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# **Trends and Challenges in Modeling and Simulation**

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## Some on-going & and background work:

- **2 Presentations in China** (Beijing & Changsha): **2011**  
“*Future of Modeling and Simulation: Normative Views, Desirable Growth Areas & Challenges*”
- **An article** (in preparation): **2013**  
*International Journal of Modeling, Simulation, and Scientific Computing* (of the Chinese Association for System Simulation (CASS) by the World Scientific Publishing Co. China
- **S/G special issue** (Ören & Yilmaz, editors): **2013**
- **Tuncer Ören’s previous work** (1973-2011)

**He that would perfect his work  
must first sharpen his tools\*.**

Confucius, 551-479 BC

- \* includes M&S theories, methodologies, methods, software environments.

# (1) Tools – A waiting synergy

We have:

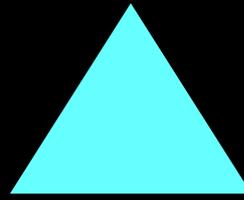
(1) Mobile devices

(mobile simulation )

(2) Cloud computing

for: data, models,  
experimentation scenarios

(cloud simulation)



(3) e-glass

for visualization

# (1) Tools:

- Mobile simulation
- Cloud simulation (cloud computing for: data, models, experimentation scenarios)
  - (multi) e-glass visualization

➔ **Ubiquitous simulation**

- for augmented reality but not limited to it
- for 3 aspects of simulation:

*experimentation*

*experience for:*

*training entertainment*

## (2) Tools:

- **Comprehensive model bases** (as repository of knowledge generation (predictive) knowledge – as opposed to descriptive knowledge)
- Models expressed in **high-level specification languages** – as opposed to mere programming languages)
- If a domain expert needs programming knowledge to understand a simulation model, the specification language lacks descriptive power.

### (3) Methodology:

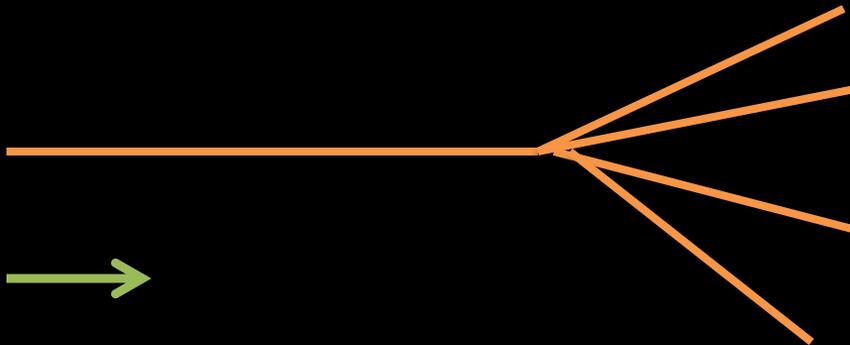
#### → **Multisimulation**

(ability to simulate several aspects of reality concurrently )

Consider yourself :

(1) at a cross road &

(2) experiencing “n” separate journeys simultaneously



## (4) Methodology – (**predictive displays**):

- Two analogies:
  - What can go wrong in a *car* or *airplane* without any instrument?
- Would you be comfortable travelling this way?

Displays can also be **predictive**,  
e.g., distance you can travel with remaining gas

Or time left for the bankruptcy of a country under existing fiscal policy.

**New social metrics are urgently needed!**

**(In 2012):**

**Some complex social systems  
are crumbling miserably  
under current practice.**

# Methodology:

**As simulationists, we can think** about the possibilities **we can offer** with:

- Simulation-based **predictive displays**
- Multisimulation-based **predictive displays**

**Hope one day,  
similar to training of pilots on simulators,  
education/training of public decision makers  
(including those at the highest levels)  
will include experience with predictive displays  
based on simulation and multisimulation.**

**Otherwise, national and international  
systems may continue to fail miserably,  
while the decision makers **gain experience  
on the job!****

Please remember history of dentistry:  
Centuries ago, monks and barbers used to  
work as “dentists”.

I hope that *statesmanship* will one day start  
emulating the maturity process of dentistry.

## (5) Realization of the Importance of Modeling & Simulation

- USA

**is the leader to declare the vital importance of M&S**

- China

**acknowledges the importance of M&S**

## **(5) Realization of the Importance of Modeling & Simulation**

### **European Union**

- I strongly believe that **official declaration of modeling and simulation** as a critical area in EU can be beneficial for every nation involved;
- and hope that this declaration will be done **soon**.
- **(I salute the leader:**  
an individual / group / nation / community within EU who will realize this.)



Thank you for your attention!