

HIKING THE GRAND CANYON FOR SCIENCE

GLORY EMMANUEL AVIÑA

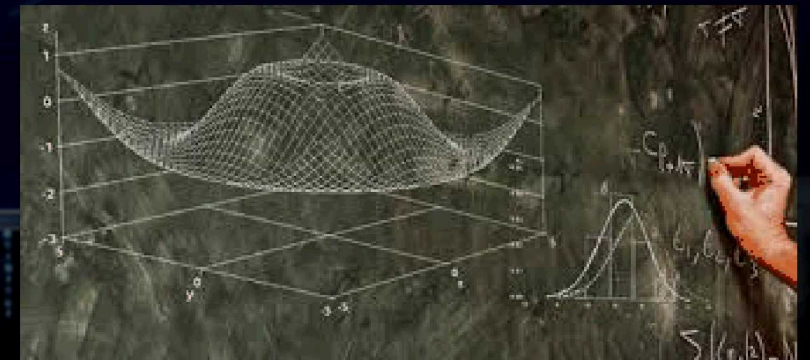
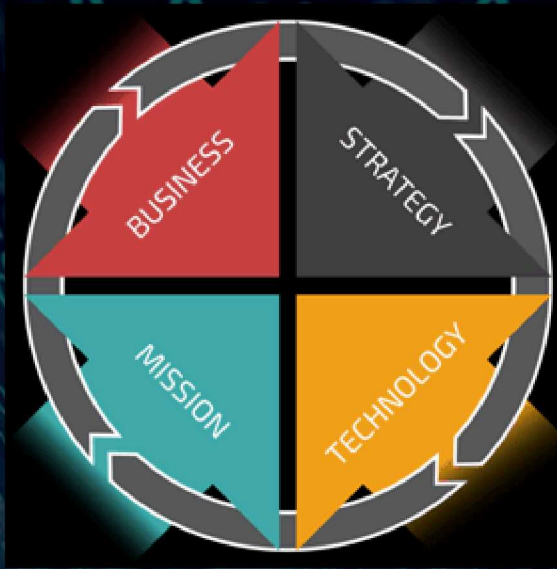
L1 MANAGER, 8766 CYBER SECURITY ASSESSMENTS

STUDENT TALK -- JUNE 2019

INTRO TO ME

- L1 Manager for Cybersecurity Assessments
- Started in 2006 as student intern
- Worked at SNL-NM for 10 years
- Been a SNL-CA for 4 years

CAREER PATH



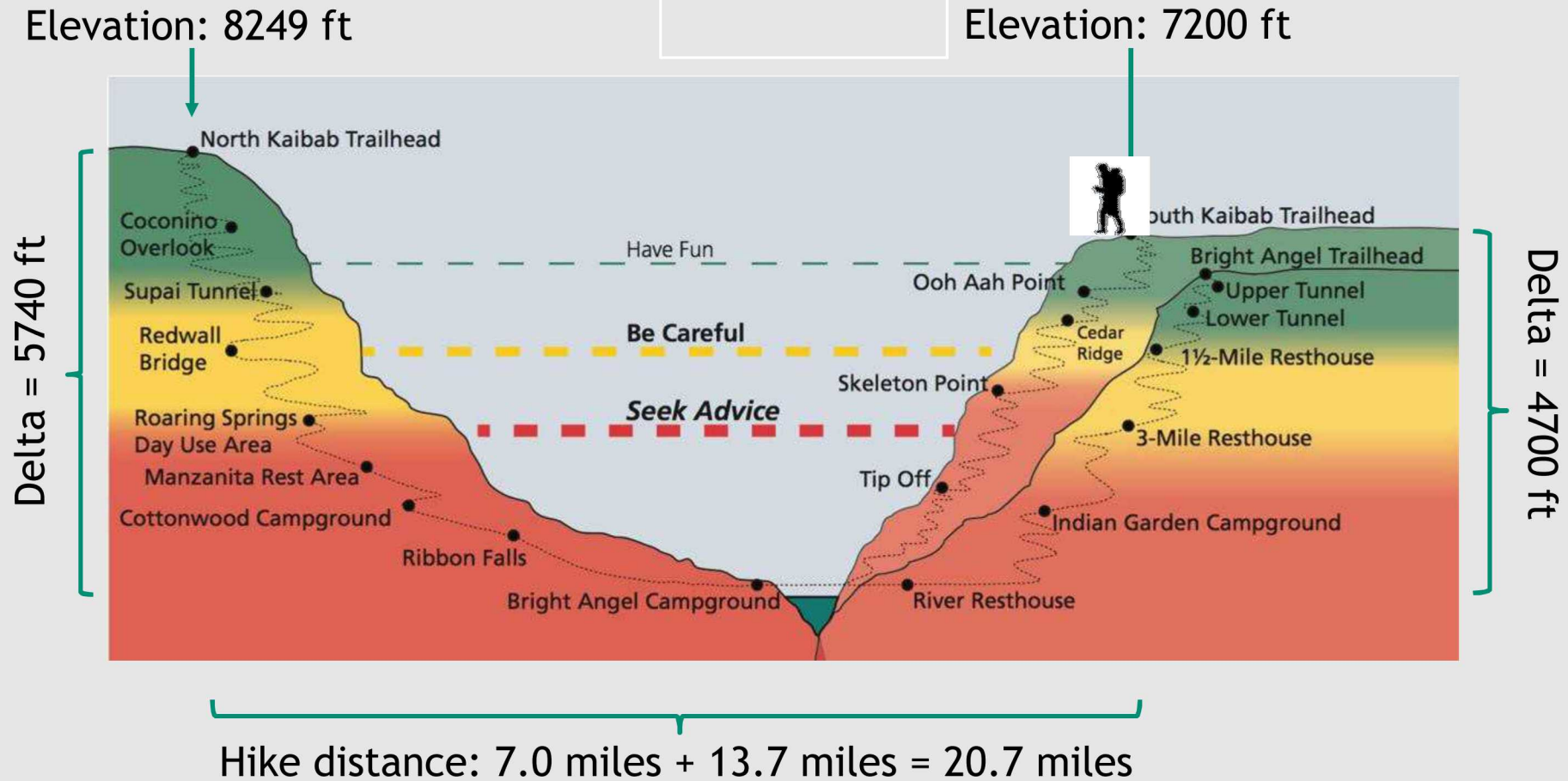


WATCH STUDY

WATCH STUDY PURPOSE

- 1) **Markers for Health:**
identify physiological, cognitive markers most related to health and task performance
- 2) **Wearable Devices:**
identify which COTS wearable devices are best for measurement and in rugged environments
- 3) **Health Events:**
use statistical analyses on collected data to identify which markers are most predictive of benign vs. traumatic health events

THE RIM-TO-RIM HIKE





PUBLIC HEALTH ALERT!!

RABIES

Two foxes exhibiting abnormal behavior were recently euthanized near Phantom Ranch along the Colorado River in Grand Canyon and tested positive for rabies.

In order to protect yourself and others, please take the following precautions:

Stay away from wild animals! Do not attempt to feed, approach, or touch wild animals (alive or dead). Teach this important message to your children, and keep a close eye on your kids at all times. **Rabid animals may show no fear of people and may even seem friendly, or may become aggressive.** Sleeping in tents is recommended.

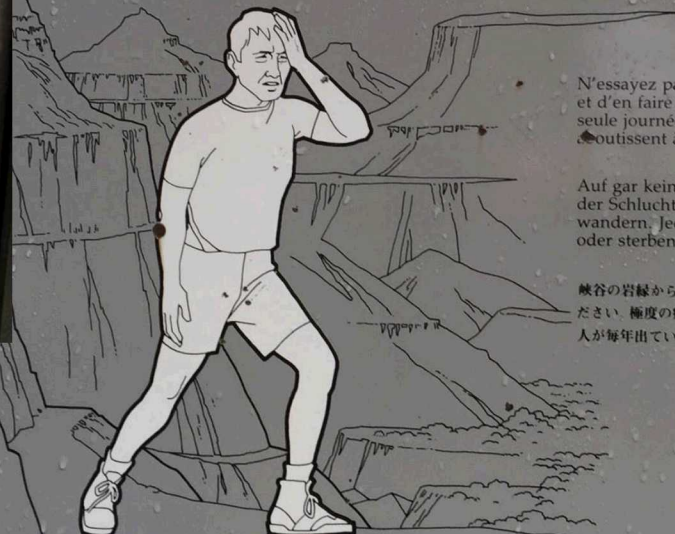
If you are bitten by an animal, or come into contact with an animal's saliva, wash the exposed site immediately with soap and water. Be sure to see a healthcare provider as soon as possible for recommendations about receiving rabies exposure preventive vaccine and report the bite to a Park Ranger.

Report it:
If you see a sick or dead animal, or an animal acting abnormally in this area, please report it to a Park Ranger as soon as possible.

Warning

Danger!
Warnung!
ご注意

DO NOT attempt to hike from the canyon rim to the river and back in one day. Each year hikers suffer serious illness or death from exhaustion.



N'essayez pas d'atteindre le bord du fleuve et d'en faire le retour à pied en l'espace d'une seule journée. Tous les ans de telles excursions aboutissent à l'épuisement et parfois à la mort.

Auf gar keinen Fall in einem Tag vom Rande der Schlucht hinunter zum Fluss und zurück wandern. Jedes Jahr werden Wanderer krank oder sterben wegen Erschöpfung.

峡谷の岩縁から川まで日帰りの往復ハイキングはご遠慮ください。極度の疲労により重病を患ったり死亡したりする人が毎年出ています。

Danger

Gefahr
Danger

危険



Use caution near the edge

People die here falling from the edge. Do not go beyond—or climb on—walls or railings. Most who die have gone beyond walls or rails.

Prudence près du bord

Attention: ne pas aller au delà ou escalader murs ou garde-fous. Certaines personnes se sont tuées ici après s'être aventurées au-delà. La plupart s'étaient aventurées plus loin que les murs et garde-fous.

Vorsichtig an der Bergkante sein

Bleiben Sie innerhalb der Mauern oder Geländer und klettern Sie nicht auf dieselben. Stürze vom Grat führen hier zu Todesfällen. Die meisten Todesfälle rühren daher, daß Personen nicht innerhalb der Mauern oder Geländer geblieben sind.

岩縁付近では特に気をつけてください。

ここから先は登攀したり、岩壁などに近寄らないこと。多くの人が禁止されているところを越えて突端から転落死しています。

Grand Canyon National Park

National Park Service
U.S. Department of the Interior



Warning



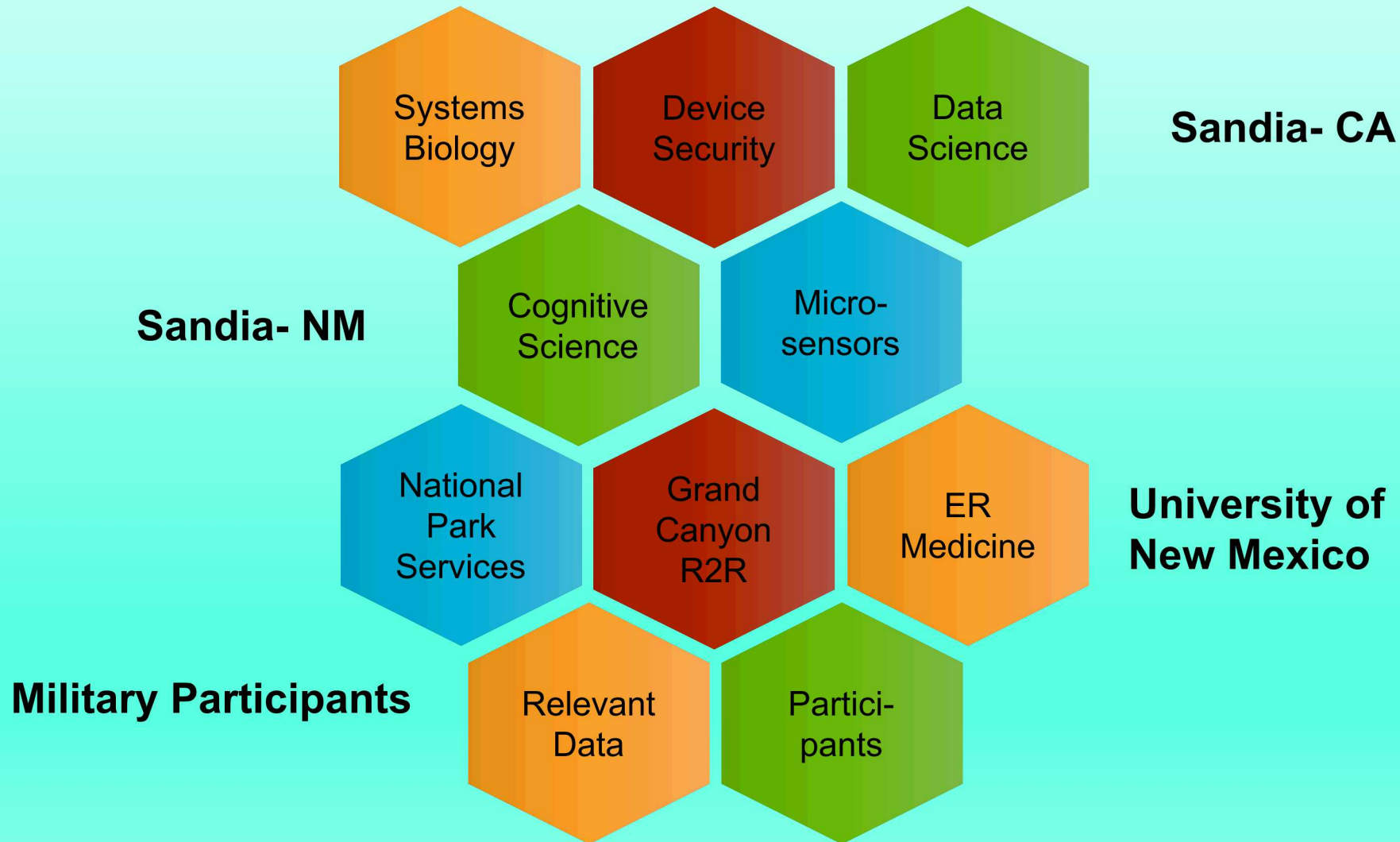
Hiking to the Colorado River and back in one day is not recommended due to long distance, extreme heat, and a nearly 5,000-foot (1,500 m) elevation change. If you think you have the fitness and expertise to attempt this extremely strenuous hike, please seek advice from a park ranger at the Backcountry Information Center.

Avertissement : Nous déconseillons dans tous les cas d'essayer de descendre jusqu'au Colorado River et de remonter le jour même, en raison des longues distances à parcourir, des changements de chaleur extrême et du dénivelé de près de 5 000 pieds (1 500 m) dans chaque sens. Si vous pensez avoir la condition physique et l'expertise pour tenter cette randonnée extrêmement intense et exigeante, veuillez demander conseil auprès du garde au Backcountry Information Center.

Achtung: Aufgrund der großen Entfernungen, großer Hitze und einem Höhenunterschied von 5.000 Fuß (1.500 m) in jeder Richtung wird davon abgeraten am selben Tag zum Colorado River und zurück zu wandern. Wenn Sie meinen, dass Sie körperlich in der Lage sind und genug Erfahrung haben, diese sehr anstrengende Wanderung zu unternehmen, lassen Sie sich bitte zuvor im Backcountry Information Center von einem Park Ranger beraten.

警告: 厳しい天候、距離の長さ、片道5,000フィート(1,500 m)近い標高差のため、Colorado Riverまでの往復ハイキングを日帰りするのは絶対にやめてください。このように非常に厳しい条件でハイキングをする体力と経験があると思われる方は、Backcountry Information Centerでパークレンジャーにご相談ください。

Interdisciplinary Approach



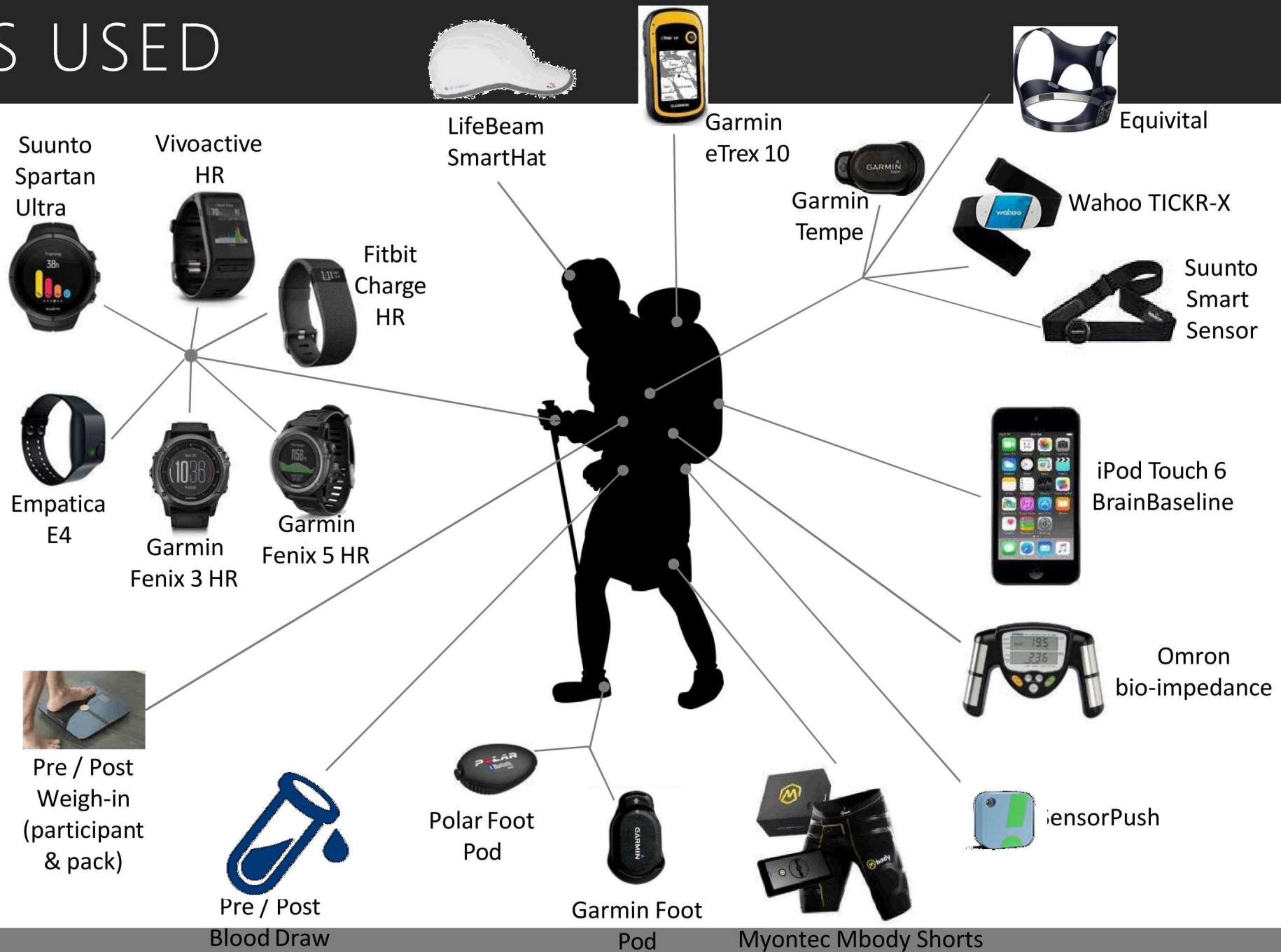
OOH AAH POINT



Photo credit: WATCH team member, Rob Abbott

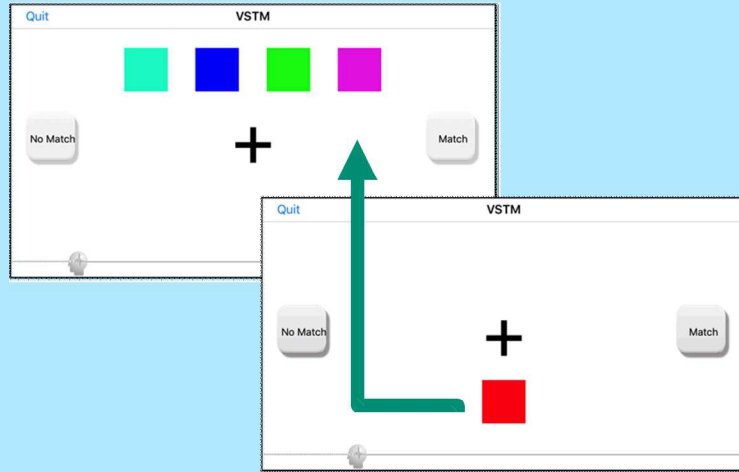
0.7mi; 790ft Down
20 miles to go!

DEVICES USED

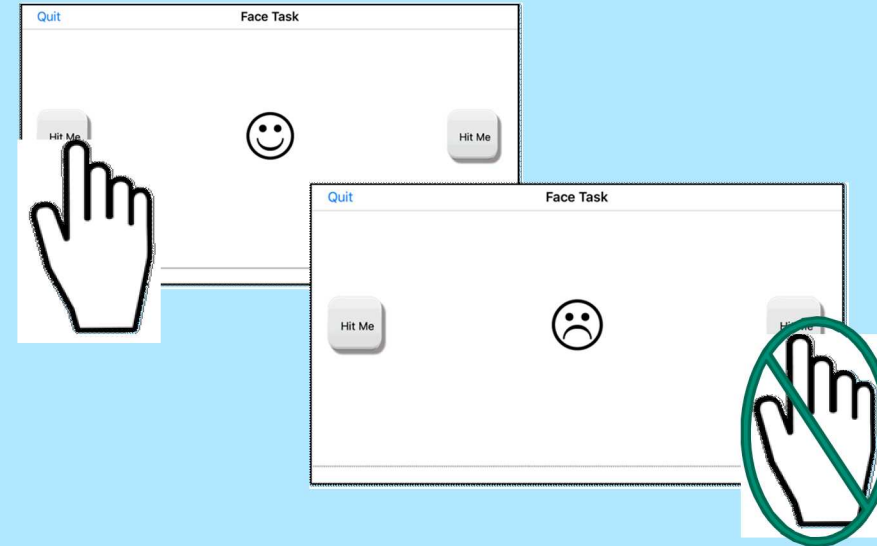


COGNITIVE ASSESSMENTS

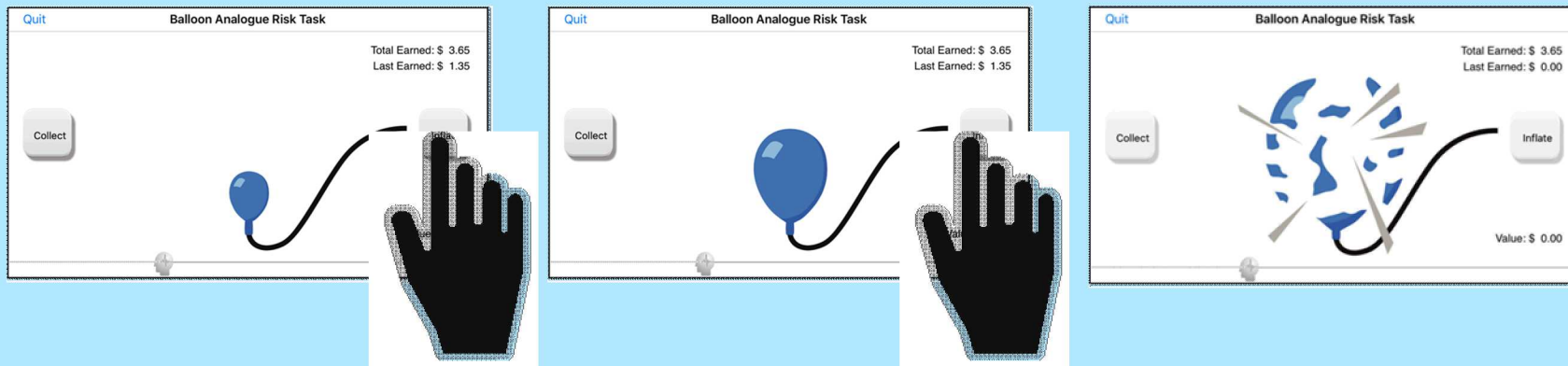
Visual Short-term Memory (VSTM)



Go/No-Go



Balloon Analogue Risk Task (BART)



DATA COLLECTED

	Wearables	Cognitive	Bloodwork	Surveys
TOTAL	174	162	179	452
Sep 2018	38	38	37	38
Oct 2017	27	27	24	27
May 2017	59	57	67	99
Oct 2016	50	40	51	288



Heatmap showing the correlation matrix between various variables. The color scale ranges from -1 (dark red) to 1 (dark blue). A green box highlights the correlations between d_ck and the VSTM variables. A black box highlights the correlation between d_hct and minVSTM.

	d_hct	d_lac	d_pco2	d_pH	dPre_VSTM	dFT_VSTM	minVSTM	preVSTM
d_ck	0.11	-0.09	-0.02	0.08	-0.13	-0.01	0.05	0.07
d_hct	-0.08	-0.13	-0.16	-0.29	-0.27	-0.33	-0.2	
d_lac	-0.12	-0.36	-0.04	-0.08	0.11	0.04		
d_pco2	-0.44	0.32	0.33	0.02	-0.03			
d_pH	0.09	0	0.05	-0.07				
dPre_VSTM	0.72	0.25	-0.2					
dFT_VSTM	0.26	0.12						
minVSTM	0.75							

Interpreting the Blood & Cognitive Connection

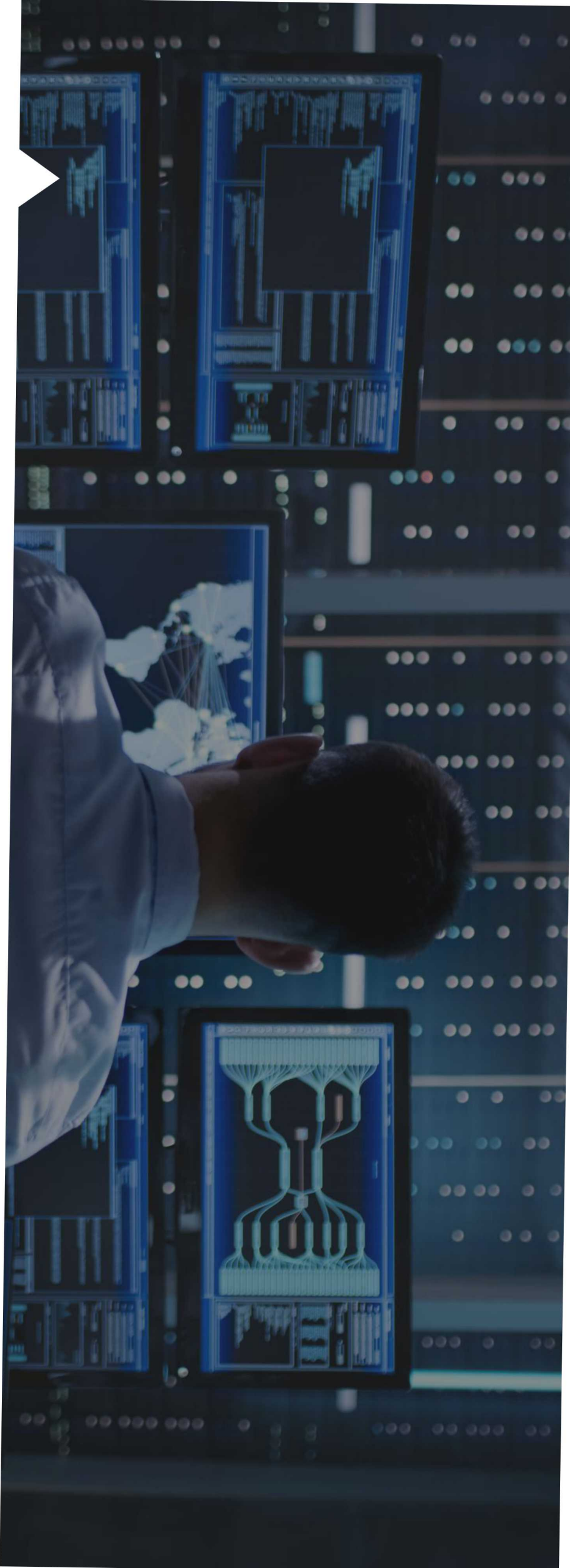


Blood-centric perspective:

- Increased hematocrit associated with...
 - Increased reported fatigue (mental fatigue across hike, max mental fatigue, physical fatigue across hike)
 - Reduced VSTM performance (across hike and min score)
 - Lower minimum BART total value
 - More explosions in BART from final training to end of hike
- Decreased pCO_2 associated with...
 - Lower physical fatigue ratings at start of hike
 - Poorer performance on VSTM at end of hike relative to start
 - Slower response time on VSTM task (across hike and relative to final training)
- Decreased pH levels associated with...
 - Increased reported fatigue (max mental and physical fatigue, mental fatigue across hike, physical fatigue across hike)
 - More explosions in BART from start to end of hike

BrainBaseline-centric perspective:

- Increased fatigue ratings associated with...
 - Increased hematocrit (mental fatigue change, max mental fatigue, physical fatigue change)
 - Increased pCO_2 (physical fatigue at start)
 - Decreased pH levels (max mental and physical fatigue, mental fatigue across hike, physical fatigue across hike)
- Reduced performance on VSTM associated with...
 - Increased hematocrit (VSTM across hike and min score)
 - Decreased percentage CO_2 (VSTM across hike)
- Slower response time on Go/No-Go associated with decreased pCO_2
- Increased explosions in BART associated with...
 - Decreased pH levels (BART across hike)
 - Increased hematocrit (BART from final training to end)
- Lower minimum BART total value associated with increased hematocrit



EMULYTICS

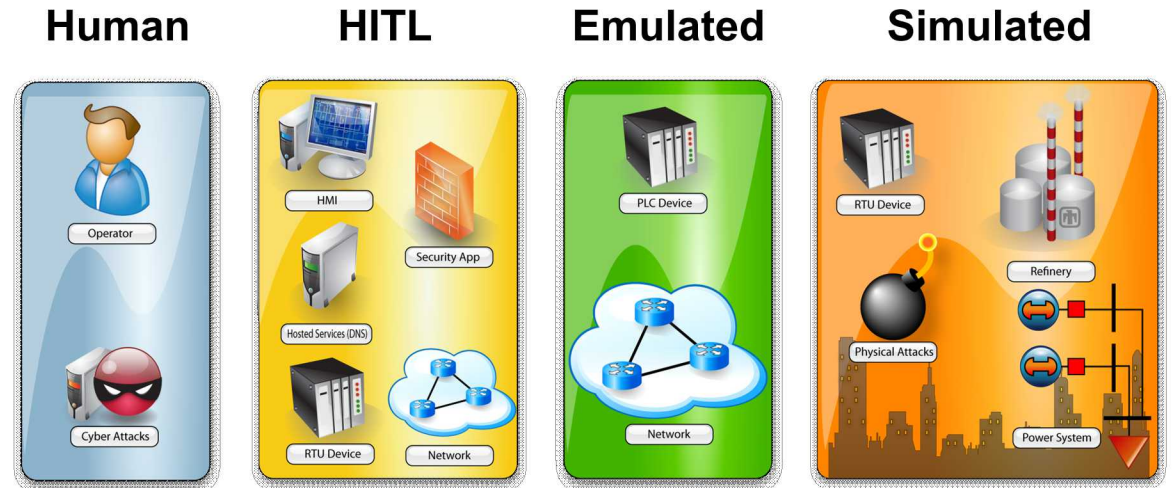
EMULTICS

Emulytics = Emulation of complex, distributed cyber network systems + analytics of that data

Provides a safe environment at scale to evaluate the parameters and technologies can be evaluated with fidelity and at scale

Delivers solutions for the empirical analysis and design of complex cyber systems in three overarching application areas:

- Human in the Loop
- Predictive Simulation
- Real Time





Questions & Discussion