time, \_\_\_\_\_ courteous when replying to colleagues.

(a) but is it also important to be

(b) but also is it important being

(c) but it is also important to be

(d) but important it is also to

## Qualification Task #1: Business listing verification

- **For a specific University name and department, what are the first three names of professor that appear on webpage**
- First names of all professors
- Last names of all professors
- Position titles of all professors

## Qualification Task #2: Business listing verification

- **For various non-profit companies, find the CEO, Chairperson of Board, and other contact info**
- First and last name of Board
- Position titles of all professors

# Predictive model for success in the marketplace

- Time on tests predictive of time required for actual tasks
- **However**, skills tests do not work as well as simply measuring performance on past work
- So, we want tests that are more like “real” tasks...

it is time to draw! you'll be given 5 minutes to draw a random word

I'm ready to draw!

not yet, I'd rather vote some more...



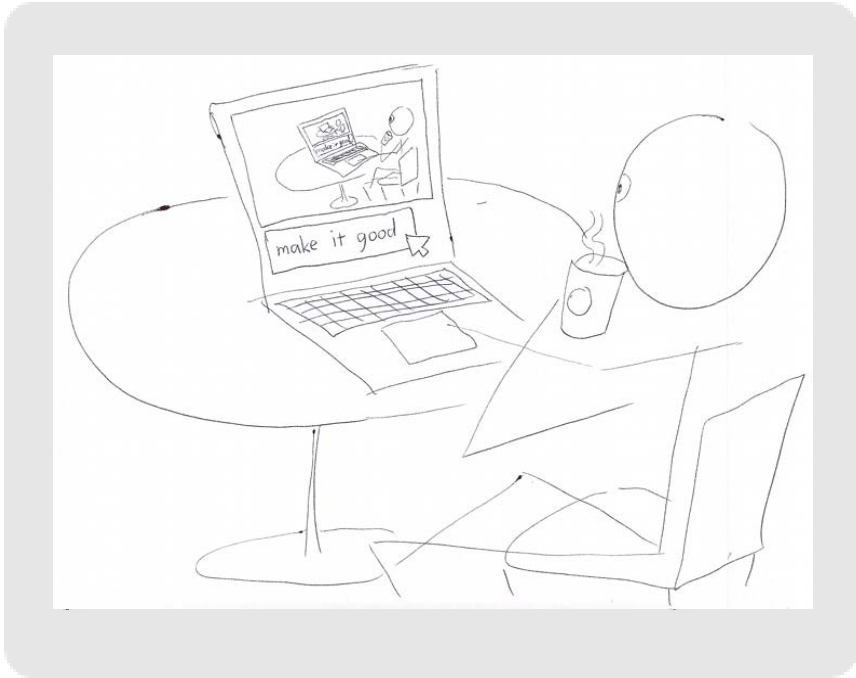
draw a **home**. time left: 4:41

pencil eraser clear

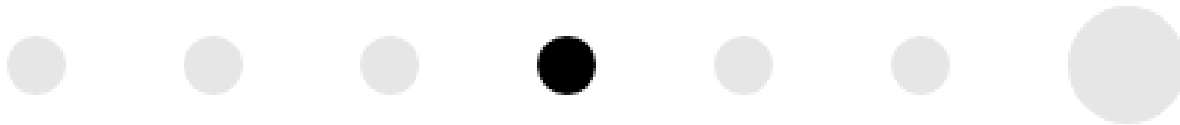


submit

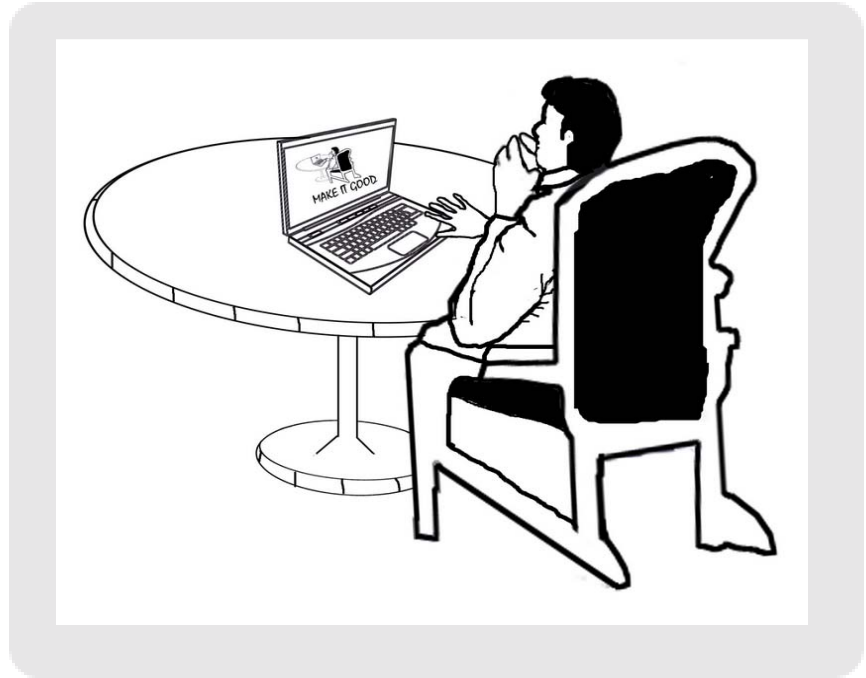
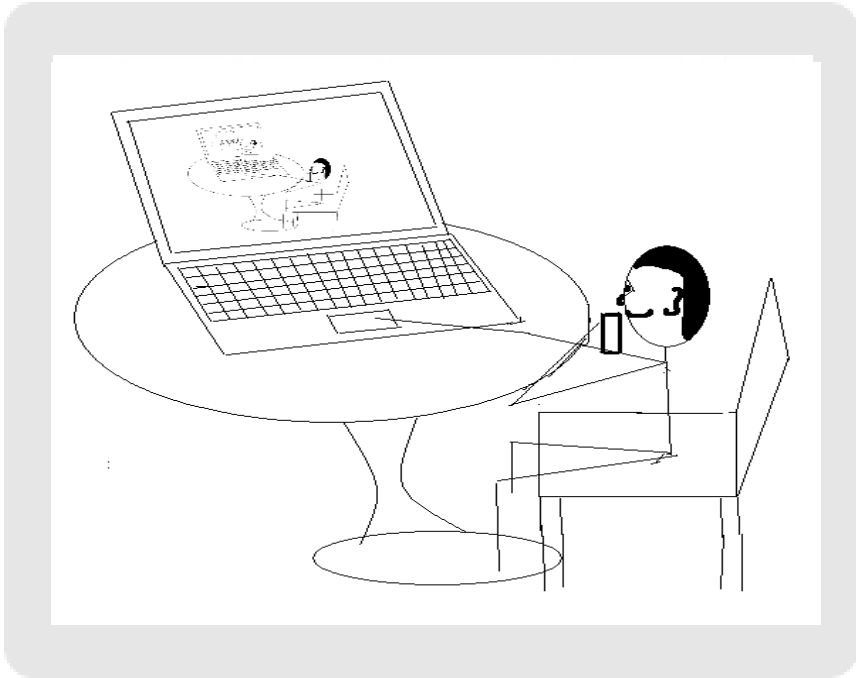
Which artist would you hire?



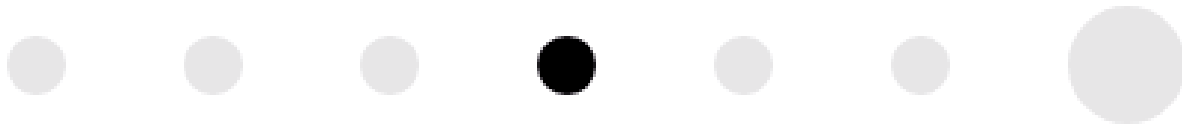
skip »



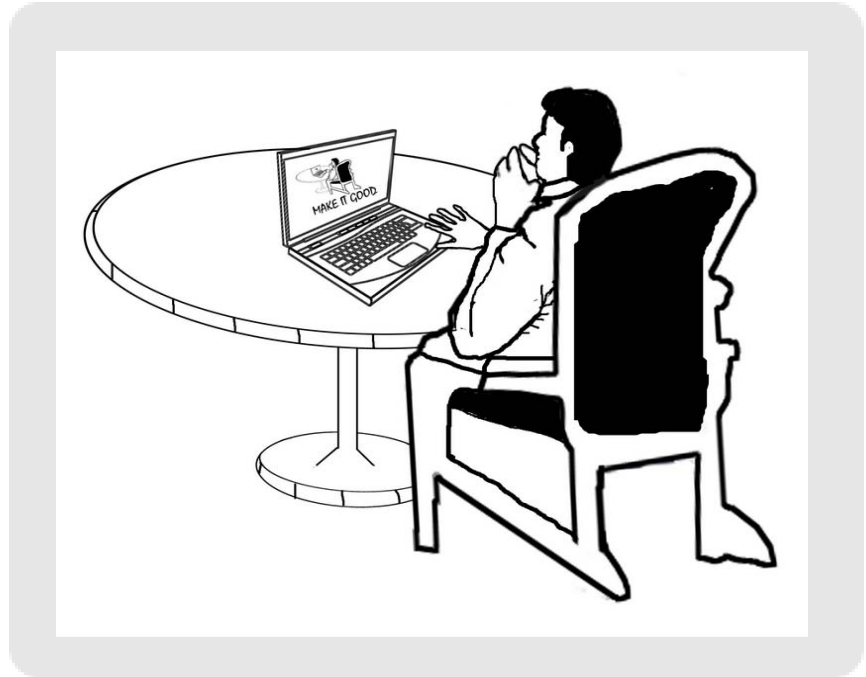
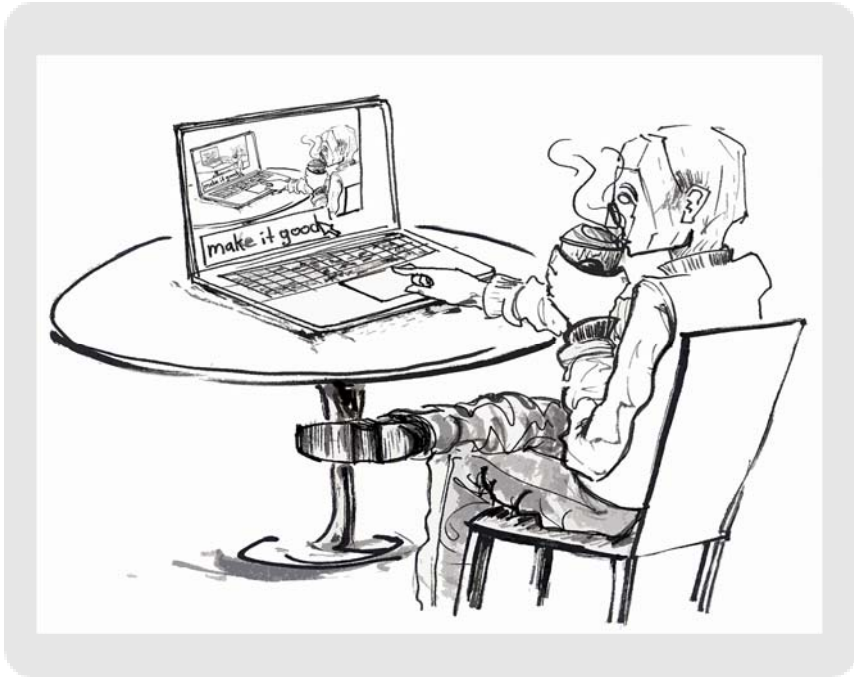
Which artist would you hire?



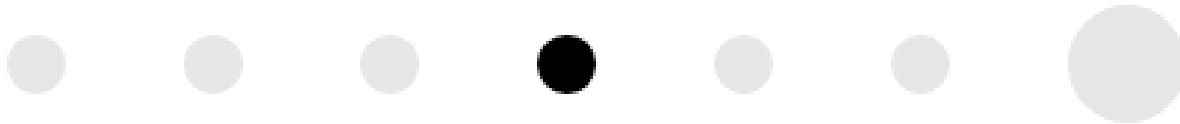
skip »



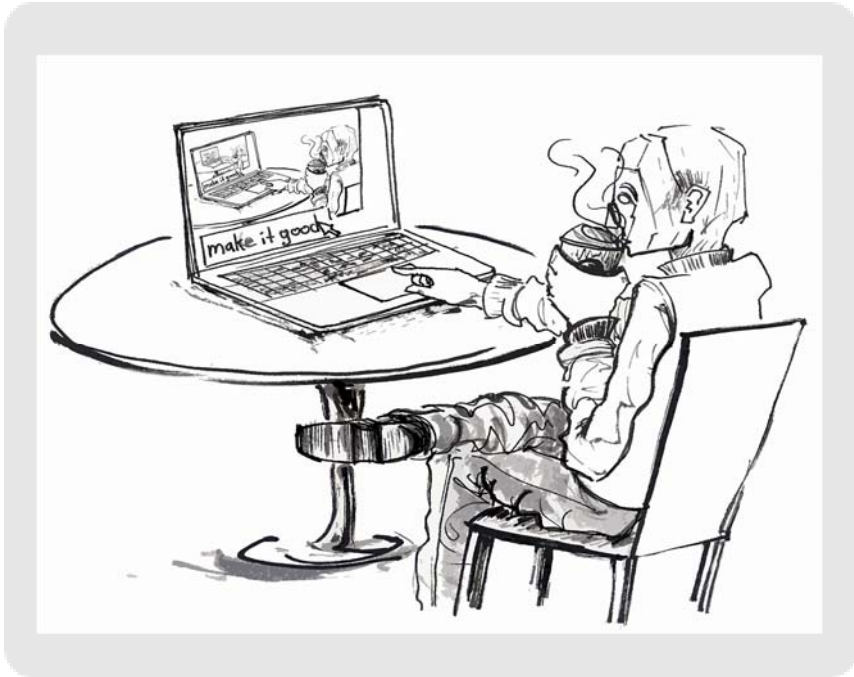
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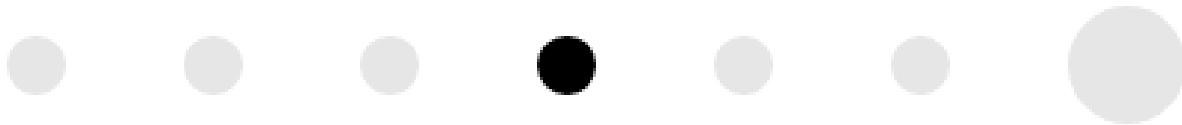
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Which artist would you hire?

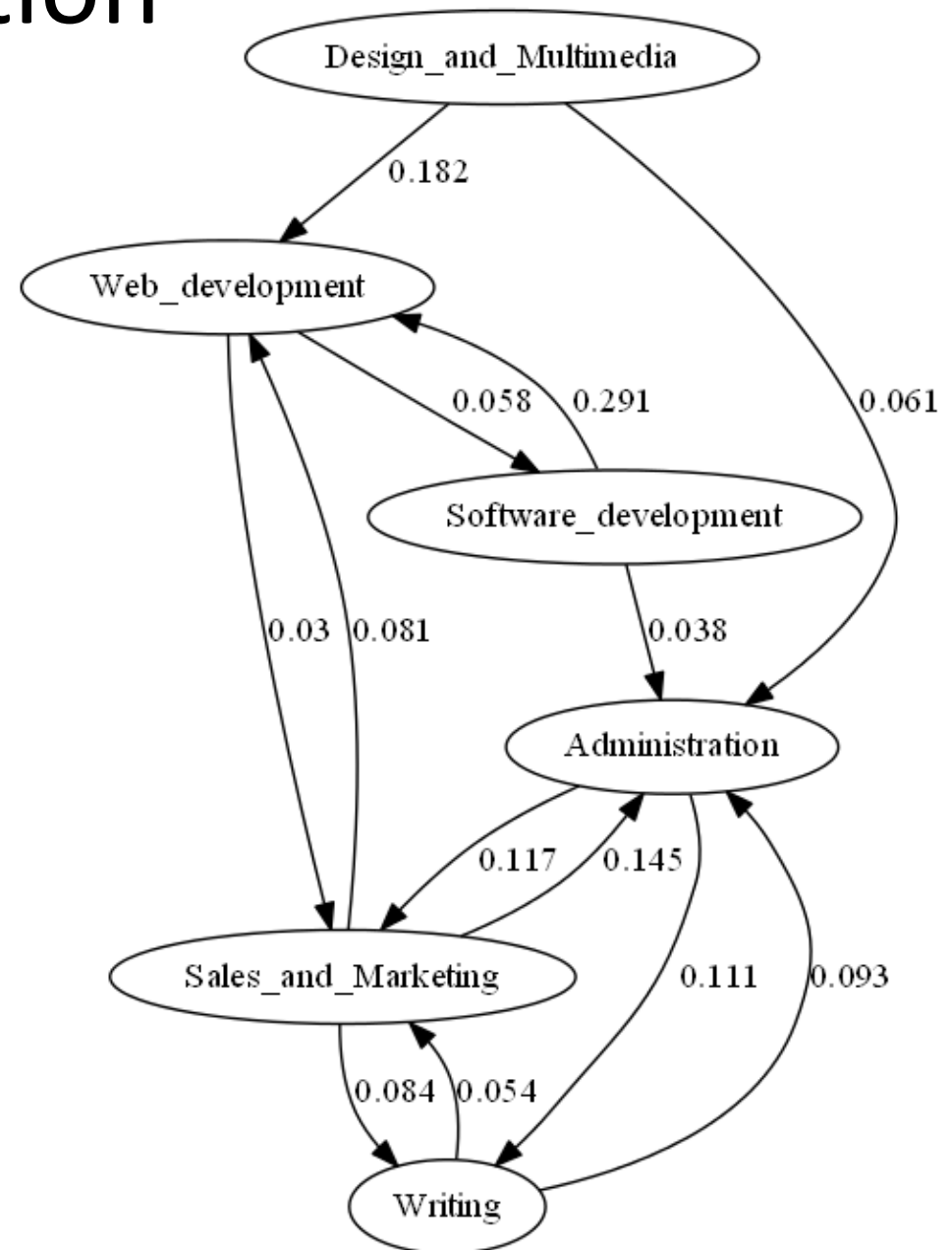


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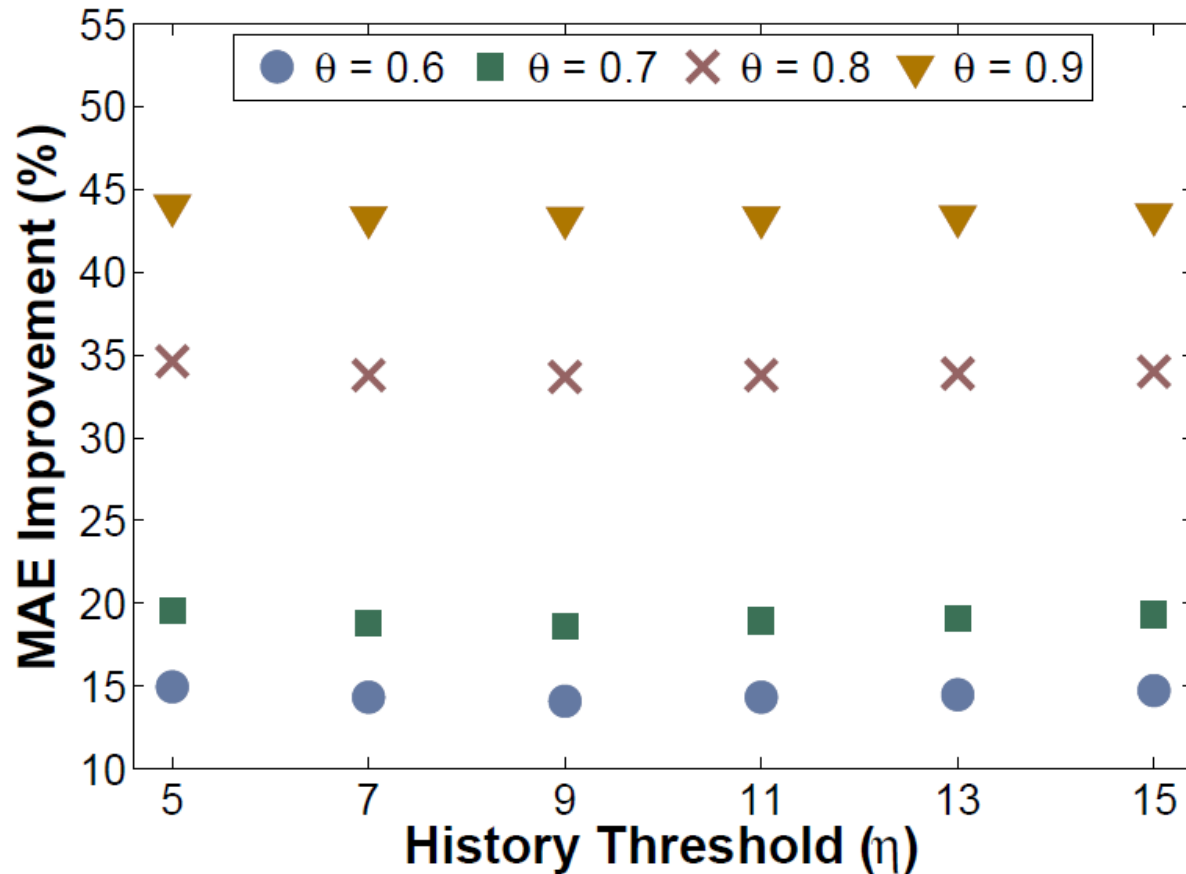


# Across-task Reputation

- What is the affinity across types of tasks?
- If someone is good in sales, what do we know about their writing? About web development?



# Results



- Knowing type of prior tasks leads to better performance estimates
- 35-45% improvement in future performance prediction

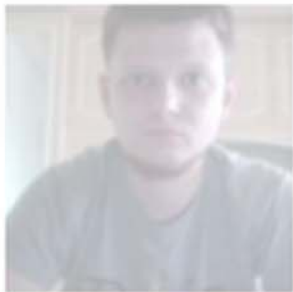
# Skill-specific Training

- For “KPO”<sup>(\*)</sup> tasks:
  - General history sufficient
  - *“A good admin is a good writer [when self-selected]”*
- For technical tasks:
  - Past performance in tasks with similar skill requirements is predictive



# Question #3

What job streams<sup>(\*)</sup> are best for each contractor?



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spring-framework apache-struts web-services hibernate jasperreports

(\*) Individual jobs fill quickly, and queries repeat

# Utility of Skill/Job Stream

heroku git visualization jquery json d3.js

Heroku is a cloud platform as a service (PaaS) run by the San Francisco, California-based company with the same name. Heroku led the way for a multi-language PaaS, introducing the 'polyglot platform'. Heroku PaaS now supports six languages: Ruby, Java, Node.js, Scala, Clojure and Python cloud PaaS. [wikipedia.org](http://wikipedia.org)

Jobs: 117 | Contractors: 96

## Ruby on Rails, Heroku Developer

Hourly - Est. Time: 1 to 3 months, 20 hrs/week - Posted 1 day ago

We are currently looking for a Ruby on Rails developer to push to Heroku and handle creating some database queries with cron jobs to send out emails using our current e-mail system.

Client: ★★★★★ Skills: ruby heroku Qualifications

## RAILS Developer w/Twilio Experience

Hourly - Est. Time: More than 6 months, 40 hrs/week - Posted 1 day ago

We are looking for a RAILS expert for Playpen.com, an adult social networking site. The immediate task will be to implement pay-per-minute phone-chat via the Twilio API. This is a fast-moving and fun project. You must be able to deploy changes quickly while maintaining the consistency and quality of our codebase. Your work schedule must overlap considerably with UTC-8 9AM-5PM for daily scrums and conversation via Skype/Campfire. ... more

Client: ★★★★★ Skills: ruby ruby-on-rails twilio-api ajax css3 html5 agile amazon-ec2 heroku

api-development Qualifications

## Ruby On Rails Developer

Hourly - Est. Time: 3 to 6 months, 20 hrs/week - Posted 2 days ago - 3 Interviews

We are looking for a RoR developer. The job will be on-going paid hourly. We would like someone to spend around 15/hrs per week. Ruby, Rails, RSpec, Capybara, FactoryGirl, Git, Javascript, AJAX, TDD, Rails Admin, Heroku, PostgreSQL, devise, CanCan, Koala, OAuth, SASS Ruby > 1.9.X Rails > 3.2.X We prefer to communicate via Skype. We practice SCRUM with week long sprints. Please send us projects you have contributed on GitHub.

Client: ★★★★★ Skills: ruby rspec ajax javascript scrum heroku postgresql oauth git sass

Qualifications

## Data Visualization Specialist Needed to display Building Energy

Data

Hourly - Est. Time: More than 6 months, 20 hrs/week - Posted 2 days ago - 1 Interview

google-app-engine go-programming-language ui-design

Google App Engine is a platform as a service (PaaS) cloud computing platform for developing and hosting web applications in Google-managed data centers. It virtualizes applications across multiple servers. [wikipedia.org](http://wikipedia.org)

Jobs: 95 | Contractors: 2,270

## Webapp development for online travel agency

Hourly - Est. Time: More than 6 months, 40 hrs/week - Posted 1 day ago

Our company is an online travel agency, based in Norway, and we are looking to hire a team of for a long-term project, with a possibility of permanent employment. If you have expertise in any looking for you. Please send me your resume and cover letter along with samples of your work include: 1. Your relevant experience for this project 2. Your profici ... more

Client: ★★★★★ Skills: html5 python google-app-engine go-programming-language ui-des

javascript ruby-on-rails Qualifications

## Chat App with location

Fixed-Price - Est. Budget: \$200 - Posted 2 days ago - 2 Interviews

looking for experienced developer who can make a chat application and integrate the location b details will be provided at later stage.

Client: ★★★★★ Skills: gps google-app-engine live-chat-software

## Hybrid iPhone/Android app

Hourly - Est. Time: Less than 1 month, 40 hrs/week - Posted 3 days ago

I need an App programmer who is familiar with hybrid App building using a web based wysiwyg program the pages necessary to port into the App by either HTML or fed from a mobile web site (pages for financial calculations) ----- If you are building Apps, this should be very easy have a web based platform service for building Apps that you may be able ... more

Client: ★★★★★ Skills: html iphone-app-development android-development ios-development

play-framework Qualifications

# Utility of Skill

Market

Market

Contractor

?

$$U = F(\text{Jobs}, \text{OfferedRate}, \text{AskingRate}) \times \text{Pr}(\text{hired})$$

An iPhone App is an application software developed with the iOS SDK for use with Apple, Inc.'s iPhone line of smartphones. Apps have diverse functions, including games, reference, GPS navigation, social networking, security, and advertising for television shows, films, and celebrities. [wikipedia.org](http://wikipedia.org)

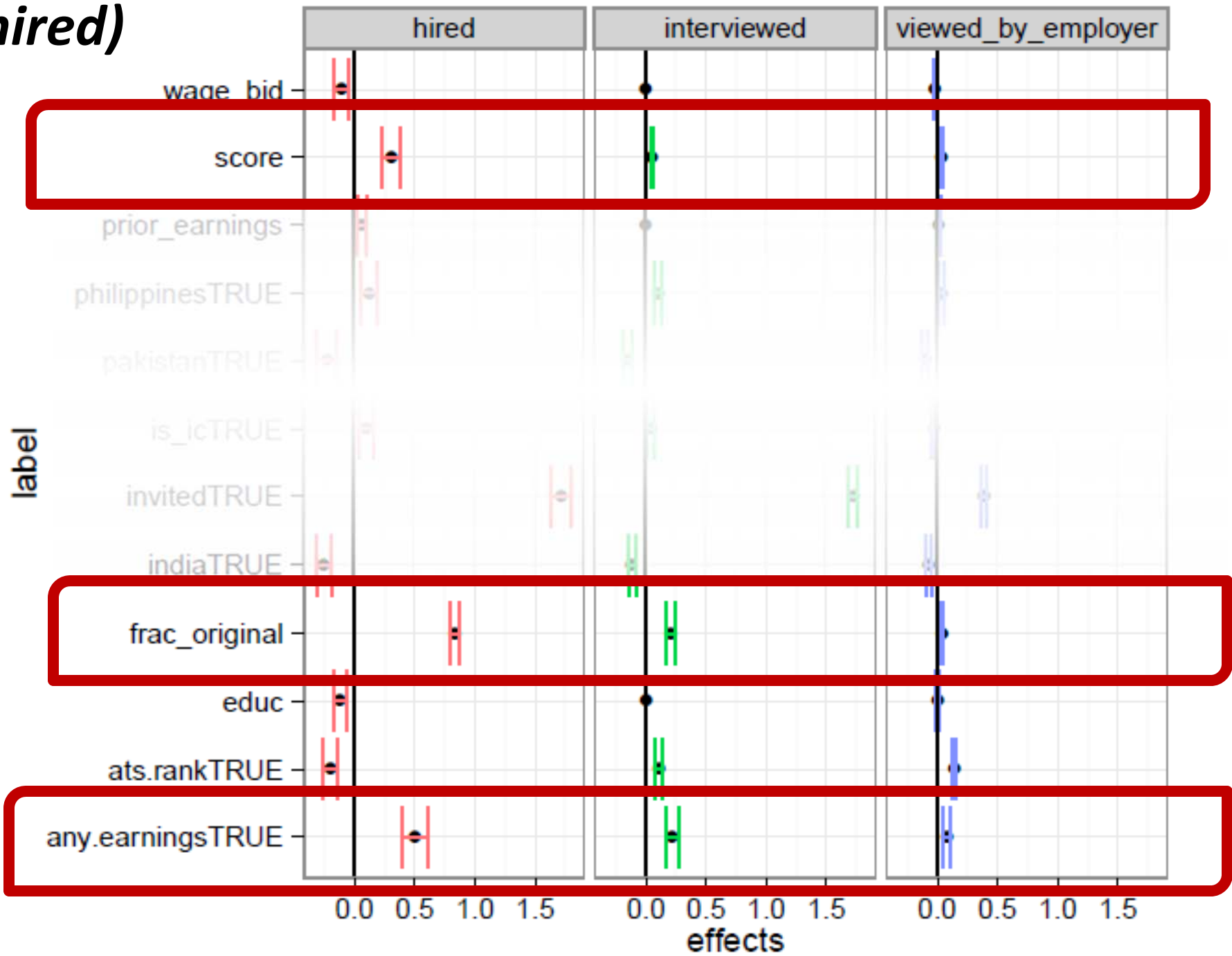
Jobs: 1,948 | Contractors: 1,264

iphone-app-development

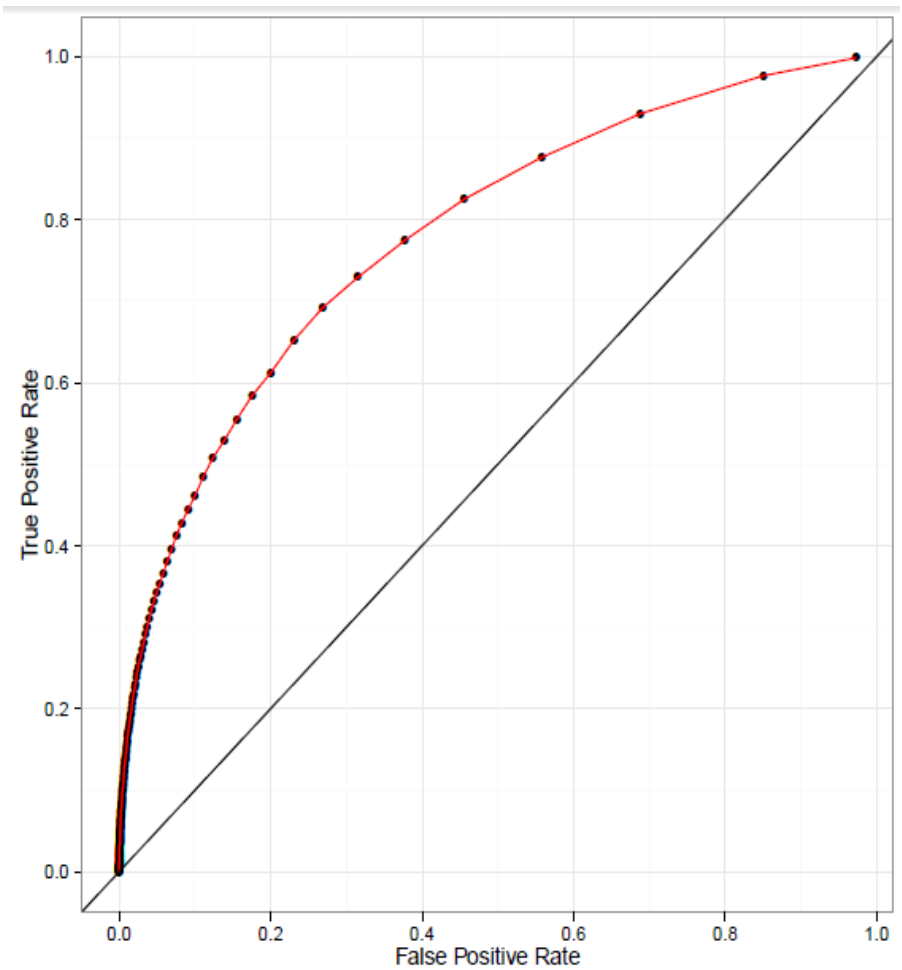
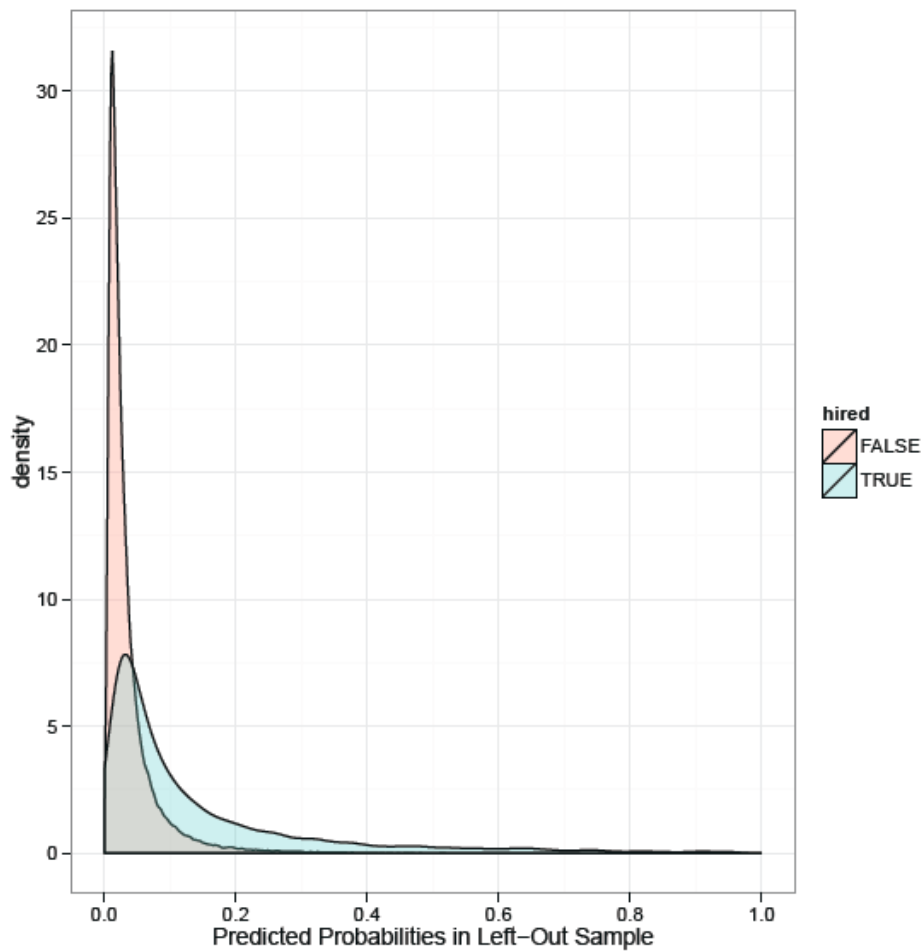
cocoa

objective-c

# *Pr(hired)*



# $Pr(\text{hired})$



# Question #4

What skills (if any) should a contractor *learn*?



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selenium, glassfish

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★★★★★ (4.89)

jee

xhtml

database-modeling

android-development

jboss

glassfish

ejb

jquery

selenium

spring-framework

apache-struts

web-services

hibernate

jasperreports

(\* ) Individual jobs fill quickly, and queries repeat

# Utility of (Future) Skills

$$U = F(\text{NewJobs}, \text{NewOfferedRate}, \text{NewAskingRate}) \times \text{NewPr}(\text{hired})$$

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Jobs: 1,948 | Contractors: 1,264

iphone-app-development   cocoa   objective-c

# What is the *utility* of each skill?

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---

Jobs: 1,948 | Contractors: 1,264

iphone-app-development   cocoa   objective-c

ipad   research

The iPad is a line of tablet computers designed, developed and marketed by Apple Inc., primarily as a platform for audio-visual media including books, periodicals, movies, music, games, and web content. [wikipedia.org](http://wikipedia.org)

---

Jobs: 2,521 | Contractors: 1,722

adobe-photoshop   website-wireframing   balsamiq   web-

Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated. [wikipedia.org](http://wikipedia.org)

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Jobs: 3,187 | Contractors: 105,900

machine-learning ×   Search Jobs

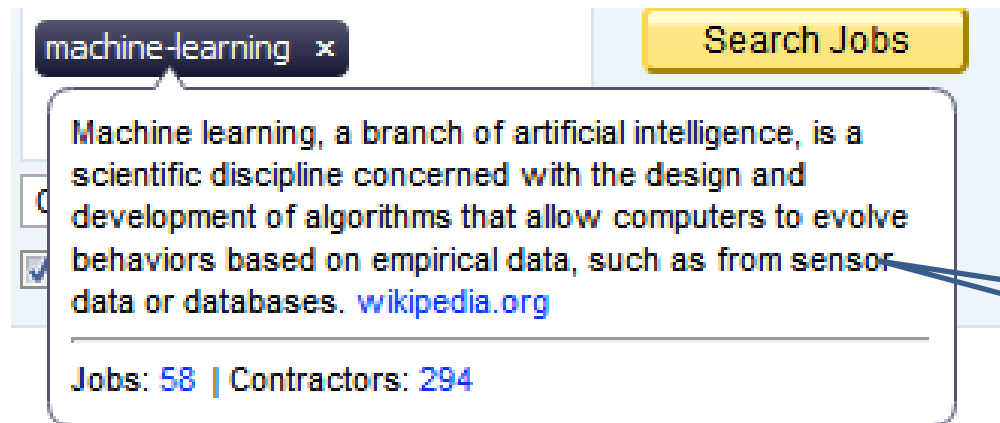
Machine learning, a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases. [wikipedia.org](http://wikipedia.org)

---

Jobs: 58 | Contractors: 294



# What is the *utility* of each skill?



A screenshot of a job search interface. At the top left, there is a search bar containing the text "machine-learning" with a small "x" icon to its right. To the right of the search bar is a yellow button with the text "Search Jobs". Below the search bar, there is a white box with a blue border containing the following text: "Machine learning, a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on empirical data, such as from sensor data or databases. [wikipedia.org](http://wikipedia.org)". Below this text, there is a horizontal line, and then the text "Jobs: 58 | Contractors: 294".

Hey, do you have a (good) machine learning person that I can hire through oDesk?  
Cost is not a problem!

# What is the *utility* of each skill?

The image shows a screenshot of a job search interface. At the top, there is a search bar with the text "machine-learning" and a "Search Jobs" button. Below the search bar, there is a tooltip for the skill "iphone-app-development". The tooltip contains the following text:

An iPhone App is an application software developed with the iOS SDK for use with Apple, Inc.'s iPhone line of smartphones. Apps have diverse functions, including games, reference, GPS navigation, social networking, security, and advertising for television shows, films, and celebrities. [wikipedia.org](http://wikipedia.org)

Jobs: 1,948 | Contractors: 1,264

At the bottom of the tooltip, there are three tags: "iphone-app-development", "cocoa", and "objective-c".

# What is the *utility* of each skill?

The image shows a screenshot of a job search platform. At the top, there is a search bar with the text "machine-learning" and a "Search Jobs" button. Below the search bar, there are several callout boxes providing definitions and job statistics for different skills.

**machine-learning** ×

Machine learning, a branch of artificial intelligence, is a scientific discipline concerned with the design and development of algorithms that allow computers to evolve behaviors based on data or database.

Jobs: 58 | Contractors: 1

**iphone-app-development**

An iPhone App is an application software developed with the iOS SDK for use with Apple, Inc.'s iPhone line of smartphones. Apps have diverse functions, including games, reference, GPS navigation, social networking, security, and advertising for television shows, films, and celebrities. [wikipedia.org](#)

Jobs: 1,948 | Contractors: 1

**ipad** research

The iPad is a line of tablet computers designed, developed and marketed by Apple Inc., primarily as a platform for audio-visual media including books, periodicals, movies, music, games, and apps.

Jobs: 1,948 | Contractors: 1

**adobe-photoshop** website-wireframing balsamiq web-development

Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated. [wikipedia.org](#)

Jobs: 3,187 | Contractors: 105,900

# OK, problem solved! (not)

**coursera** COURSES A


**STANFORD UNIVERSITY**

## Machine Learning

Andrew Ng, Associate Professor

Learn about the most effective machine learning techniques, and gain practice implementing them and getting them to work for yourself.

[Sign Up](#) [Preview](#)



**Next Session:** 20 August 2012 (10 weeks long)  
**Workload:** 5-7 hours/week  
Statistics, Data Analysis, and Scientific Computing  
Computer Science: Artificial Intelligence, Robotics, Vision

# “Market for Intellect”: Model

- Assume market is “mostly efficient”
  - Some skill channels do have higher utility than others
  - Utility is “similar” across skill channels, adjusted for crossing costs
  - But jumping across channels has an opportunity cost
- Workers self-select skills to learn:
  - If worker does not have skill, this is not random but a choice (“endogenous choice”): The “Return on investment” is negative/small
- Estimate distribution of utilities across workers
- Estimate distribution of “time to learn”

# What is the *opportunity cost*?

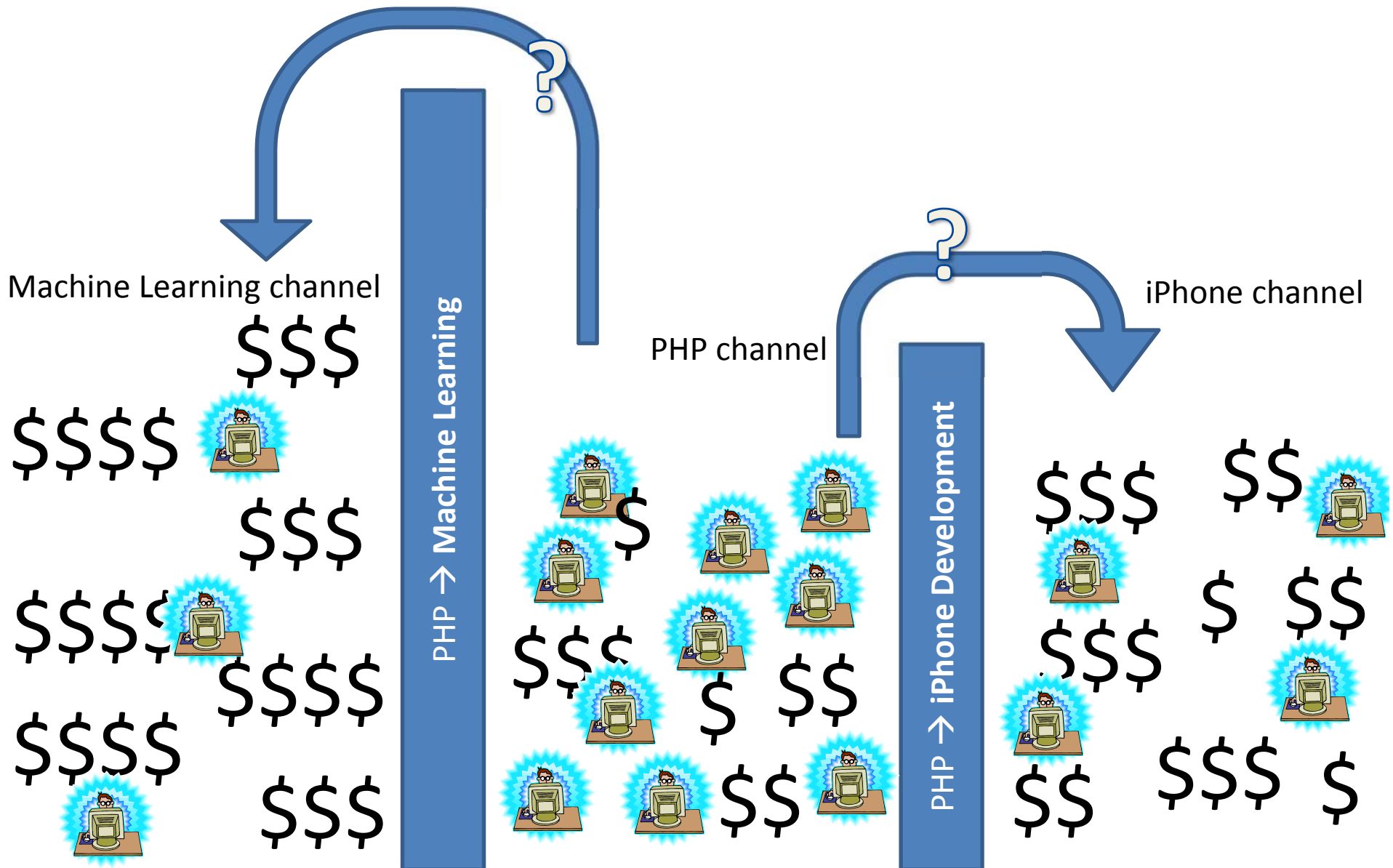
Cost(Skill) = “Utility of Current Skills” x “Time to Learn”

$U(\text{Current\_Skills}) = F(\text{Jobs}, \text{OfferedRate}, \text{AskingRate}) \times \text{Pr}(\text{hired})$

$U(\text{Future Skills}) = F(\text{Jobs}', \text{OfferedRate}', \text{AskingRate}') \times \text{Pr}'(\text{hired})$

Differences in utility between old and new skills show how long it takes to learn a skill

# Barriers to entry: Utility vs. Opportunity Cost



# What is the net *utility* of each skill?

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Jobs: 1,948 | Contractors: 1,264

iphone-app-development

con

machine-learning x

Search Jobs

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Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated. [wikipedia.org](http://wikipedia.org)

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# Thanks!

## Questions?

