2017
annual INCOSE
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Los Angeles, CA, USA
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Working Group on

Human-Systems Integration

www.incose.org/IW2017

Agenda: January 2017

- Saturday
  - 10-12: Introduction
  - 14-18: Status of HSI
- Sunday
  - 13-18: Terminological issues & perspectives
- Tuesday
  - 10-15: Future of HSI

HSIWG

Introduction

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- Purpose
  - Prepare new content for SEBoK and SE Handbook
- Approach
  - HSI = HCD + SE
  - Complex systems
  - Life cycle
  - Human-in-the-loop simulations
  - Creativity
  - Share various HSI cultures worldwide

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- GEM session
  - Define HSI within Systems Engineering
- Negative points
  - HSI not well organized
  - Human component of interactive complex systems not enough considered
  - HIS requires more training in psychology and cognitive science
  - Technology evolves faster than human adaptation
  - HSI for marketing & politics rather than human-centered design
  - Virtual vs. tangible

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- Positive and desirable points
  - Modeling & simulation crucial for HSI
  - HSI involves agile development, formative evaluation and participatory design
  - HSI Architecture
  - HSI: a collection of competencies in SE
  - HSI: a multi-agent endeavor
  - HSI: Safety, efficiency, comfort, security, quality, user experience
  - HSI: HITLS
  - HSI: multi-disciplinary

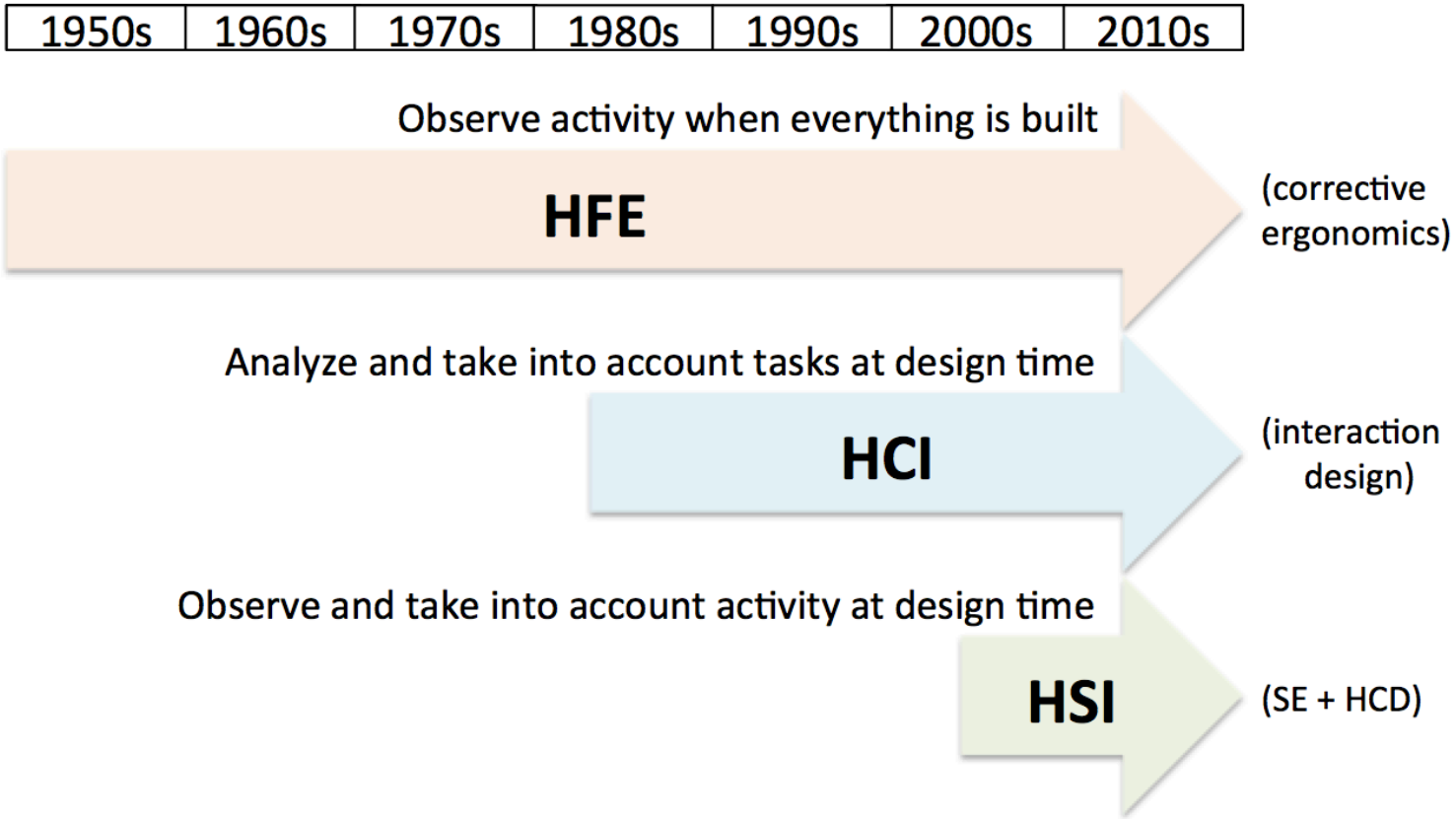
Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- Action items
  - HSIWG should organize task force with mission of studying socio-technical evolution, innovation and other important issues
  - Best practices & lessons learned
  - HSI imbedded in design processes like DNA
  - Make HSI everybody's responsibility (safety, efficiency & comfort)
  - HSI → holistic model for SE
  - HSI guidelines for engineering teams (shared understanding)
  - HSI → design principles and procedures (participatory design, looking for emergence)
  - HSI → universal language across organizations and cultures (ontology)
  - HSI → leading disciplines in SE
  - HSI → risk management
  - Top management trained in HSI
  - HSI introduced in economics
  - HSI through the life cycle of a system
  - HSI → function allocation
  - HSI → visualization

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- Questions
  - What does successful HSI look like?
  - Will HSI need a standardized language throughout industry toward industry standards? Do we need HSI ISO standard? Should we have more standardized processes for HSI?
  - Should we take the risk of inventing a new discipline dealing with complexity instead of consolidating what we already have?
  - Should we see HSI dealing with cooperative systems where machines and people are equally autonomous?
  - Accountability in HSI?
  - Should HSI address climate changes?
  - How can HSI address biomedical systems integration (cyborg)?
  - How can big challenges, such as Mars terraforming, galvanize technological advances?
  - What kinds of HSI tools should be developed commercially?

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)



Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

- Questions
  - HSI semantics?
  - Human-system architect?
  - INCOSE's HSI charter?

Report: HSIWG Workshop at FIT (Oct 4-5, 2016)

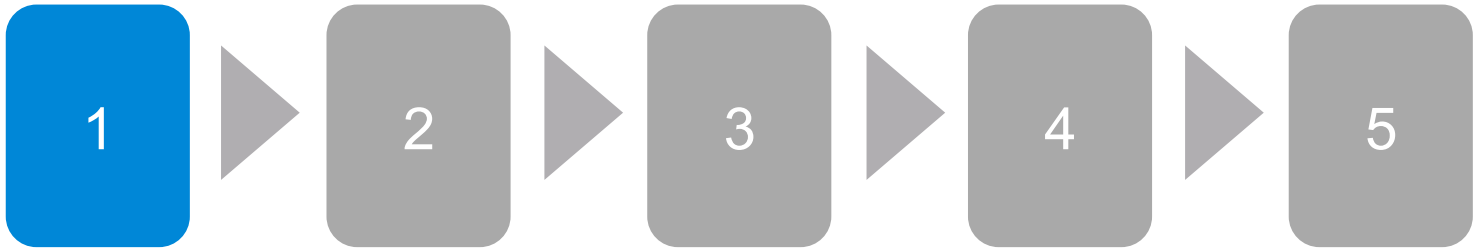
- Action items (short term):
  - Form an active INCOSE HSI steering committee
  - Organize a telecon on November 30, 2016
  - Organize one or several HSI working sessions during INCOSE International Workshop, to be held on January 28-31, 2017, in Torrence, CA.

Logo

HSIWG

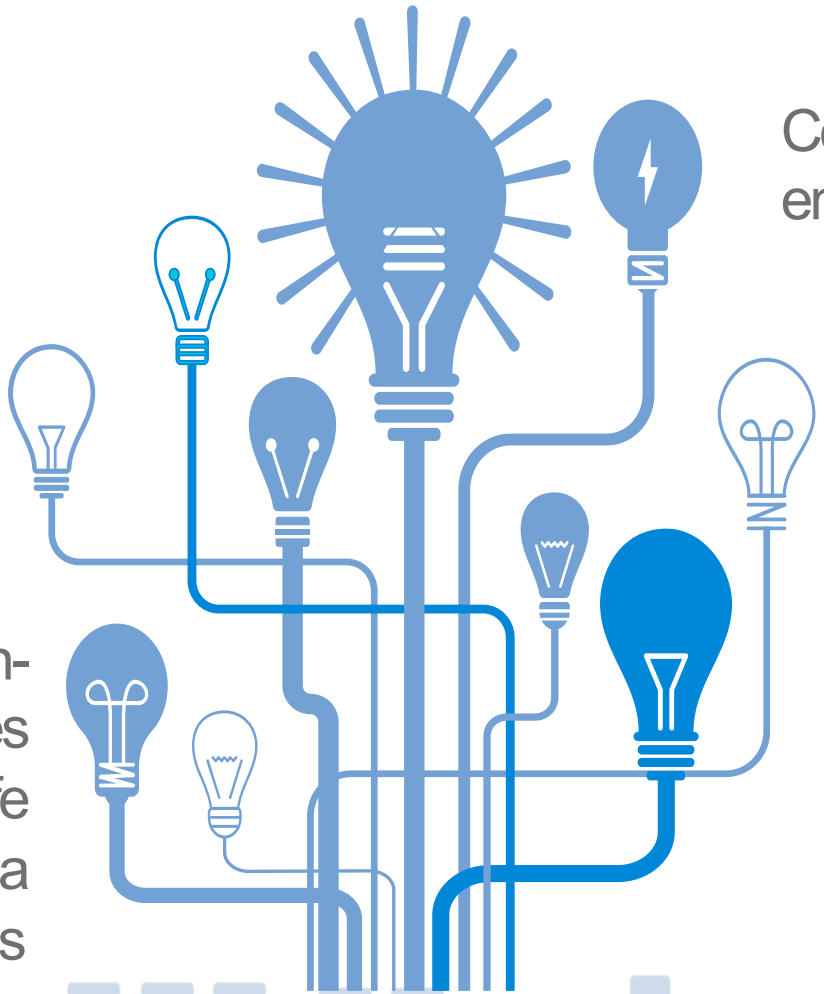
Status of HSI

A sequence for this afternoon (14:00-18:00)



1	2	3	4	5
What is HSI?	A few presentations by HSI WG participants	What is the difference between HFE, HCI, HSI and other human-technology disciplines?	What are the relationships between HSI & other SE disciplines (SoS, agile, systems science, healthcare, MBSE, etc.?	Synthesis and recommendations

What is HSI?



Cognitive engineering

Modeling & Simulation

Technology, Organization & People

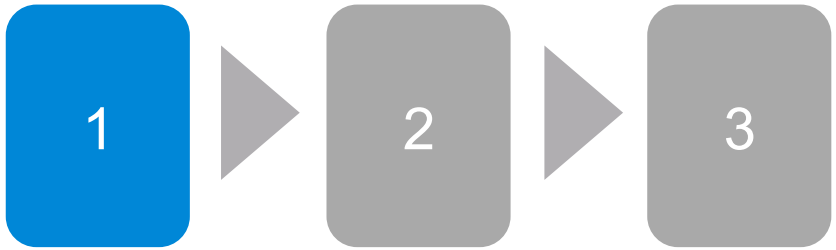
Human-systems issues during the life cycle of a systems

Other things…

HSIWG

Terminology and perspectives

A sequence for this afternoon (13:00-18:00)



Brainstorming on terminology and ontology supporting HSI

Compilation of perspectives on HSI terminology

Definition of a terminology for HSI

Concepts

Human-systems integration
Context
Environment
Maturity
Multi-agent vs. single-agent: social
Integration
Experience
Task
Activity
Goal
Autonomy
Tangibility
Fidelity

This part has been generated during the workshop…

Concepts

Tangibility

- Real, actual, material
- Opposite to imaginary or visionary
- Physical tangibility: touchable, graspable
- Figurative tangibility: acceptability, meaningfulness

Concepts

Fidelity

- Relation to the real world
- Realism
- May take several forms: physical, environmental, software, hardware, etc.
- Realistic scenarios (task fidelity)
- Degree of similarity with real world object, feature or condition (modeling)
- Levels of fidelity with respect to design and development phases
- Appropriateness: levels of abstraction with respect to system (or component) purpose and complexity
- Appropriately documented (e.g., for reuse)
- Fidelity from 3 viewpoints: technology, organization and people

Concepts

Human-systems integration

- Interdisciplinary process (i.e., human and technological sciences together)
- Bring the human in the design process
- Not limited to user interface design
- Considers all stakeholders dealing with technology being developed
- Intent: increase total system performance
- Life cycle framework (i.e., from design to disposal)
- Suggestion: human-centered systems integration or human-centered systems engineering (condition is that SE would be a human-centered integrating discipline)
- The term “system” should be thought as a representation

Concepts

Human-centered design

- ISO: … focuses on usability and HFE
- Technology, organization and people during the whole life cycle of a system
- Design vs. engineering
- Integration of HCD and engineering
- HCD supported by human-in-the-loop modeling and simulation
- HCD supported by complexity analysis and modeling (addressing messy and wicked problems)

Concepts

Complexity

- Problem understanding difficulty
- Difficulty in understanding relationships among component of a system to be designed
- Unpredictable
- Non-linear
- All systems with humans in them are complex adaptive systems
- Emergent properties and behaviors

Concepts

Human-in-the loop simulation

- Fidelity and realism in terms of technology, organization and people
- Enables to consider human factors at design time by observing activity
- Separability issue

Concepts

Activity

- Set of actions effectively executed
- Result of the application of a function executing a task

Concepts

Goal

- End state that needs to be achieved
- Can be decomposed into sub-goals
- ISO 9241-11: intended outcome

Concepts

Function

- Role of an agent
- A system outcomes which contribute to goals or objectives.
- To have a function, a system must be able to provide the outcome through two or more different combinations of elemental behavior. (Ackoff 1971)
- An action, a task, or an activity performed to achieve a desired outcome. (Hitchins 2007)
- A broad work area encompassing multiple related disciplines (e.g., Engineering, Finance, Human Resources, etc.). (Created for SEBoK)
- A function is defined by the transformation of input flows to output flows, with defined performance. (Created for SEBoK)

Concepts

Task

- Prescribed set of actions
- To achieve a goal
- ISO 9241-11 (1998)

Concepts

Competency of the design team

- Designing for idiots versus designing for experts
- Risk taking and management
- Human errors and human engagement

Concepts

User experience

- ISO 9241
- Should be measurable
- Needs to be better defined

Concepts

Integration (human-centered)

- Structure and function (ontology)
- Intentional and reactive behavior
- Function allocation
- Architecture
- Where in the life cycle
- Minimalism, seamlessness, noise reduction, value added

Concepts

Multi-agent vs. single-agent: social dimension

- Systems of systems
- Types and locus of control (hierarchical, heterarchical)
- Centralized versus distributed organizations
- Dependency versus autonomy
- 3C (communication, cooperation, coordination)
- Delegation, authority, responsibility, accountability
- Security
- Common frame of reference (language)
- Knowledge management

Concepts

Autonomy

- Self direction
- Levels of autonomy
- Autonomy validity boundaries (constraints)
- Coordination rules
- External information processing (consciousness and support)

Concepts

Context

- Environmental
- Social and historical
- Normal, abnormal and emergency (nominal and off-nominal)
- Expected versus unexpected
- Operations, maintenance, training, certification, decommissioning, design, manufacturing, etc.
- Culture and education
- Ethical values
- Legal and regulatory
- Economical and business

Concepts

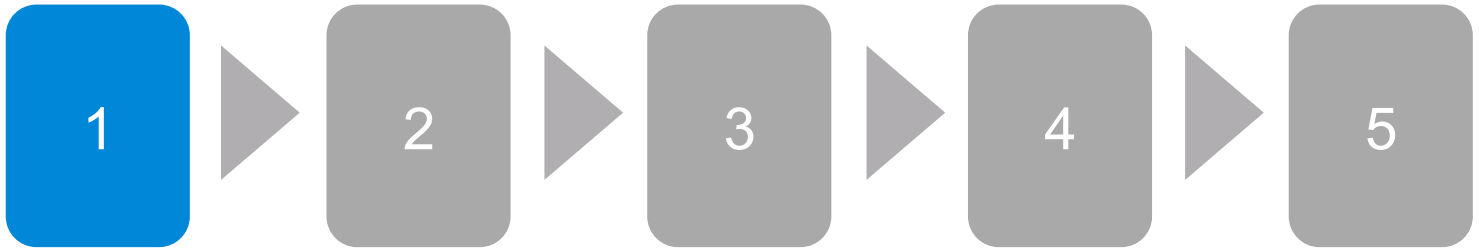
Maturity

- Process-driven (CMMi, TRLs)
- Technology and product (usability, usefulness)
- Culture, practice and training (social and human readiness, ISO 9241/220)

HSIWG

Future of HSI

A sequence for today (10:00-15:00)



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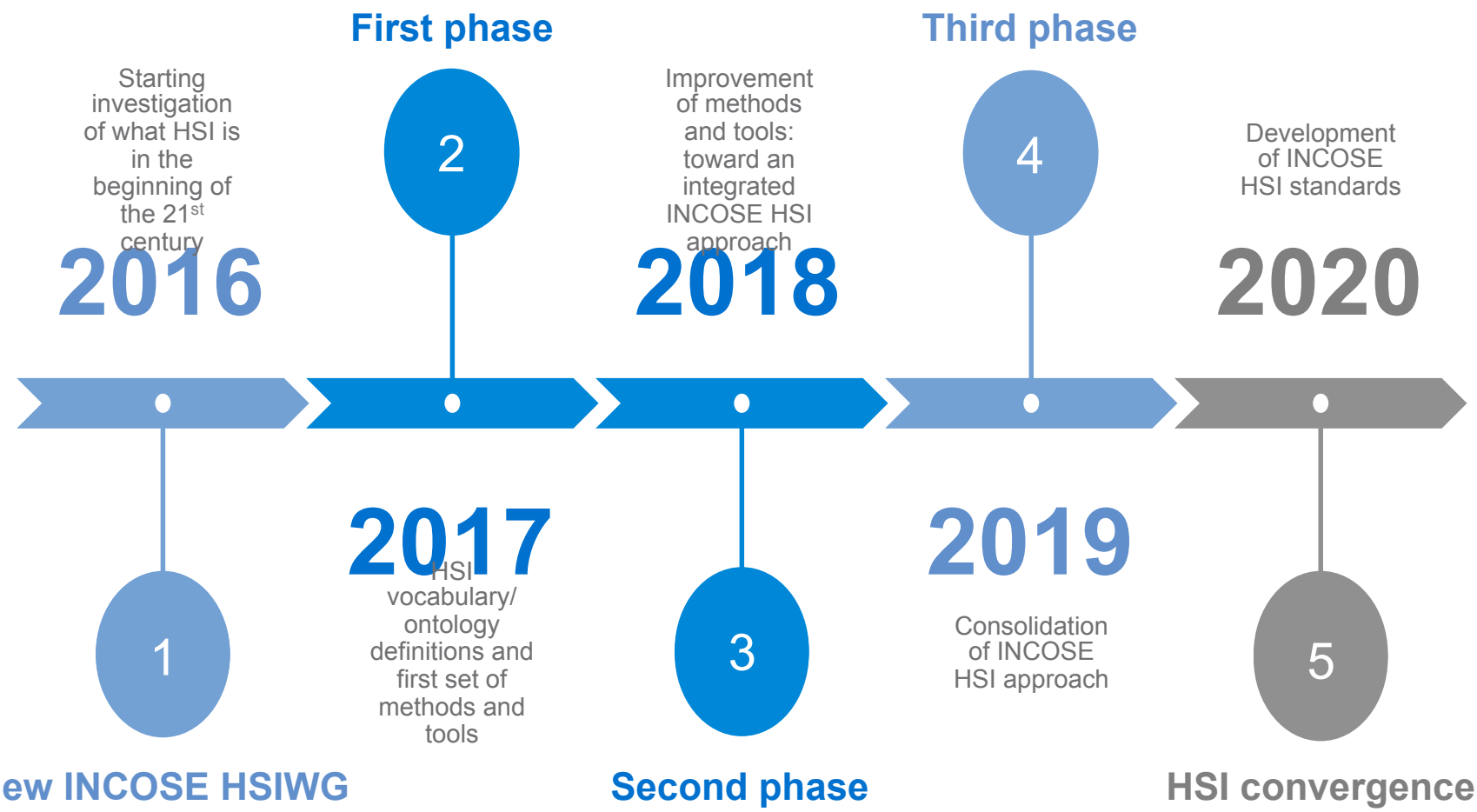
Discussion topics: standardization, innovation, maturity, design, influence of data science, complexity science, organization science, etc.	Short-term HSI issues and action items	Longer-term HSI strategic initiatives	Nomination of a write up committee (for SE-BoK and SE-Handbook)	Wrap-up and decisions

INCOSE HSI Roadmap



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