

# Transforming Craft Training with Virtual Reality



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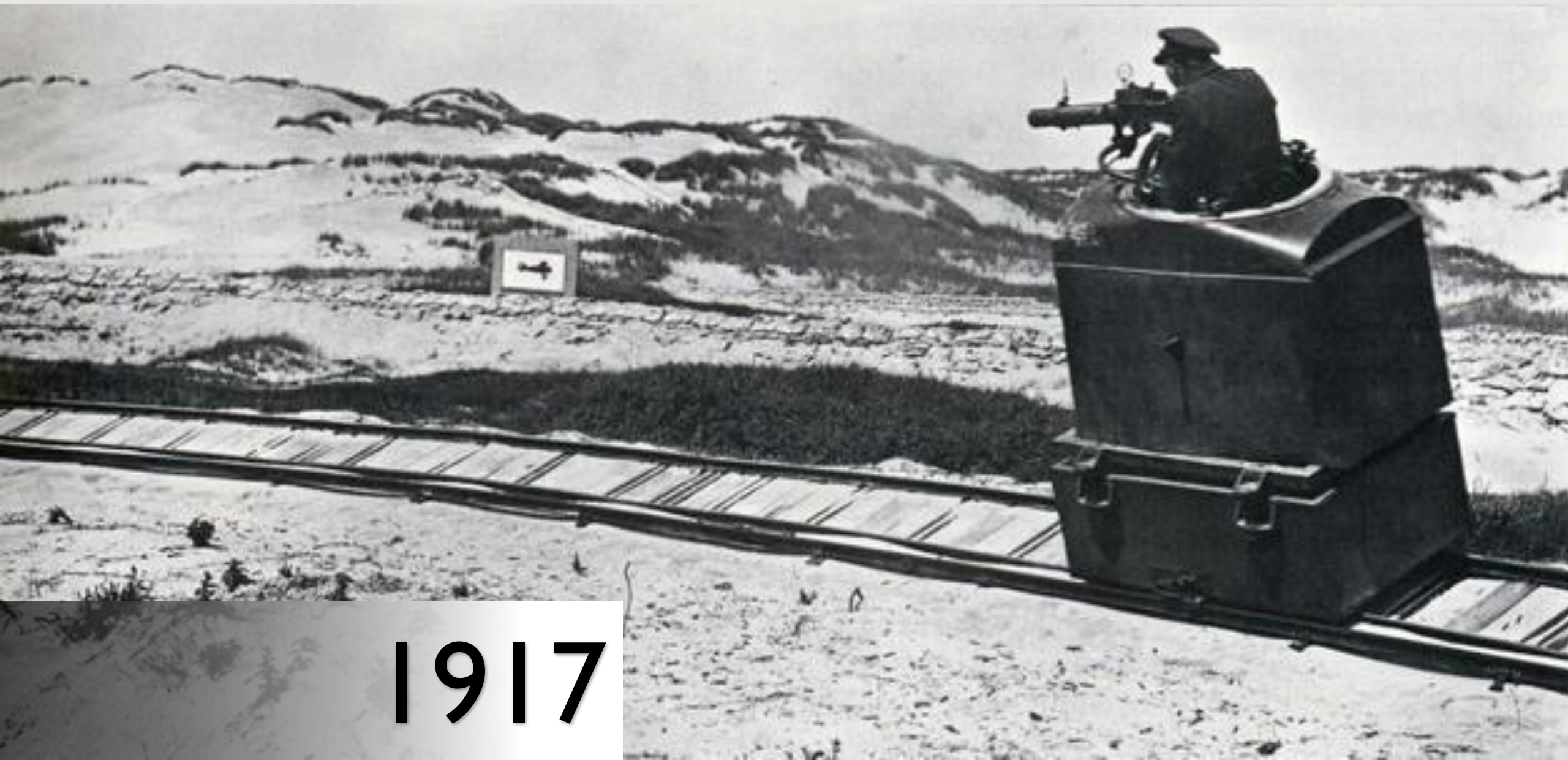
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# {Short History of Equipment Simulation}





1917



1958





1963



1979





1993



1998





2004



2013

What trends or traits  
do you notice?

Who? What? How?



# Equipment Simulator Characteristics Past 100 Years

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- **Field of View**  $f(x)$  of Screen Quantity & Size.
- **Hardware Investment** dictates the level of authenticity.
- **Relegated to Pilots, Military, Astronauts**
- **Low adoption by construction** equipment due to cost, low level of authenticity, and lack of ROI





TODAY

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The Army is stockpiling ammo ahead of its next big fight



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## The Air Force Used VR To Train Pilots In Half The Time At A Fraction Of The Cost

By Paul Szoldra | October 02, 2018 at 12:03 PM

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# General Trends in Technology Innovation

	Early
Hardware	Expensive
Content, Apps, Games	Little
Software Features	Limited
User Pool	Small Community

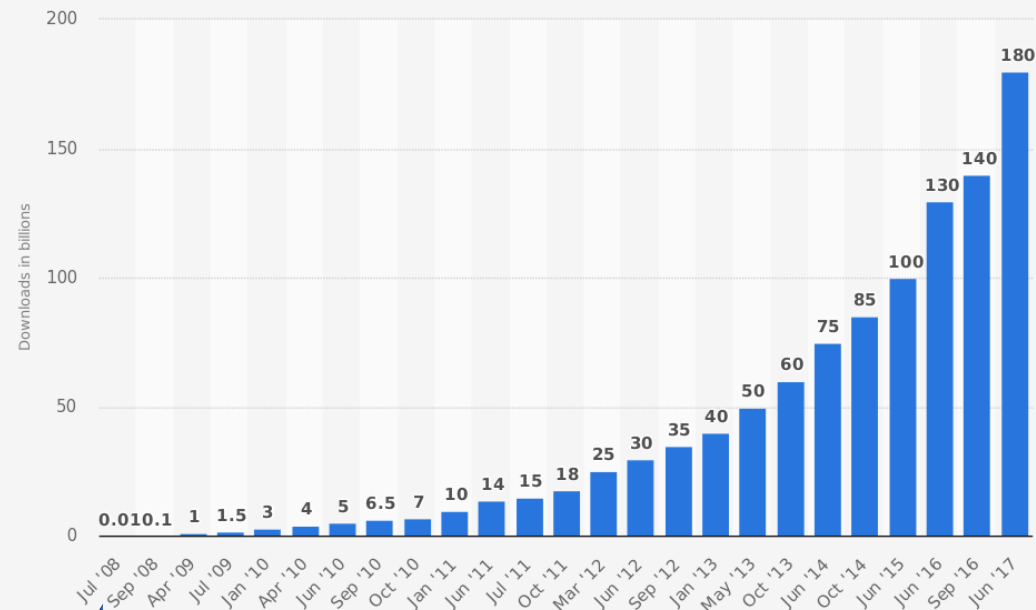
Must Read for Life-Long Learners: Walter Isaacson's *The Innovators*

# General Trends in Technology Innovation

	Early	Late
Hardware	Expensive	Commoditized
Content, Apps, Games	Little	Abundant
Software Features	Limited	Maximized
User Pool	Small Community	Large Network Effects

Must Read for Life-Long Learners: Walter Isaacson's *The Innovators*

**Cumulative number of apps downloaded from the Apple App Store from July 2008 to June 2017 (in billions)**



Source  
Apple  
© Statista 2018

Additional Information:  
Worldwide; Apple; July 2008 to June 2017

statista

## Market Summary > Apple Inc.

NASDAQ: AAPL

+ Follow

**223.00** USD **-0.10 (0.045%)** ↓

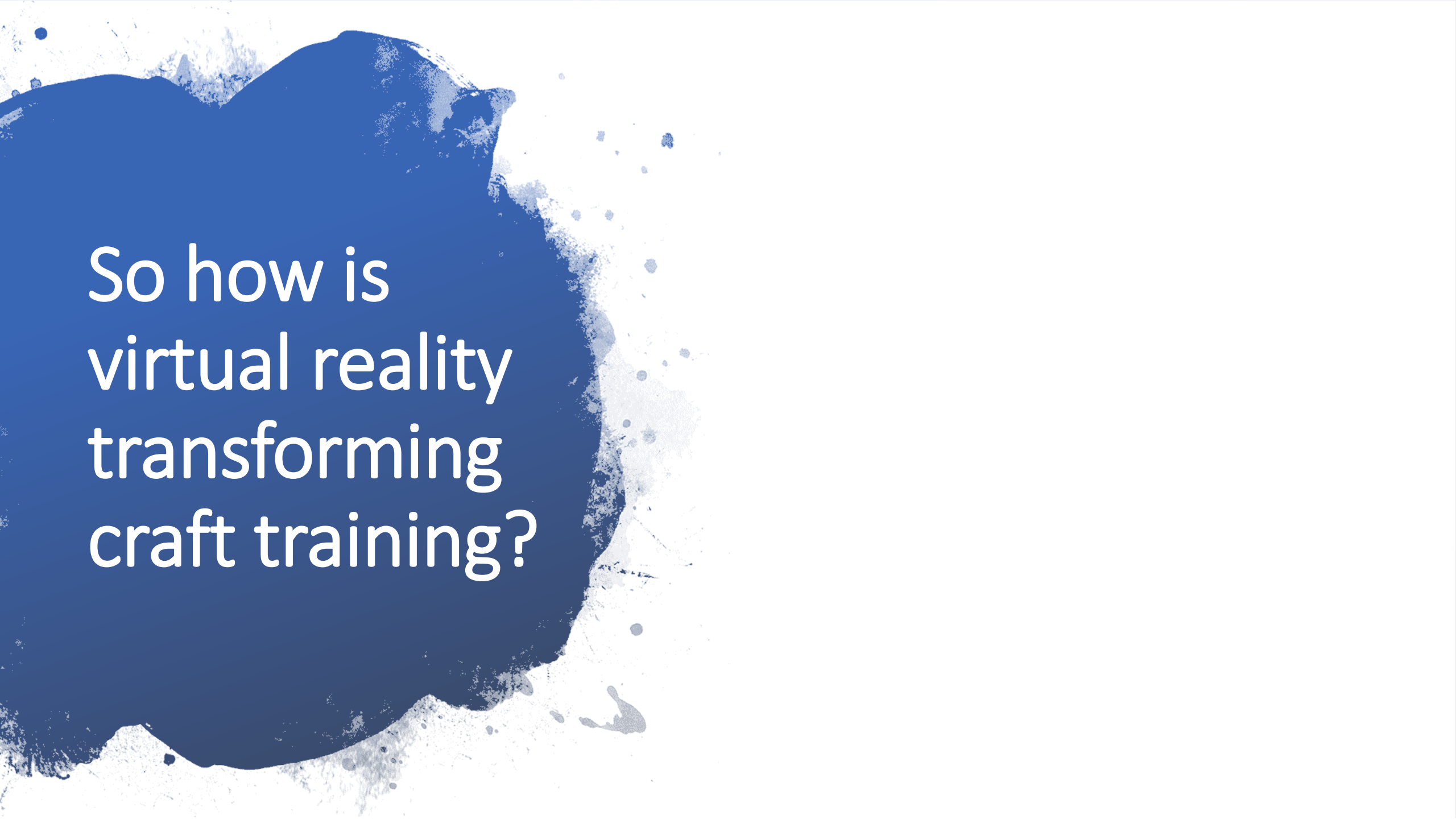
Sep 7, 12:20 PM EDT · Disclaimer

1 day 5 days 1 month 6 months YTD 1 year 5 years **Max**



Open	221.85	Div yield	1.31%
High	225.37	Prev close	223.10
Low	221.54	52-wk high	229.67
Mkt cap	1.08T	52-wk low	149.16
P/E ratio	19.33		





So how is  
virtual reality  
transforming  
craft training?

# Democratized & Authenticity



# Democratizing Simulation throughout the Workforce

The screenshot shows the Bechtel Newsroom website. The header includes the Bechtel logo and navigation links: "WHO WE ARE", "WHAT WE DO", "PROJECTS", and a "MENU" button. The main banner features a large image of a crane at sunset with the word "NEWSROOM" overlaid. Below the banner are "Print" and "Share This" icons. The article title is "Bechtel Collaborates with ITI to Broaden Workforce Development Opportunities", dated "21 September 2017". The article text begins with "The companies to expand virtual reality crane simulation library". A sidebar on the left lists "Media Contacts" and "Press Releases" with a year filter showing "2017" selected.

BECHTEL

WHO WE ARE | WHAT WE DO | PROJECTS | MENU

NEWSROOM

Print | Share This

> Media Contacts

> Press Releases

• 2018

• **2017**

• 2016

• 2015

**Bechtel Collaborates with ITI to Broaden Workforce Development Opportunities**

21 September 2017

The companies to expand virtual reality crane simulation library

Bechtel, a global leader in engineering, procurement, and construction, and Industrial Training International (ITI), a global leader in training and technical services for users of



# Authenticity

## Performance Testing as the Ultimate Example

- Can we train and assess a craft activity in such an authentic way, that it replaces/reduces the need for live testing?



# VR Crane Operator Practical Exam Study

Woodland, WA & Houston, TX 2018-2019

- Study designed to explore the feasibility of using Virtual Reality (VR) simulators as part of a ANSI accredited crane operator certification program.
- VR desktop simulators were programmed to match each crane type's user interface, physics and dynamics.
- Central Question: Whether or not a candidate's performance on a VR simulator could be considered equivalent to performance on an actual crane.



# Disclaimer

I am not a Ph.D., nor psychometrician, but Wallace is both...

Wallace Judd, Ph.D.

- Princeton BA, Harvard MS, Stanford Ph.D.
- Xerox PARC Engineer
- Apple Engineer
- World-leading expert in performance testing.



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The **Performance Testing Council** is a non-profit consortium dedicated to innovation in the design, development, and delivery of performance testing. We share our experiences, knowledge, and yes, passion in the practice of performance testing and help each others' testing efforts. Either novice or expert, there is always something new to share. Join us!

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## 42nd PTC Summit Meeting – March 20th and 21st, in Orlando, FL

### Our Spring meeting will be held March 20 - 21, 2019 following ATP in Orlando!

Register for the summit

Less than a 10 min drive from the ATP Innovations conference, we will focus our sharing and learning on performance testing (testing by doing). Join us at 3pm to 5:30pm on Wednesday, March 20th followed by a complimentary social hour. Then Thursday, March 21st we will meet from 8:30am to 5pm.

#### Who should attend?

Anyone new to or experienced in Certification Management, Exam Development, Exam Security, Lab Testing, Product Management, Psychometrics, like this group that attended our Fall summit!

Business Case to Attend Summit

### Some of the topics we will cover include:

- Case Study Results: Does Virtual Reality have a role to play in high-stakes certification, such as Crane Operators? *by Bob Mahlman, NCCCO*
- New Approach to Integrating Complex Simulations *by Leah Hojem, Dell EMC and Ruth Ramstad, Pearson VUE*
- To PBT or NOT to PBT: That Depends on the Content *by David Elfassy, Netlogon and Liberty Munson, Microsoft*
- The Scale Stability Index -- A New Measure for Performance Test Reliability *by Wallace Judd, Authentic Testing*
- A New Way to Test: Creating and Using Animated Scenarios for a Licensure Exam *by Matt Turner, ASPPB, Taylor Sullivan, HUMRRO and Tina Riner, Pearson VUE*
- Interactive discussions:
  - How do you convince the org to spend money on building better tests? Is it more effective to talk about threats of disaster or the lure of the cool?
  - Solve My Challenge

Get Full Program

# VR Study Design

- Initial Study Design

1 <sup>ST</sup>	2 <sup>ND</sup>	3 <sup>RD</sup>	4 <sup>TH</sup>	N
VR	CR	VR	CR	25
CR	VR	CR	VR	25

*Indicates Real Crane Exam*

- Actual Data Collection
  - 3 testing locations

1 <sup>ST</sup>	2 <sup>ND</sup>	3 <sup>RD</sup>	4 <sup>TH</sup>	N
VR	VR	CR	CR	19
VR	CR	VR	CR	14
CR	VR	CR	VR	10





**Site1: WCT**



**Site3: ITI WA**



**Site2: ITI TX**



**Site1: WCT**



**Site2: ITI TX**

**Site3: ITI WA**



New Hampshire  
Vermont  
Massachusetts  
Maine  
New York  
Rhode Island

**VR Crane Simulations**



# Initial Results

Summary Statistics			
Session	N	Mean Score	Pass Rate
First VR Attempt	43	53.02	23.26%
Second VR Attempt	43	65.56	37.21%
First CR Attempt	42	75.29	69.05%
Second CR Attempt	43	76.19	74.42%





# Initial Results

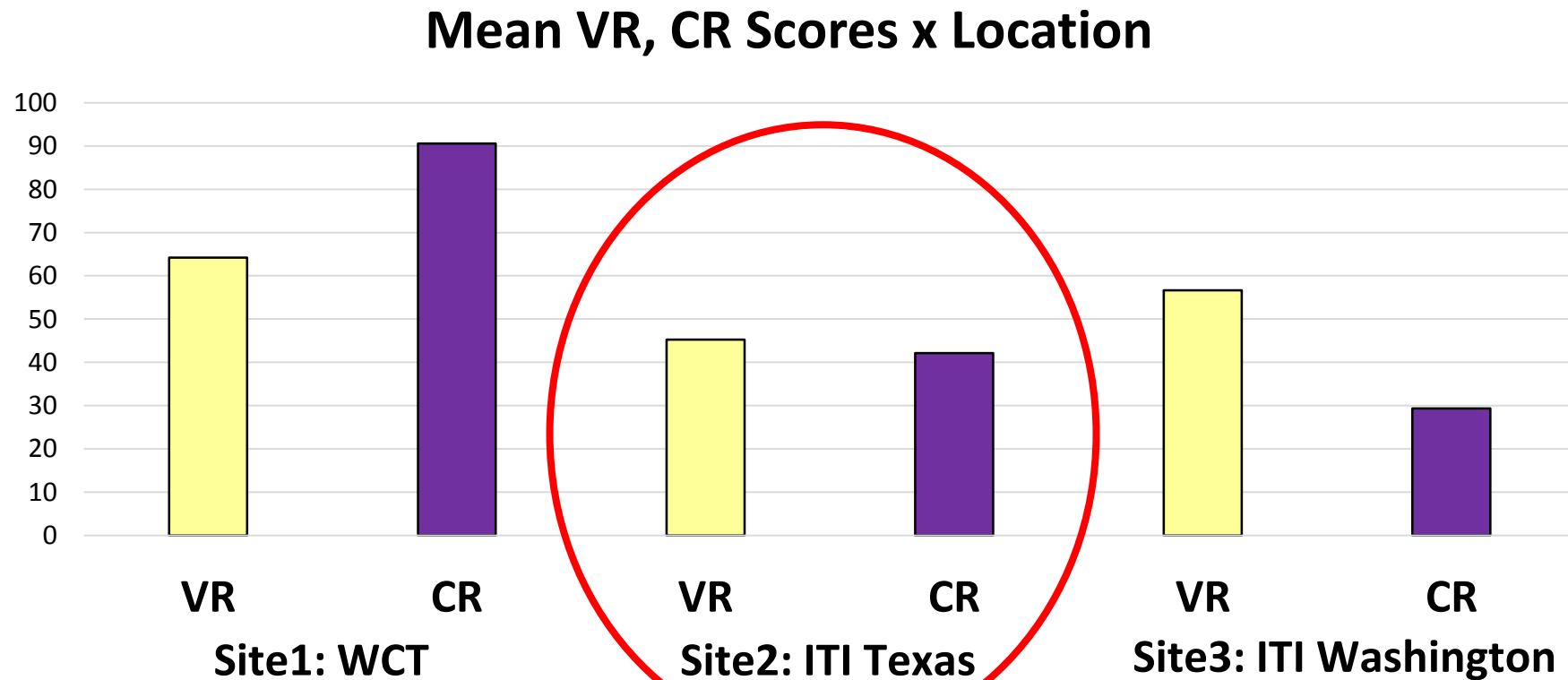
Session Pair	Test Score Correlation
CR1 to CR2	.876**
VR1 to VR2	.692**

\*\*sig. <.01



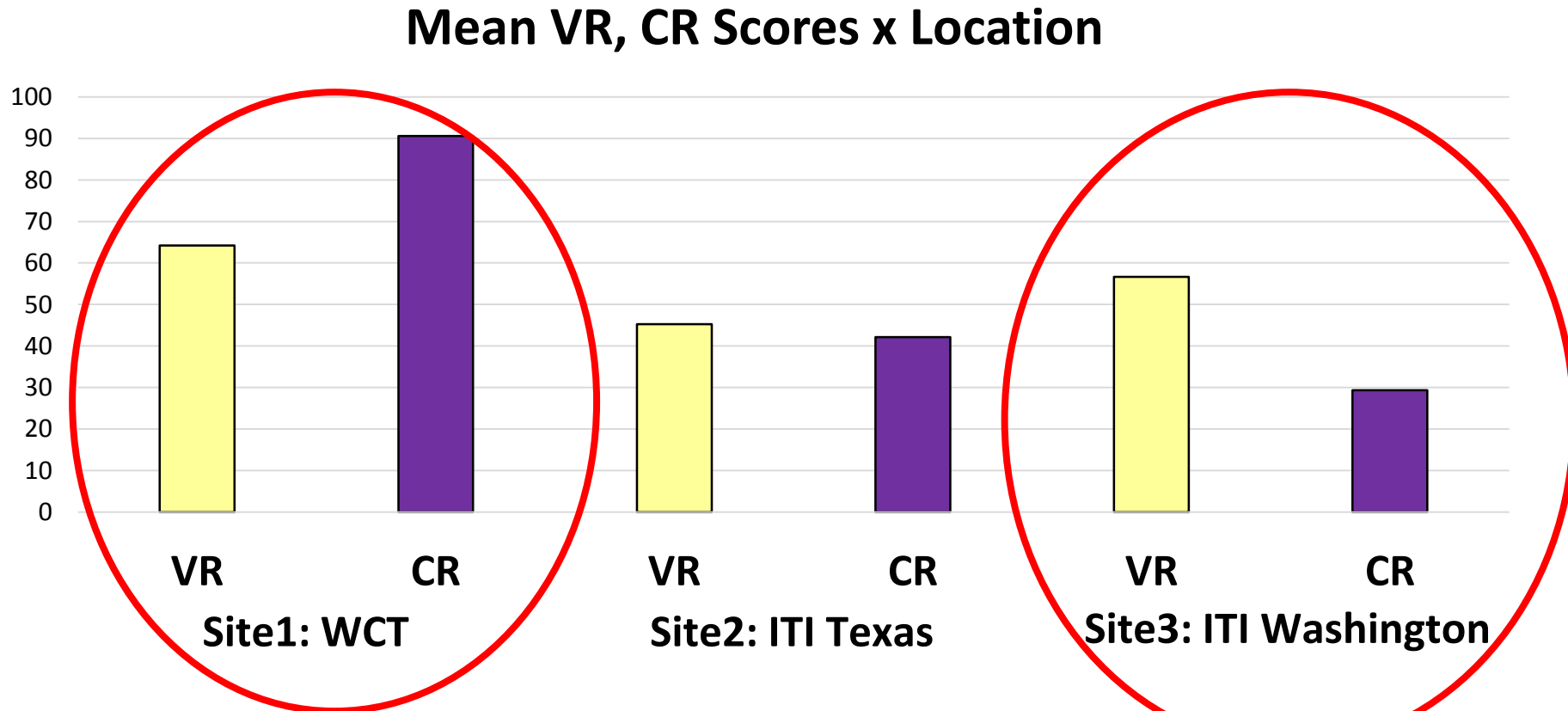
# Initial Results: Equipment Variations

- VR and Site2 matched make/model
- Site1 and Site3 had different make/models (same type)



# Initial Results: Practice Time Disparities

- Site1 Candidates: CR to VR Practice Time about 8:1
- Site3 Candidates: CR to VR Practice Time about 1:1



# Initial Result Adjustments

Limiting the locations (equipment and practice time disparities),  
using AI predictors\* with Domain Scores,

we can predict **Pass | Fail Decision Consistency** with up to **95% accuracy!**

\*[www.solver.com](http://www.solver.com)





# Site 1: WCT Classification Consistency

Final Classification Accuracy =  $53/60 = 88\%$

		Actual Crane	
		Pass	Fail
VR	Pass	53	6
	Fail	1	0
Total		54	6



# Site 2: ITI Texas Classification Consistency

- Final Classification Accuracy =  $19/20 = 95\%$

		Actual Crane	
		Pass	Fail
VR	Pass	6	1
	Fail	0	13
Totals		6	14



# Site 2: ITI Texas Classification Consistency

- Final Classification Accuracy =  $19/20 = 95\%$

		Actual Crane	
		Pass	Fail
VR	Pass	6	1
	Fail	0	13
Totals		6	14

Optimal  
Equipment &  
Practice Time



# Collaborative Communities Interested in Democratized & Authentic Simulation for the Craft Workforce





# Transforming Craft Training with Virtual Reality



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