Efficient test design for biometric exit scenarios.

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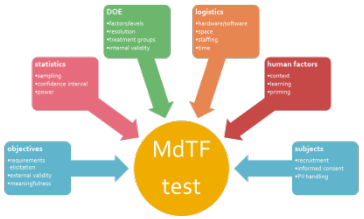
Outline

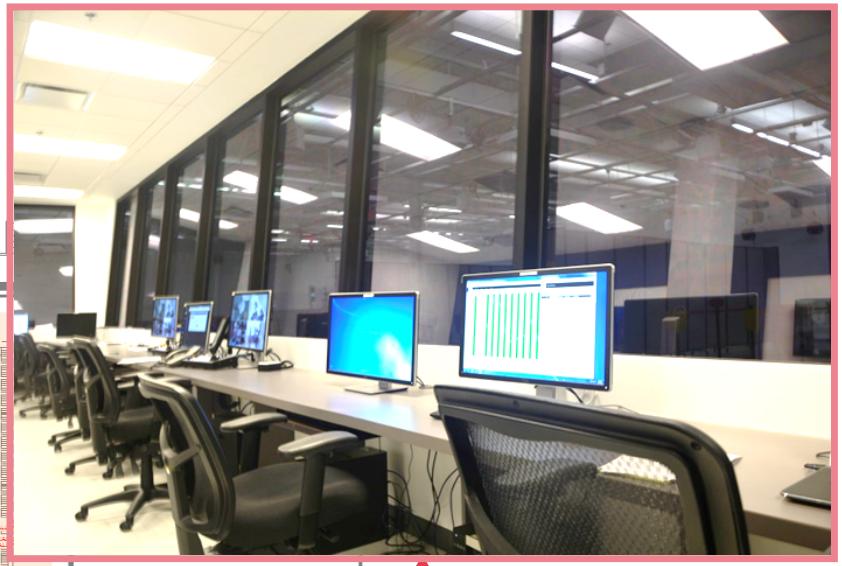
- Maryland Test Facility
  - Facilities and Capabilities

- Test Design Process
  - Balancing multiple requirements and constraints within a single test



The Maryland Test Facility

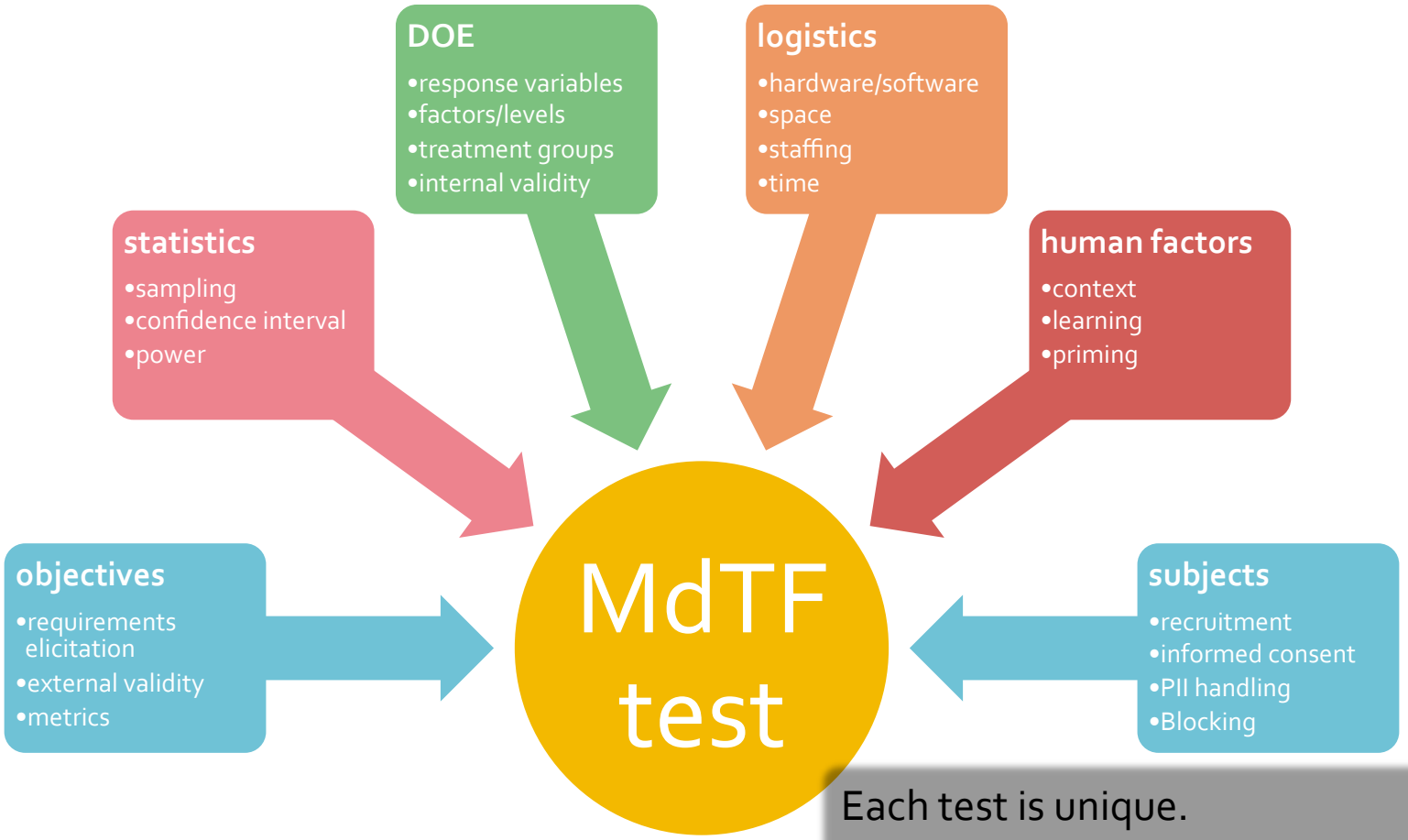
- 20,000+ ft² of office and laboratory space
- Video Recording
  - 16 PTZ and Zoom video cameras
- Eye Tracking
- Environmental sensors
  - ambient light, noise, humidity, …
- Control center
  - real-time monitoring and analysis



The Maryland Test Facility

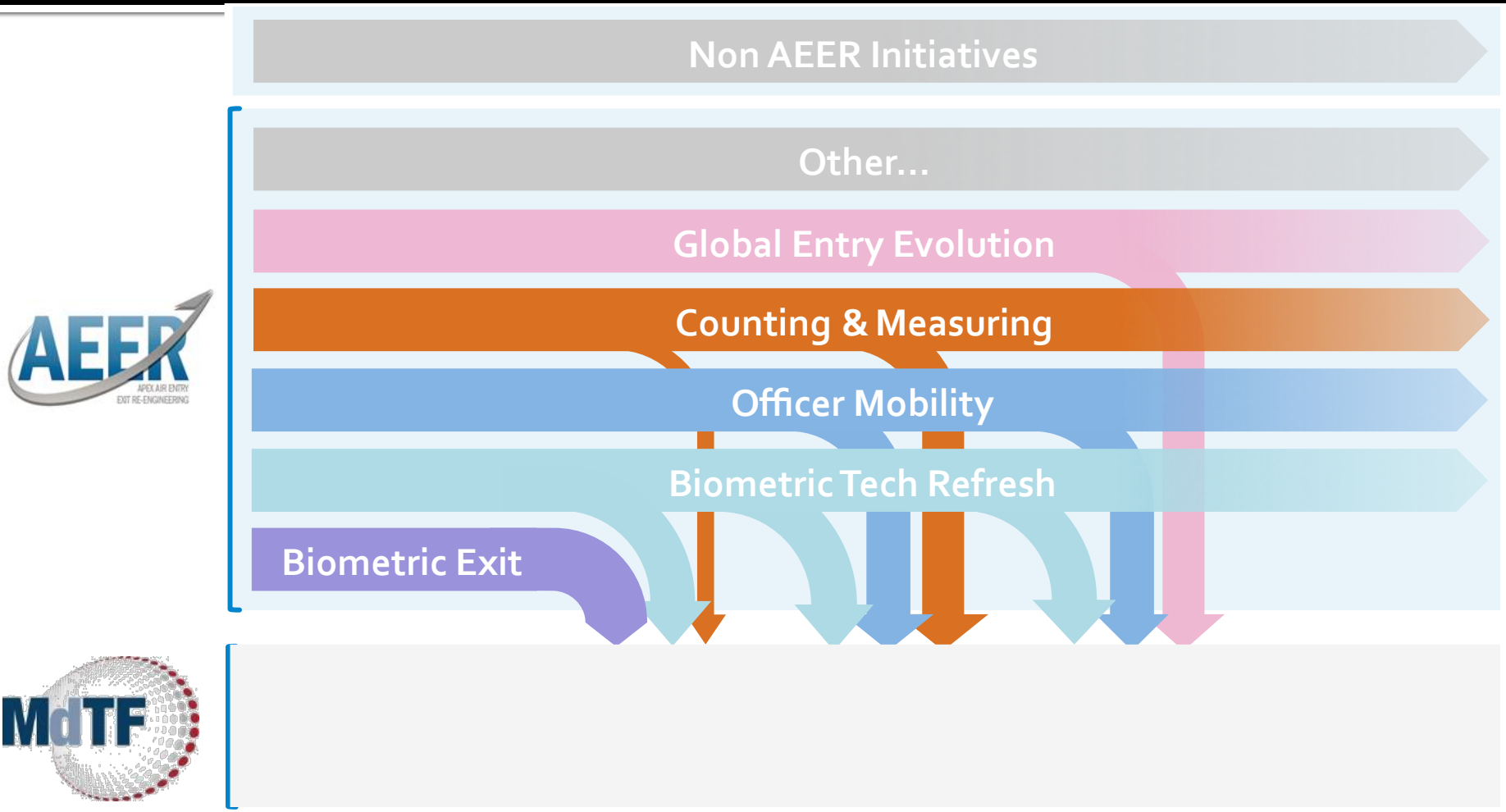
- Private briefing & debriefing rooms
  - Informed consent: closed door, white noise
- Work areas
  - Focus Groups
  - Workshops
  - Training
- Laboratory space

Elements of an MdTF test



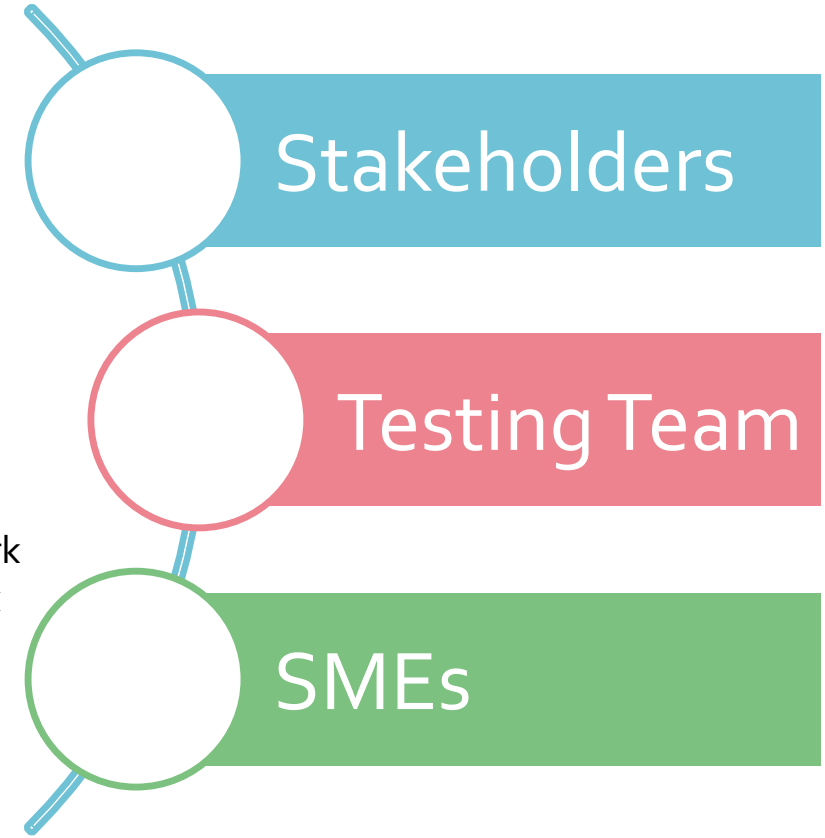
Each test is unique.
There is no common approach that will work for all tests.

MdTF Sequence Testing



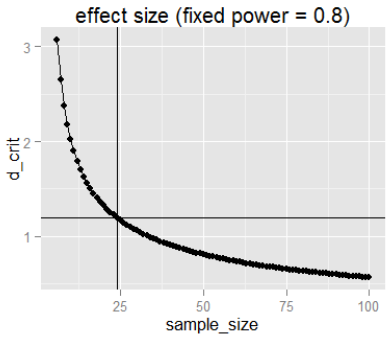
Identifying test objectives

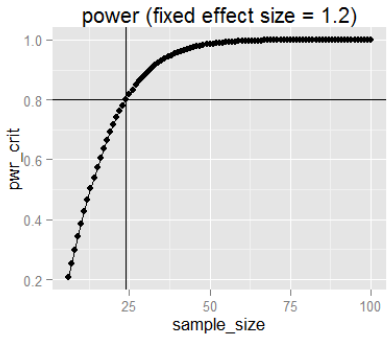
- Why is the test being performed?
  - Single process
    - validation – demonstrate function
    - exploration – identifying important factors
    - benchmarking – compare to specific criteria
    - refinement – identify best factor levels
  - Different processes
    - differentiation – identify differences
    - comparison – compare along specific metrics
- What is the desired outcome?
  - data – obtain specific data
  - knowledge – know why it works / does not work
  - demonstration – can show it can / cannot work
- What will happen as a result of the test?
  - recommendations
  - further analysis
  - down-selection

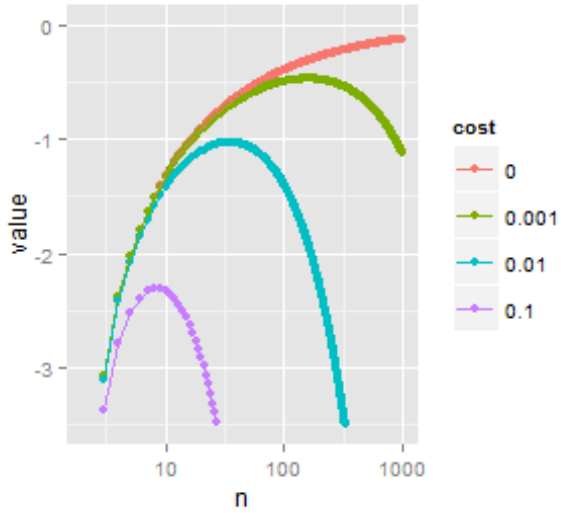


Statistical considerations

- Identify desired effect size (E) or confidence interval
  - Percentage? Benchmark? Critical difference?
- Power
  - Usually ≥ 0.8 (80% chance of detecting effect, when present)
  - Depends on sample size (n) and effect size
- Sample size
  - **Ideal world:** Sample size determined from power and effect size
  - **Reality:** Sample size drives cost (C = **$** & **t**), tradeoff depends on test objectives
- Test Value = -[E(n) + C(n)]





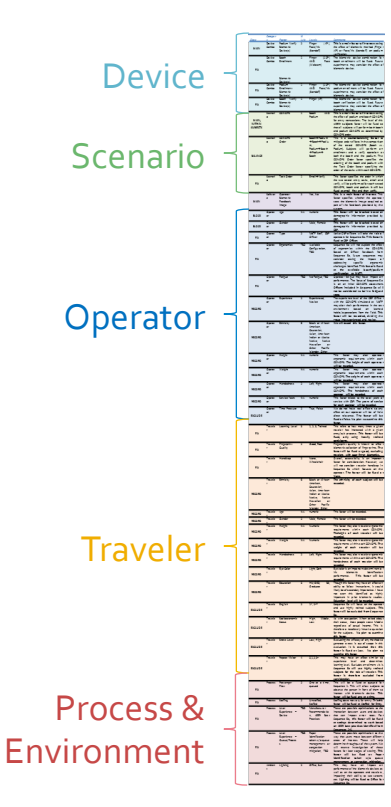


Note: cost function need not be linear and may have discontinuities, but good to be aware of ballpark when scoping the test.

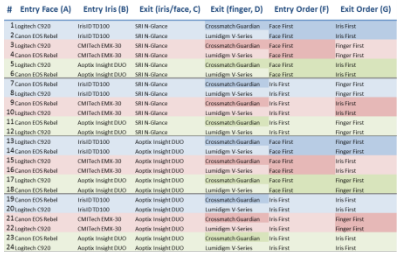
Design of Experiments

- Formalize response variables
  - E.g. Timing, performance, user feedback
- Identify factors and levels.
  - Build factor list (use stakeholders & SMEs)
  - Identify factor categories:
    - Device, Scenario, Operator, Subject, Process, Environment
  - Identify manipulated, fixed, or blocked factors
  - Do once and use many times
- We often include counterbalancing factors.
- Can everything be tested at once?
  - Treatment = tested factor/level combination
  - Use fractional factorial designs to reduce number of treatments needed
  - Use separate sub-experiments to reduce design complexity

Factors/Levels

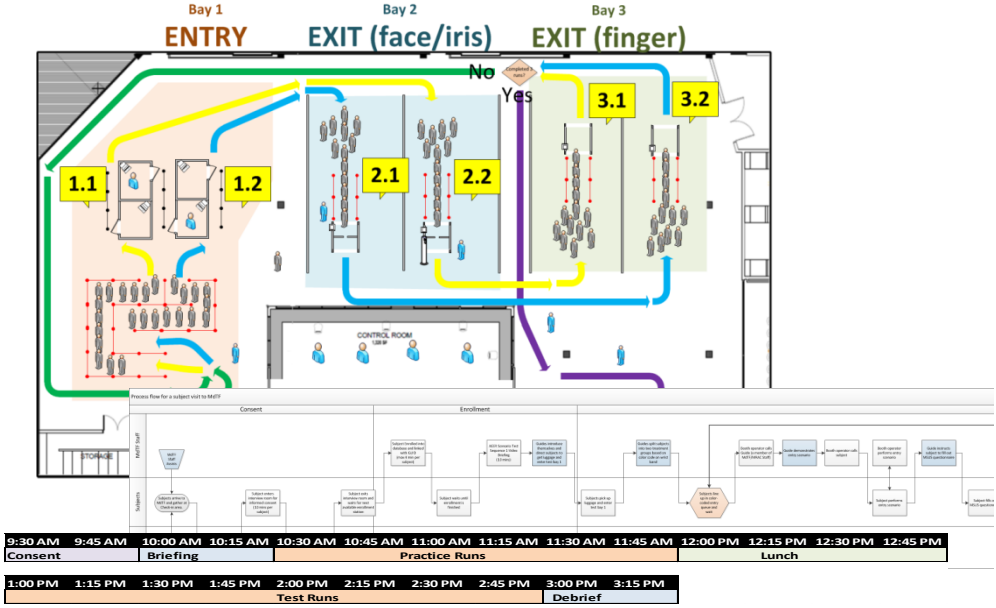


Treatments



Planning Logistics

- Space and movement
  - Facility layout
  - Movement plan
  - Process flowchart
- Time budget
  - Estimate time for each activity
    - Informed Consent, Transactions, Surveys, etc.
  - Generate test day schedule
- Time reduction through parallelization
  - Cost: more complex movements
- Staffing
  - Define test staff roles
  - Create and execute staff training sessions
  - Conduct walkthroughs
- Hardware/software
  - Build required test hardware
  - Design required test software
  - Test hardware + software



Human Factors Considerations

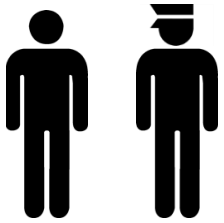
- Context
  - Video orientation / PPT Briefing
  - Context-appropriate props
    - Booths, podiums, stanchions, baggage, etc…
  - Scripted interactions
- Learning
  - Assess learning using repeated transactions
  - Mitigate learning via practice sessions
  - Simulate state of target population
    - E.g. 56% of travelers have not previously been to US
- Priming
  - Avoid pre exposure to test system
  - E.g. acquire iris images for ground-truth using non-tested collection method
  - Avoid testing multiple similar processes in sequence
    - Counterbalancing schemes
    - Make factor between subjects instead of within subjects
      - Better measure less of what is relevant than more of what is irrelevant

Test Subjects

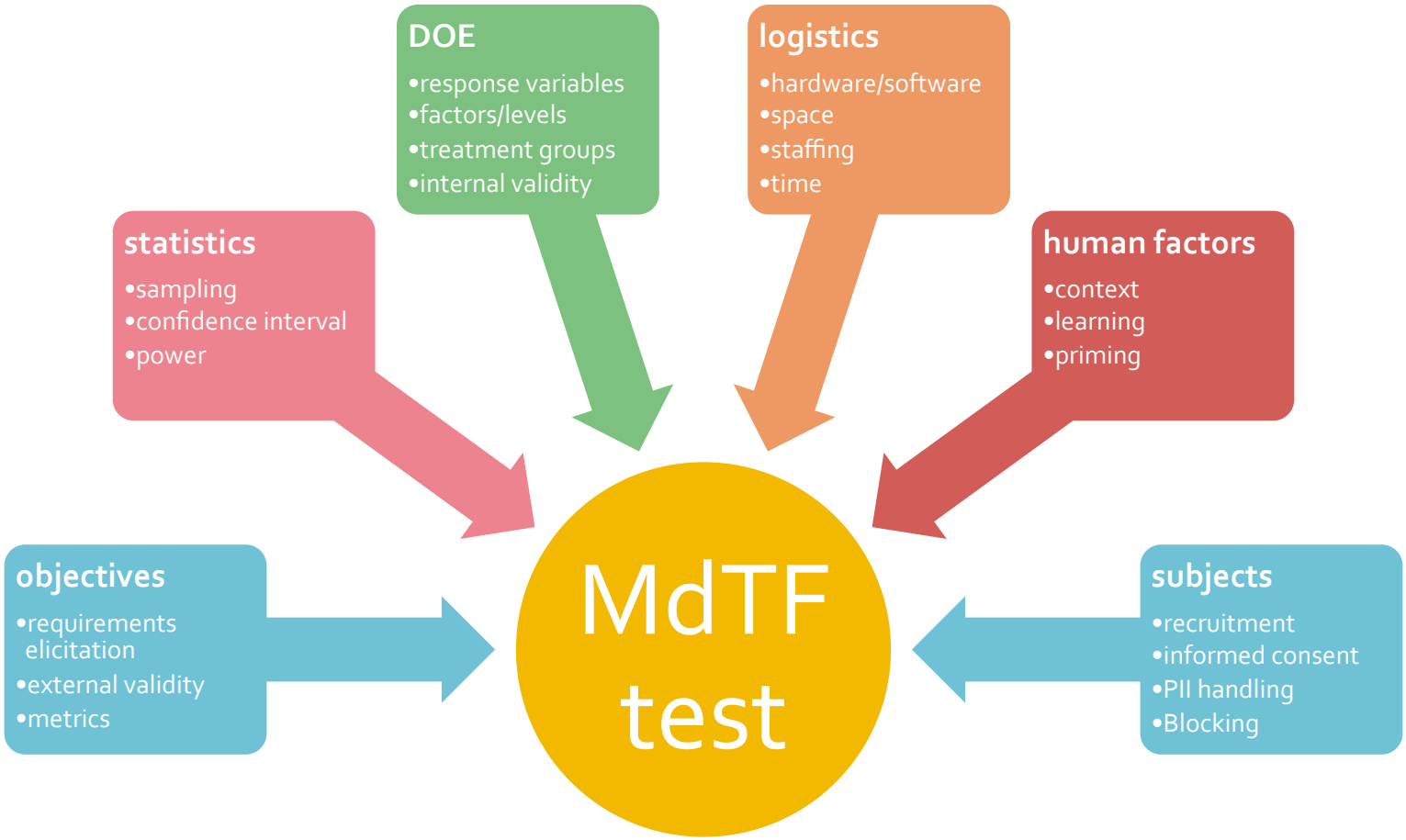
- Identify test population
  - What are the demographics?
  - What do the subjects know about the tested process?

- Develop blocks
  - Amount of stratification depends on block group size
  - Identify factors for blocking
    - May need to down-select based on importance
      - Age, gender, eye color, experience level, etc…
    - We typically block on no more than 3-4 factors for group size ~30

- Recruiting
  - Different populations require different approaches
    - Local population – for public facing devices
    - Professional population – for operator interface design
  - Population depletion?
    - Over time, becomes hard to find naïve subjects



Conclusions



Thank You!

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