

Concurrent Presentation Session  
AR/VR DISTRIBUTED LEARNING DESIGN



# Augmented Reality Based Extensible-Experiential-Expertise (X) Learning-Model Objectives

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A soldier in a combat environment, wearing a helmet with a night vision or AR overlay. The scene is dark and chaotic, with a large explosion in the background. The soldier is holding a rifle. The background shows a city street with buildings and a helicopter. The text is overlaid on the scene.

# *Augmented-Reality Based Extensible-Experiential-Expertise (X) Learning...*

## *Measuring and Managing Experiential-Expertise*

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# *Discussion Points*

1. Case for Experience over Expertise Alone.
2. Extensible-Experiential-Expertise based Learning (X-Learning).
3. The non-measured / non-detected Experiential-Expertise “leaks” .
4. AR can build experiential-expertise on-demand / anywhere (andragogy).
5. Data-data everywhere... but not a drop to link. For humans and AI.
6. Approaches for measuring / quantifying experiential-expertise.
7. Rapidly filling Experiential-Expertise “leaks” in wartime – using AR / AI.





# Experiential-Expertise: The Real Measure of Combat Readiness



**BLUF: VINCENNES NOT READY!**

*(Contrary to Assessments & CJCS Testimony)*

Experiential-Expertise training and  
*Measured / Managed* warfighters  
could have minimized mistakes

## Case Study: USS Vincennes Airbus Incident (1988)

- USS Vincennes was in “*highest state of training and readiness*” in all combat areas; *conducted multiple simulated and live training scenarios* in route to Persian Gulf.
  - typical Aegis Combat Training System (ACTS) synthetic scenario based training – emphasis “reps-n-sets” training
- USS Vincennes Anti-Air Warfare crew *misinterprets sensor data*, was *cognitively overwhelmed by real combat*, and many key roles were qualified to stand watch *based on subjective criteria* (e.g, time on ship)
- USS Vincennes combat team was *heavily biased* by earlier combat events, enabled by *routine* “reps-n-sets” *synthetic rehearsal training* scenarios.

Refs:

1. Formal Investigation into Circumstances Surrounding the Downing of Iran Air Flight 655. US CJCS 18 Aug 1988
2. Sea of Lies – American naval vessel blundered attack on Iran Air 655. Newsweek 13 Jul 1992.

UNCLASSIFIED



# FLASH FORWARD 2018



## NTSB Report on USS John S. McCain Incident

10 sailors aboard JOHN S. MCCAIN died and 48 were injured when the ship collided with tanker in Singapore Strait Traffic Separation Scheme as result of:

- Poor Human System Integration
- Lost Situation Awareness
- Poor Training (Qualification) Practice and Team / Watchstander (Role) Performance Management

i.e., Poor Experiential-Expertise

## SEEM FAMILIAR?

MANY OTHER PERSONAL-SIMILAR STORIES...

**MCCAIN** VINCENTES INCIDENT WAS A PRODUCT OF POOR COGNITIVE-CONDITIONING AND MIS-MANAGEMENT OF SMALL TEAM/INDIVIDUAL NAVIGATION READINESS ... so now what?

# Extensible Experience Produces Expertise (X-Learning Model)

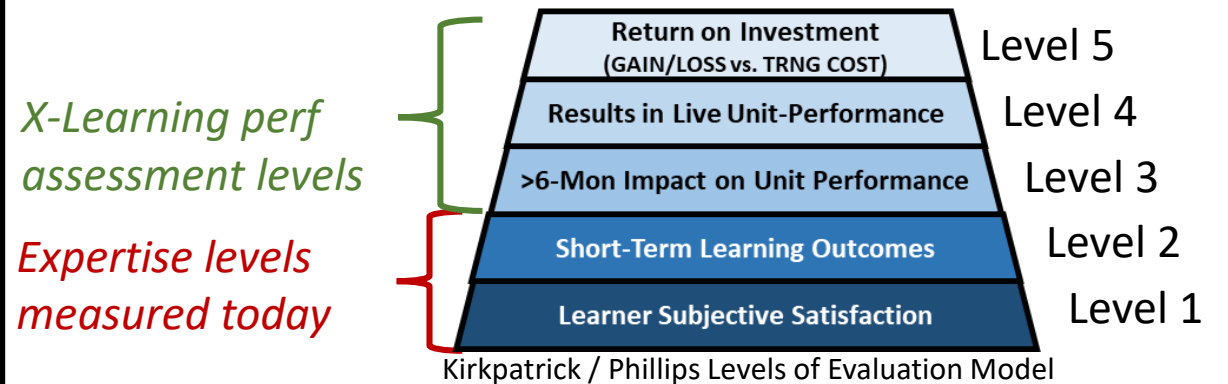
## Developing/ Accounting for Warfare Team / Warfighter Experiential-Expertise

### Experiential

- Tacit knowledge or practical wisdom gained from what one has observed, encountered, or undergone.
- The process or fact of personally observing, encountering, or undergoing something.
- The development of REAL mental models of events as they naturally occur in the course of time – produces “battlefield-wisdom”.

### Expertise

- A person who has special skill or knowledge in a particular team-role; a specialist.
  - Assessed WITHIN a degree of performance contexts in real / live experiences.
  - Reassessed – sustained – expanded
- Assessment at Level 3 / 4 only... anything lower has no predictive performance value.

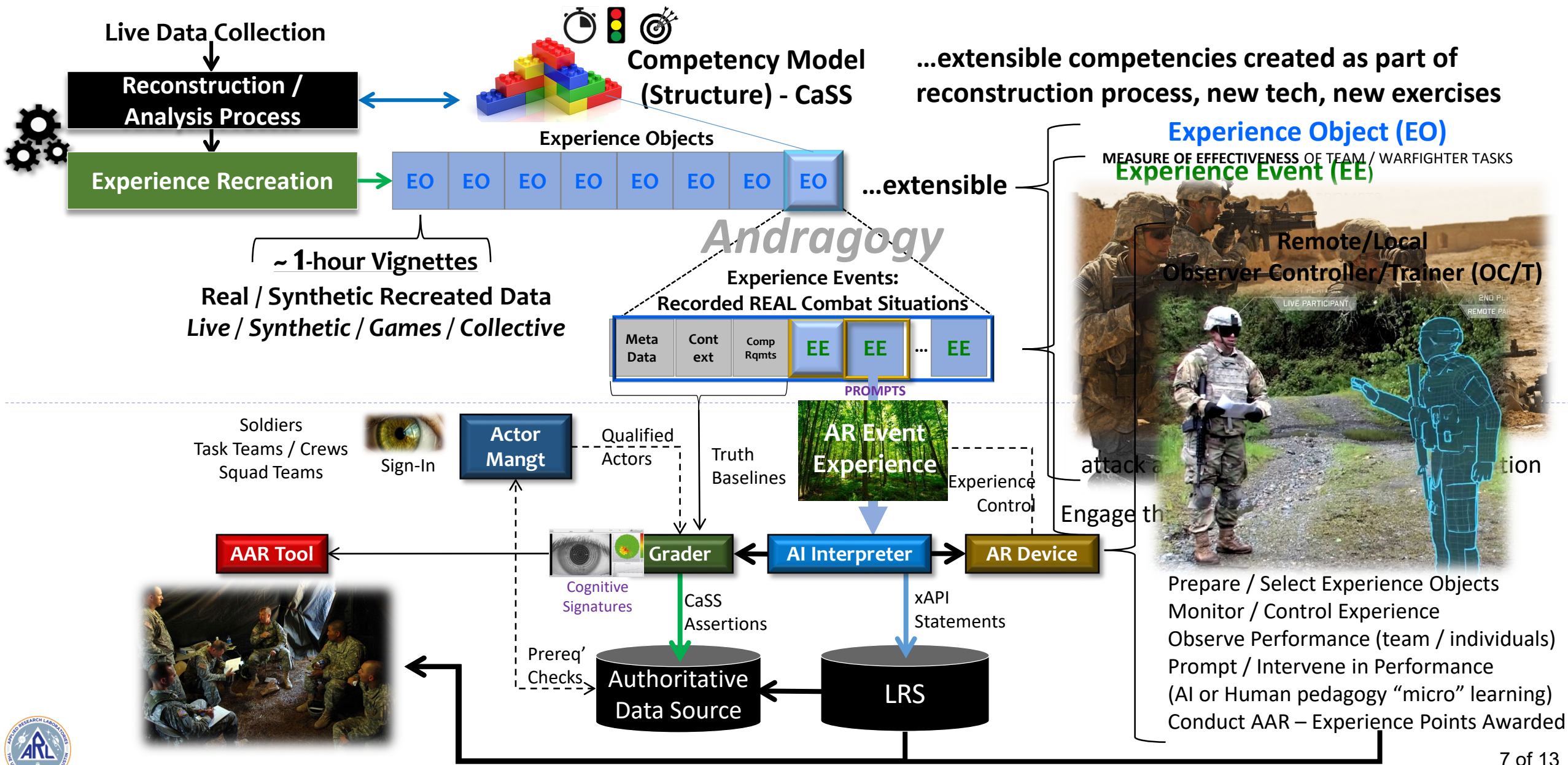


Today's Education and Training Practices Builds Declarative Knowledge, Some Expertise, little Experience





# X-Learning Process: Experience "Farming" and Consuming





# Real-Data Augmented X Learning

## OBJECTIVE CONCEPT:

Environment/items (trees, shrubs) geo-registered and calibrated in AR Field of View (FOV).

With AR on, real (recorded) threats and neutral stimulus “events” can appear “inside” synthetic (or live) environment skirts.

Andragogic stimulus from real prior experience in same geographic synthetic or actual live environment appear naturally or on-demand as part of test or demonstration.

Eye-gaze tracking provides critical cognitive data collection, feedback and expertise indicator support

Other cognitive tracking shows item recognition, stress, and supports automated just-in-time declarative pedagogic support

**Real Environment or “Semi-Synthetic” “Skirts”**

**Augmented Learning**

**Augmented REAL**

**Experiential Stimulus** ⊕ Doe, a deer, a female deer. Hoofed mammals native to this region. Threat: none.

**Automated Cognitive Classification** ⊕

**Gaze Spatial/Range Tracking**

**AR FOV (typical AR limits 45°H x 30°V\*)**

\*Human eyes true FOV – 180°H x 135°V





# Please Save the Data... Expertise Depends on It

Artificial Intelligence Supported AR (Realistic Environments/Entities/Performance) NEEDS DATA

Data Collection Opportunities

TRAINING LOCATION	THE PLATOON PREPARED FOR WAR	OBJECTIVE STAGE
UNIT	Platoon Training SQUAD/PLT LFX	6
UNIT	Squad Training ARM : SQUAD/PLT L	
UNIT	Fire Team Training ARM : FIRE AND MOVE	
UNIT	Crew Training MAINTENANCE : ZERO : QUAL	
IET/ UNIT	Buddy-Team Trainin FIRE AND MOVEME	
IET/ UNIT	Individual Training WPN MAINTENANCE : BRM : ZERO	



SINGLE AND MULTIPLE TARGETS FIELD FIRE II SCORECARD			
For use of this form see TC 3-22.9, the proponent agency is TRADOC.			
ID CODE 12345678	UNIT Dco. 1-23 INF	DATE (YYYYMMDD) 20161004	EVALUATOR'S ID CODE 23456789
TABLE 1 SUPPORTED FIRING POSITION	TABLE 2 SUPPORTED FIRING POSITION	TABLE 3 PRONE FIRING POSITION	SCORE

SINGLE TARGET FIELD FIRE I SCORECARD																				
For use of this form see TC 3-22.9, the proponent agency is TRADOC.																				
		UNIT Dco. 1-23 INF				DATE (YYYYMMDD) 20161003				EVALUATOR'S ID CODE 23456789										
POSITION	TABLE 2 SUPPORTED FIRING POSITION					TABLE 3 PRONE FIRING POSITION					TABLE 4 KNEELING FIRING POSITION									
	MISS	RD	RANGE (m)	TIME (sec)	HIT	MISS	RD	RANGE (m)	TIME (sec)	HIT	MISS	RD	RANGE (m)	TIME (sec)	HIT	MISS				
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2	TOTAL					17	1	TOTAL					9	TOTAL					8	1

Today lots of task data is collected everyday... then dropped in the "bucket"



BIT BUCKET

POSITION	NUMBER OF ROUNDS FIRED
Prone supported firing position or (at the unit commander's discretion) the supported firing position	20
Prone unsupported firing position	10
Kneeling unsupported firing position	10

QUALIFICATION RATINGS	NUMBER OF TARGETS HIT
Expert	36 to 40
Sharpshooter	30 to 35
Marksman	23 to 29
Unqualified	22 and below

EXAMPLE/ARTIFICIAL DATA ONLY – Marksmanship



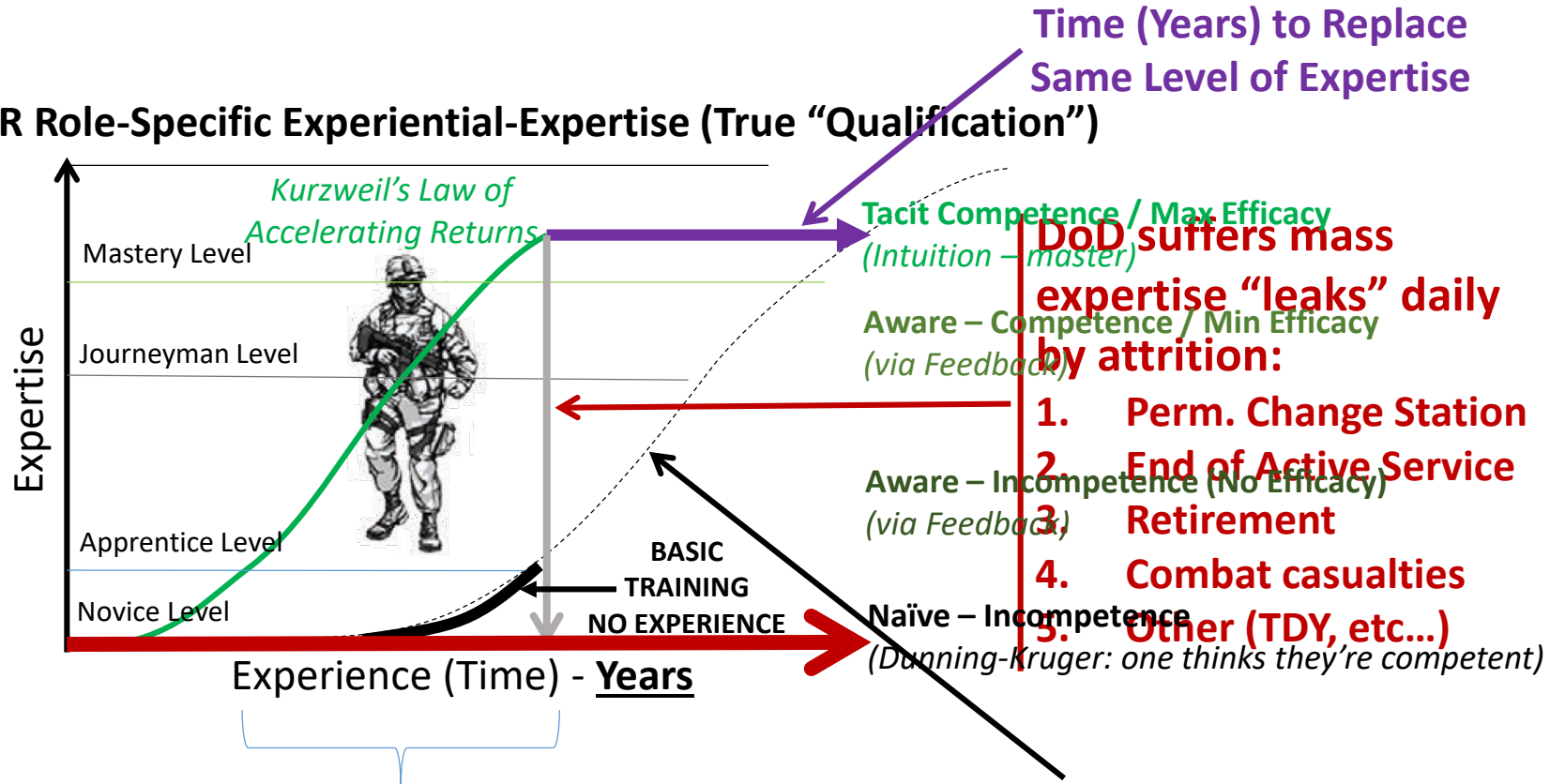
# Task-Team / Warfighter Experiential-Expertise “Leaks”

How do we rapidly “refill” sudden unit experiential-expertise “leaks”?

The gap or loss of “battlefield wisdom” in combat units



Team OR Role-Specific Experiential-Expertise (True “Qualification”)

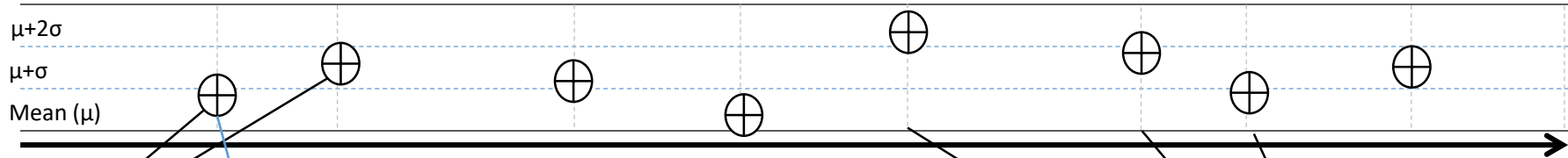


Exercises in order of cost and deployment savings..

Today's estimated "expert replacement" trajectory

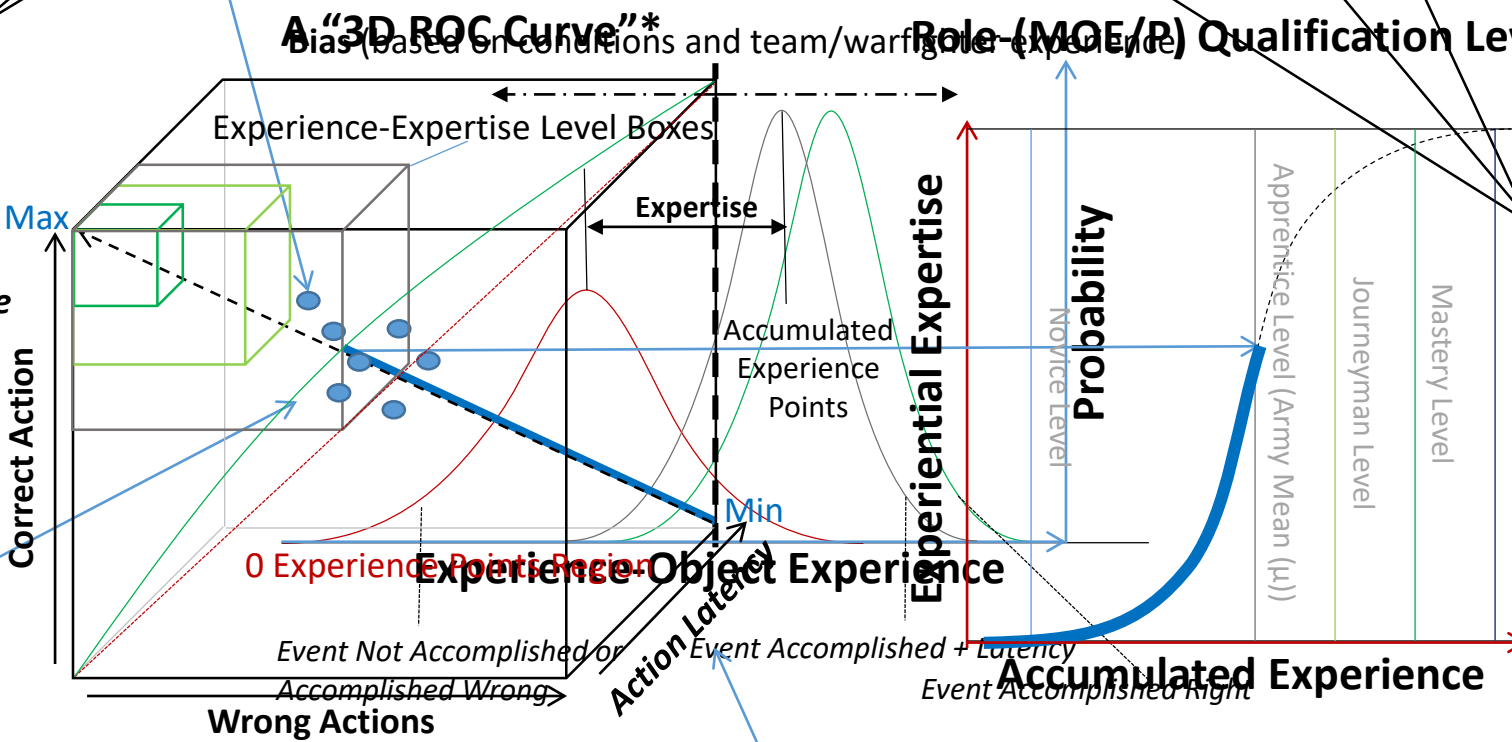
# Tracking Experiential-Expertise to Predict Future Performance

Raw Performance Data Converted to AI & OC/T Interpreted Task Measures of Performance



**Warfighter MOE - Measures of Performance (MOPs):**

1. Setup sensor for environmental characteristics.
2. Search data for target-like contacts.
3. Investigate and analyze contacts.
4. Report contact to leadership.
5. Etc....



**Experience OBJECT:**  
Warfare-Team/Warfighter mission (collective task) vignette - e.g., *Search an Area*

**Measure of Effectiveness (MOE) Experience EVENTS:**  
Warfighter performance task - e.g., *Search assigned sector with a [given] sensor*

**Pupillometry / EEG signatures:**



**BIAS LINE**  
Represents Many Conditions

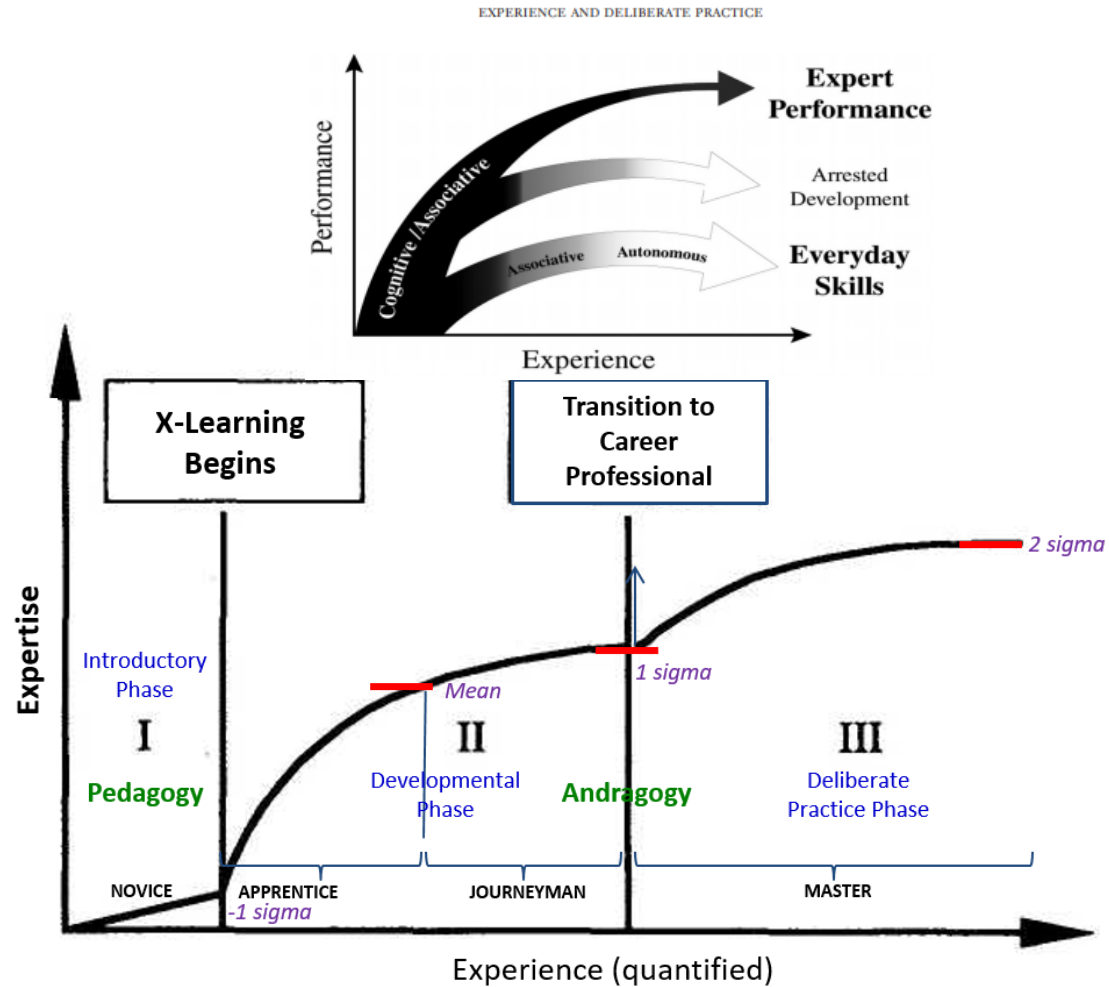
Missing Key Predictor of Expertise



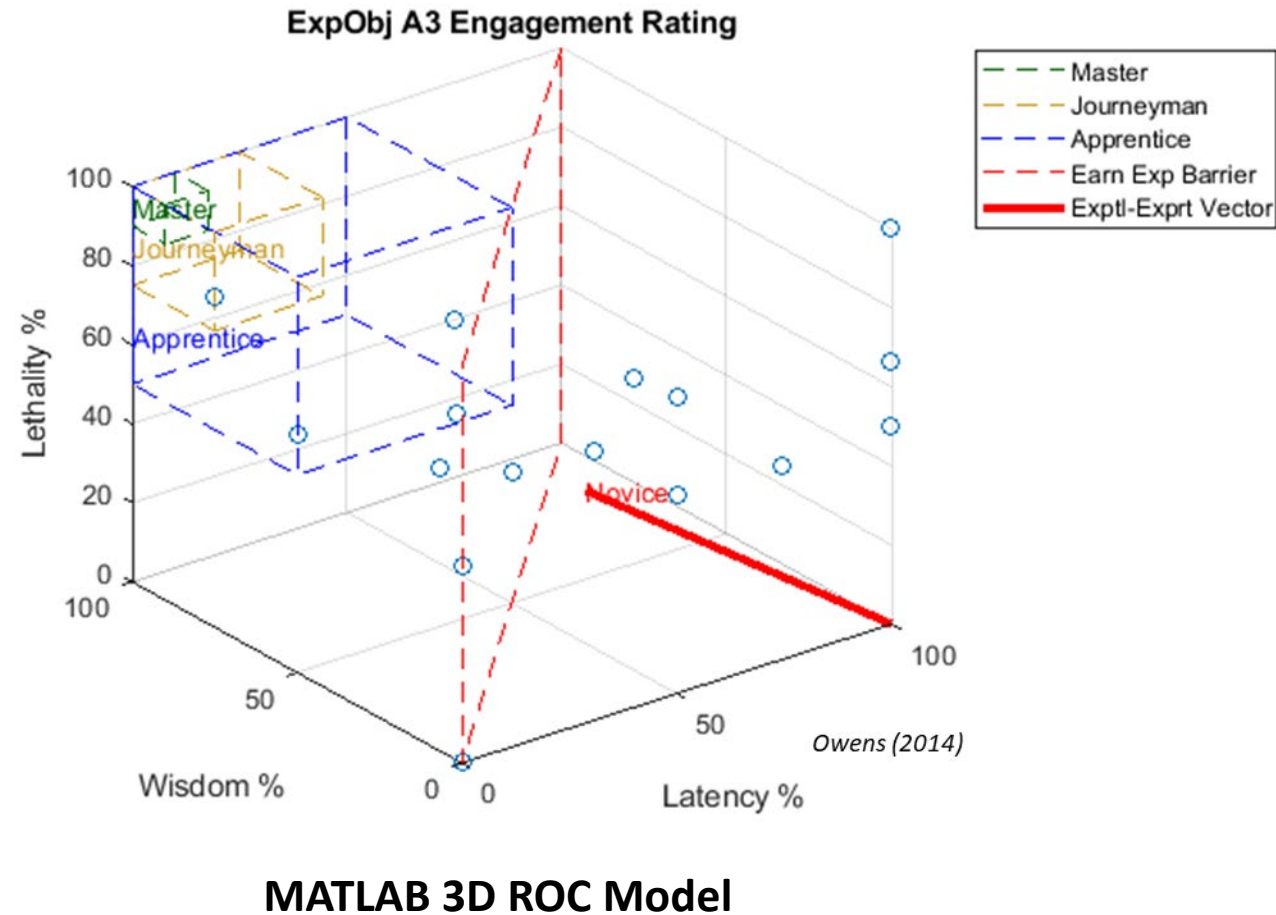
\*Owens (2014)



# Experiential-Expertise Based Qualification Required Research



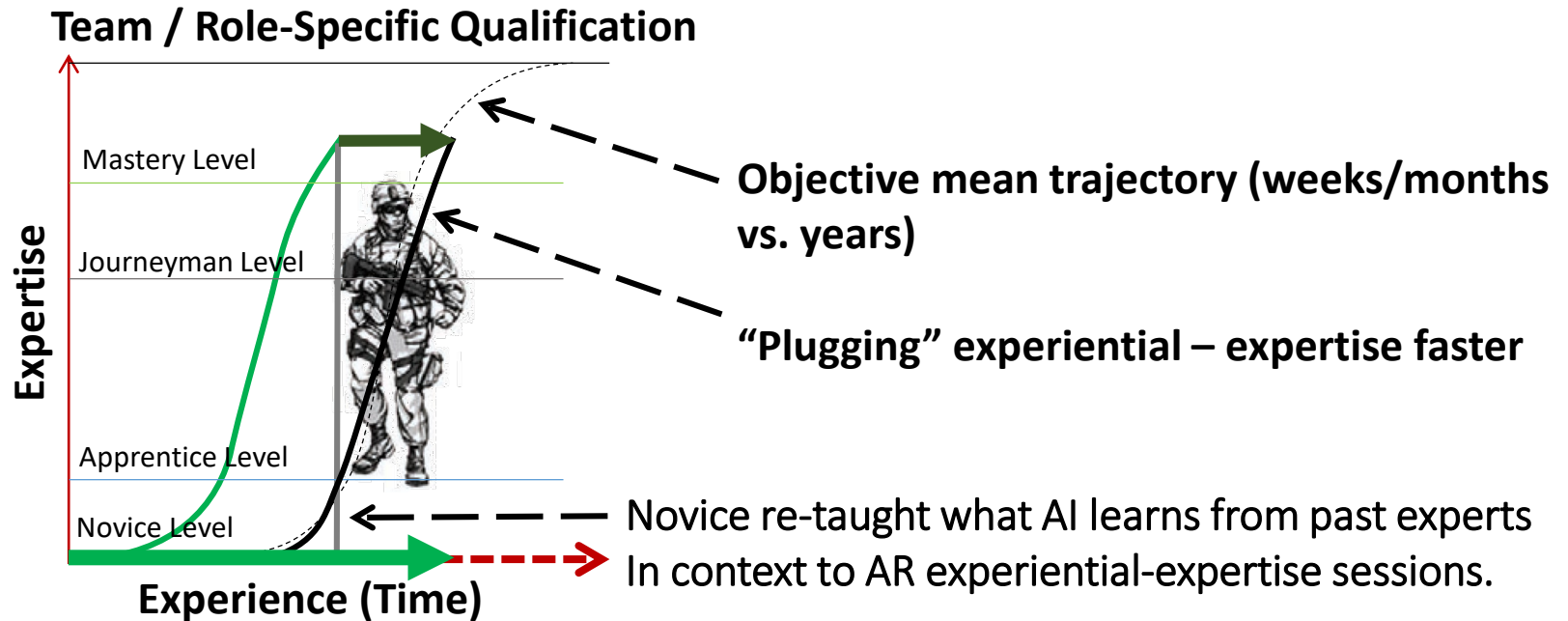
Expertise Curve Based on K. Anders Ericsson et.al (1968 -2006)



# “Plugging” Task-Team / Warfighter Experience “Leaks”

All teams / warfighters must re-experience “saved” experiences only few have today!

Can preserve our knowledge with AI but MUST preserve our wisdom with humans



Augmented Reality based Extensible-Experiential-Expertise (X-learning),  
Using recorded/recreated real-past Experiences and Artificial Intelligence support,  
CAN BUILD BETTER EDUCATION AND MISSION READINESS QUALITY

# *Questions?*

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