The Next Generation is Mobile

neurapulse

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How Neurapulse Makes Your Fleets Safer

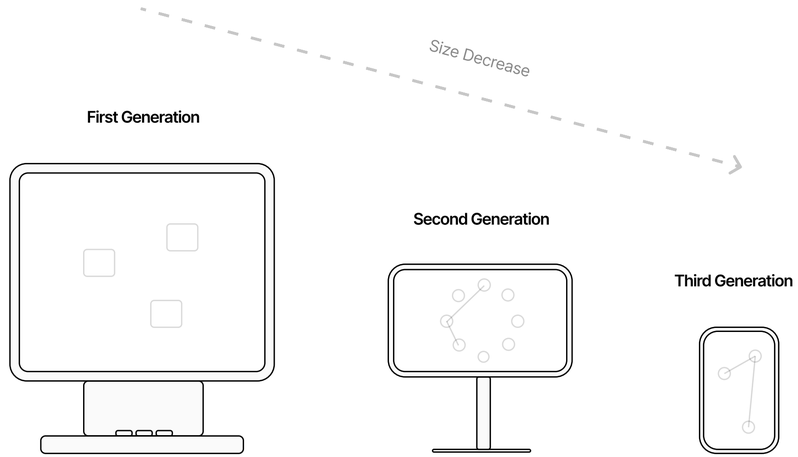
Neurapulse, Impirica's flagship risk discovery tool, is our most effective tool for predicting real-world driving, to date. Teams are able to onboard and get their first team safety rating within minutes. It is the evolution of Impirica's research, applying the last 25 years of paired driving and cognitive tests. Neurapulse delivers the predictive power of a thorough cognitive assessment in a 5-minute mobile-optimized test, that can be self-administered by fleets on a periodic basis. This unlocks a new capability for teams — grounded in real-world driving data — to measure safety at scale.

To manage driving risk well, teams need a way to quickly assess real-world ability and cognitive safety together. A standardized, scientific road test is the typical first step in the transportation industry, but many find cognitive tests to be too cumbersome to adopt. There is a need for faster, easier testing that does not compromise validity in predicting real-world driving outcomes.

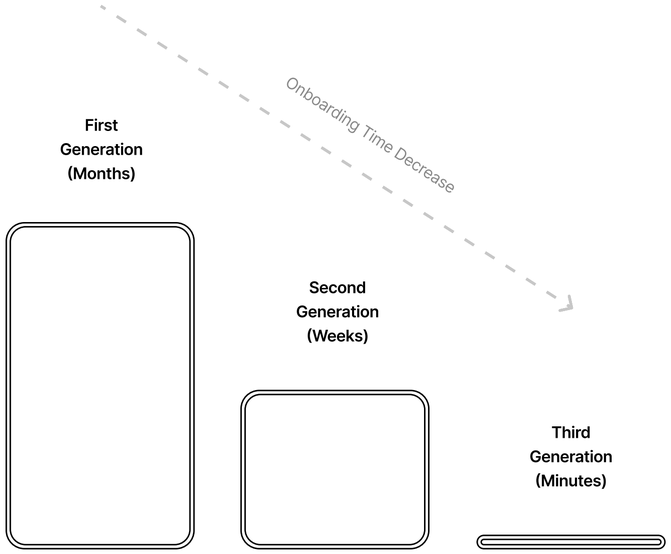
Better Portability

Impirica's original design required a dedicated touchscreen testing station. The next-generation Vitals platform streamlined the experience onto a mobile tablet, incorporating visual demonstrations and spoken instructions so it was easier to use.

Now, Neurapulse further optimizes the experience for smartphones, enabling fully mobile self-administration and allowing every candidate to take a test — regardless of location. Every driver can now take a test on their own device.



Above - Evolution of Impirica's cognitive risk tool.



Above - Decrease of onboarding time between generations.

Faster Onboarding Time

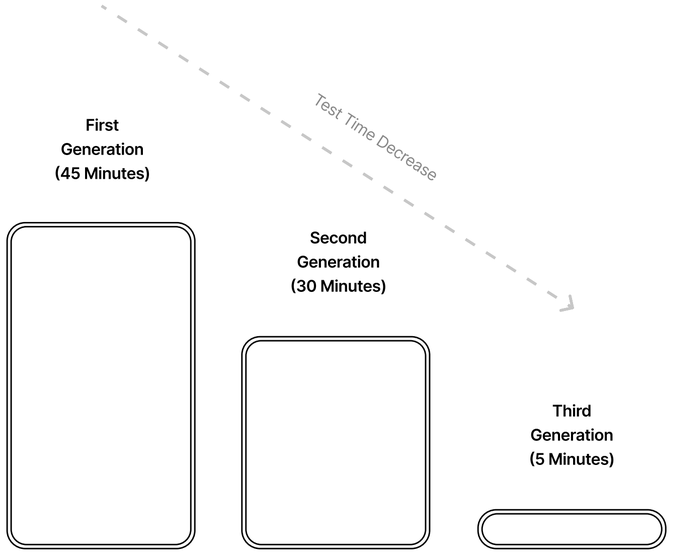
At first, the test involved shipping specialized hardware and certifying evaluators, often taking an extended period of time. Vitals accelerated onboarding with a lighter-weight tablet setup and reduced evaluator burden.

Neurapulse eliminates these barriers entirely - tests can be deployed at any scale within 5 minutes of a team signing up.

Faster Testing Time

Through iterative refinement, Impirica has progressively reduced testing time while preserving predictive validity.

Originally the test took 45 minutes, and has now been evolved to just five minutes in Neurapulse. This enables high-frequency testing that was previously infeasible.



Above - Decrease of test time between generations.

Timeline

Data Collection

To date, Impirica has conducted over 200,000 cognitive driving risk assessments across its products, including thousands of Neurapulse tests on mobile devices. This large dataset powers the design and optimization of the Neurapulse's predictive models.

Notable Research Findings

Key academic studies validating Impirica's approach include:

- Developing a standardized on road test — a critical part of understanding a ground truth for driving safety — and establishing a measure of real-world driving behavior.
- Initial research demonstrating the ability to distinguish cognitively safe and unsafe drivers.
- Multi-thousand driver studies confirming the ability to predict real-world cognitive risk.
- Post-validation studies replicating the results as the above studies.

Additional Notes

Internal research has also confirmed the core cognitive domains of memory, judgement, reaction time, and fine motor control remain predictive when evolved into the Neurapulse task and mobile form factor.

Development of Neurapulse

Task Selection

Impirica distills the most predictive elements of the first and second generation into its flagship test. The tasks used in Neurapulse preserve measurement of the important domains - reaction time, memory, judgment, and fine motor control - in a tightly controlled, scientific design. Its data capture methods provide insight into cognitive performance via high throughput touch data.

Optimization for Mobile

Neurapulse has been incrementally refined, maximizing visual clarity and ease-of-use on smartphone screens. Each generation of test has been optimized and tested for its form factor, making sure it can be relied on.

Self-Administration

Neurapulse is a self-administered assessment, allowing drivers to test themselves on their personal device without direct supervision. It ensures test authenticity and device compatibility. This unlocks driver risk testing at scale and avoids overburdening managers.

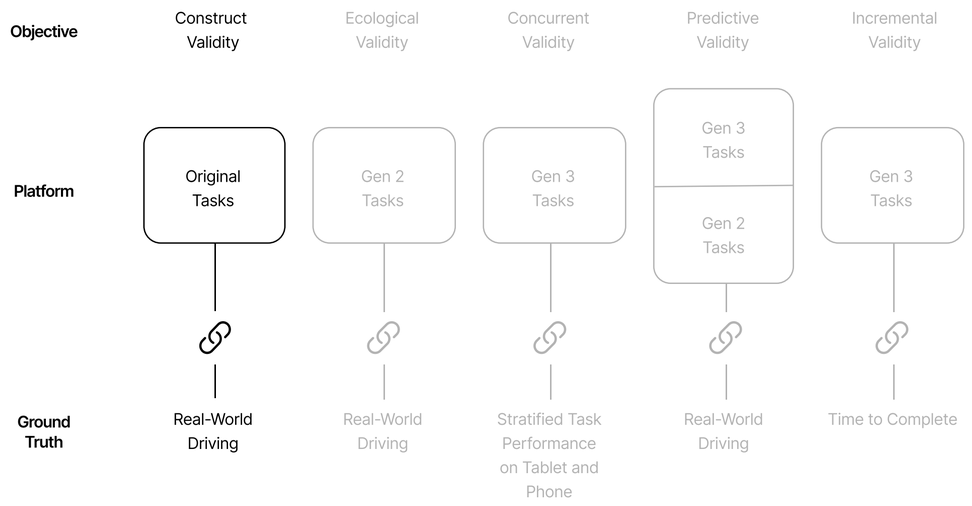
Technical Validation

In its development, key aspects of Neurapulse's validity have been controlled. The Neurapulse task -- an extension of the Trails A/B task -- measures the cognitive domains relevant to driving risk that are most relevant and predictable. It includes reaction time, judgement, memory, and fine motor control.

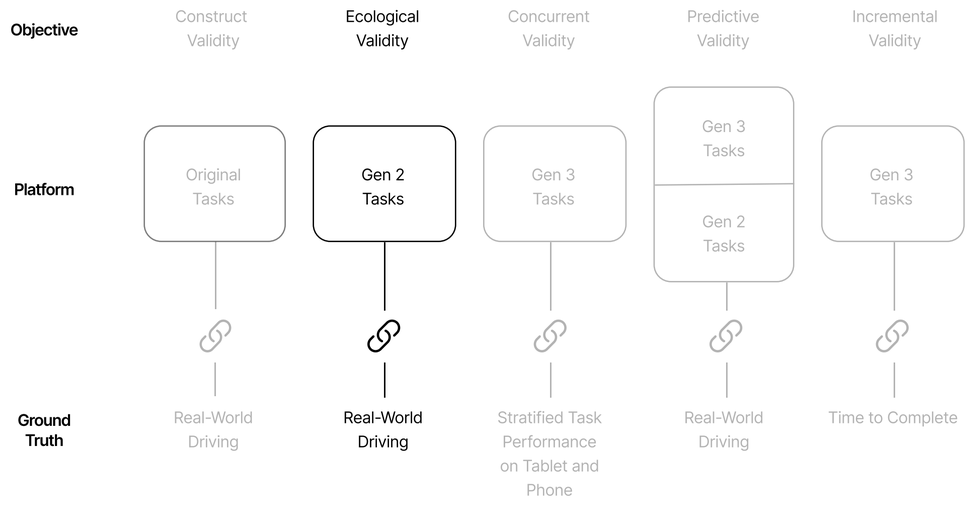
Neurapulse enhances its task with continuous touch data capture, providing deeper insights into cognitive performance. This increases the predictive power beyond classical measures that include total time, and incremental validity in assessing driving risk. To enhance accessibility and reduce potential cultural biases, the task was modified to use single-digit and double-digit numbers instead of the traditional letter-number combination in the Trails B task. Testing with a research team from the University of Alberta confirmed no important difference in difficulty or validity between these versions. The assessment underwent comprehensive testing across stratified samples of tablet and mobile device users, accounting for variables such as age and gender. This approach focused on maintaining Neurapulse's robustness across diverse user demographics.

Technical Validation: First Generation

In its first generation, construct validity was a key focus in the assessment's development. Research began at the University of Alberta in 1998 to evaluate the most relevant impaired cognitive functions related to driving safety, using a rigorously designed road course and a computerized touchscreen assessment. It tested critical domains included attention, judgment, flexible thinking, working memory, and fine motor control. From the 45 minute assessment, it could correctly distinguish between safe and unsafe drivers from these cognitive domains. The assessment was useful for medical professionals and licensing authorities that needed to make decisions about continued driving with patients, but could stand to be more accessible.



Above - The first generation supported construct validity, linking driving performance with the risk of cognitive impairment. [2] [3]



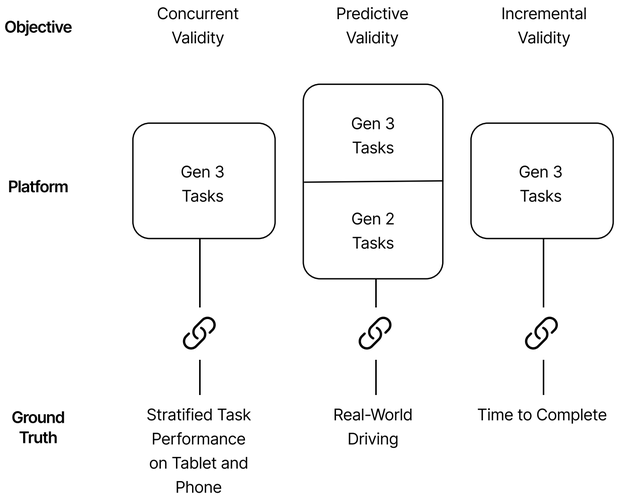
Above - The second generation supported ecological validity, demonstrating the tasks could distinguish safe/unsafe drivers in the general driving population. [1] [4]

Technical Validation: Second Generation

To improve ecological validity, Impirica developed an easier to use tablet form of the assessment -- to demonstrate its ability to generalize to a real-world driving population. This evolution improved the standardization, portability, and simplicity for test takers and evaluators. Impirica completed research of the task's ecological validity in a large populations of drivers and included diverse experience levels and vehicle types.

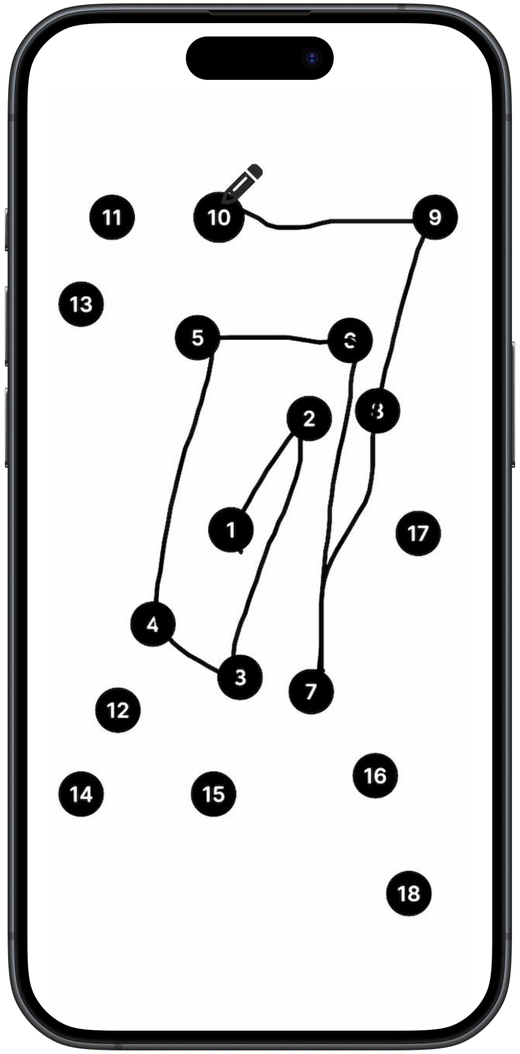
Technical Validation: Third Generation

Neurapulse



Above - The third generation supported incremental and concurrent validity, and was used to predict driving safety parallel to the second generation. Predictive power was sustained with reduced test time.

Right - A screenshot of the Neurapulse test.



Incremental Validity

In 2022, Impirica began task development with a specialized team from the University of Alberta. The work expanded on the platform of well-understood tasks to leverage capabilities from Impirica's previous assessment generations. Neurapulse's current task -- the Mental Flexibility task -- is derivative of this work, and can be deployed to tablet and phone.

Concurrent Validity

To establish concurrent and predictive validity, Neurapulse was integrated into the existing Vitals platform. This integration allowed for direct comparisons with established measures, confirming Neurapulse's alignment with previous generations, and calibrating a predictive model for real-world driving safety. When calibrated to real-world driving outcomes, Neurapulse shows strong correlations both independently and in conjunction with other cognitive domains and can robustly predict risk.

Conclusion: What Neurapulse Means for Your Driver Safety

Neurapulse makes Impirica's predictive power more accessible than ever, enabling driver risk testing at an unprecedented scale and frequency. With mobile-ready cognitive assessments that can be self-administered in 5 minutes, transportation safety managers now have a scalable tool to proactively ensure every driver is fit for duty every day - without compromising validity or the overhead.

Impirica's driver risk models are uniquely grounded in decades of real-world driving research. To learn more about how Neurapulse can transform your driver safety program, visit www.impirica.tech.

References

1. Atkin, A. E., Scott, D., & Singhal, A. (2024). Validating the Vitals assessment: A replication study on cognitive assessments and commercial driving risk. Journal of Transport & Health, 35, 101778.

2. Dobbs, A. R., Heller, R. B., & Schopflocher, D. (1998). A comparative approach to identify unsafe older drivers. Accident Analysis & Prevention, 30(3), 363-370.

3. McCracken, P. N. (2007). The DriveABLE assessment: a review. Can Rev Alzheimer Dis Other Demen, 10(2), 4-7.

4. Scott, D., Atkin, A. E., Granley, A., & Singhal, A. (2023). The utility of cognitive testing to predict real world commercial driving risk. Transportation research interdisciplinary perspectives, 18, 100783.