



- Intelligent/adaptive human-machine interfaces design

- Job design and work organization

4) Regulation, Control and Automation:

- Biocybernetics

- Adaptive automation (or adjustable autonomy)

- Adaptive aiding/assistance

- Dissonance control for human reliability and system resilience (c.f., Vanderhaegen, F. (2017). Towards increased systems resilience: New challenges based on dissonance control for human reliability in Cyber-Physical & Human Systems, Annual Reviews in Control, vol. 44, pp. 316-322).

5) Decision Support/Analysis:

- Decision-making, cognitive processes, and cognitive (neuro)engineering

- Adaptive task/functional allocation

6) Performance Assessment/Evaluation:

- Human operator support and functional state assessment

- human performance assessment

- Human operator selection and training

Have you created/amended your TC website?

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- Address <https://tc.ifac-control.org/4/5/>

List of Working Groups

- Name

- Focus

- Timeline

- Deliverables

Date and Place of Last TC Meeting July 10, 2017, Toulouse, France (during the 20th IFAC World Congress)

Is your TC contributing to a Milestone Report ?

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Congress Year Report only

- Number of Congress Papers Reviewed by TC

About 70 papers reviewed by the TC4.5 for the 2017 IFAC World Congress (Toulouse, FR).

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Events sponsored or co-sponsored by your TC:

The major event sponsored by the TC4.5 is the triennial series IFAC Symposium on Analysis, Design and Evaluation of Human Machine Systems (HMS). The next one, 14th IFAC Symposium on Analysis, Design and Evaluation of Human Machine Systems (HMS 2019), will be held in Tallinn, Estonia, September 16-19, 2019. The application has obtained IFAC approval (email notification from IFAC Secretariat, dated Mar. 12, 2018).

In addition, the following IFAC events are also technically co-sponsored by the TC4.5:

1) 4th IFAC International Conference on Intelligent Control and Automation Science (ICONS), at the end of August 2019. Primary sponsor: TC3.2 on Computational Intelligence

in Control; General Chair: Prof. Seán McLoone, Queen's University Belfast, UK; IPC chair: Thierry Guerra, University of Valenciennes, France.

2) 9th IFAC International Symposium on Advance in Automotive Control (AAC2019), Orleans Conference Center, France, 24 - 27 June 2019. IPC Chair: Lars Eriksson; NOC Vice Chair: Guillaume Collin.

3) 2019 IFAC Workshop on Control of Smart Grid and Renewable Energy Systems (CSGRES 2019), Jeju Island, Korea, June 10 – 12, 2019. Prof Kwang Y. Lee (IEEE Fellow, IFAC TC 6.3 Chair), Baylor University, USA. Primary sponsor: TC 6.3.

4) 18th IFAC Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing, South Africa, 2019. NOC co-chairs: Dr Kevin Brooks, Chief Engineer, Blu ESP (Pty) Ltd.

5) 2nd IFAC Conference on Cyber Physical and Human Systems (CPHS2018), Miami, Florida (USA), Dec 14-15, 2018. IPC Chair: Prof Sandra Hirche, TU Munich, Germany.

6) 12th IFAC Symposium on Robot Control (SYROCO 2018), Budapest, Hungary, August 27-30, 2018.

Plans for TC?

The recent plan is to well publicize and organize the 14th IFAC Symposium on Analysis, Design and Evaluation of Human Machine Systems (HMS 2019), to be held in Tallinn, Estonia, September 16-19, 2019, in order to make it a success.

Another future plan is to organize another Special Issue of CTW to attract the research work of both practitioners and researchers on the topic of Human Performance in Aviation/Transportation, where articles could be provided from air traffic controllers, train drivers, supervisors, human factors consultants, as well as academics, with a particular focus on bridging the research-application gap.

In the long run, the traditional scopes and objectives of the TC will be expanded to reflect the emerging trends in the field and to make the TC more inclusive (e.g., to draw researchers from the fields of neuroscience, neural technology, brain-computer interface, artificial intelligence, and machine learning). On the other hand, the TC newsletter will be released online to inform the human-machine systems community of the latest events and developments in the field.

Problems – especially any that require TB attention?

None.

What is the long-term outlook for the scientific topics of your TC?

*Please describe likely future major developments within the scope of this TC*

We identify the long-term promising topics within the scope of this TC as follows:

- BCI (Brain-Computer Interface)
- Physiological computing and big data analysis
- Cognitive computing/computation
- Adaptive automation (or adjustable autonomy)
- Computational and systems neuroergonomics (a combination of neuroscience and human factors)
- Human-machine collaborative systems and hybrid intelligence
- Cognitive robotics, teleoperation, and human-robot interaction

The above-mentioned topics have become increasingly important in such safety-critical industries as transportation (e.g., intelligent vehicles, electric vehicles, autonomous driving,

aerospace, etc.), national defense and security (e.g. UAVs, autonomous mobile robots, unmanned systems, intelligent autonomous systems, etc.), healthcare (e.g., home and service robots, surgical robots, neural rehabilitation, precision medicine, etc.), precision and smart agriculture, and smart and agile manufacturing (e.g., petrochemical plant, nuclear power plant, etc.).

### **Recommendation**

*Please provide recommendations relevant to TC operation such as potential new Working Groups, recommendations to merge this TC with another TC, new trends within the technical field covered by the TC that suggest future changes in IFAC scope or activities, etc.)*

An outstanding feature of this TC is its cross-disciplinary nature and increasingly important and noticeable role in real-world ubiquitous safety-critical complex systems. We need to expand the traditional scopes of the TC in the future to reflect the latest developments and trends in this broad area. In order to strengthen the visibility and significance of human-machine systems within and beyond the systems and control community, we recommend that the journal *Cognition, Technology & Work* (CTW; Springer; EiC is Prof F. Vanderhaegen, one of the Co-Chairs of the TC4.5) be developed into IFAC-affiliated journal, if possible. Another recommendation is future emphasis on different roles across the scope of this TC. In an attempt to bridge the research-practical application divide which has become apparent sometimes, we recommend to organize conference panels/sessions to encourage the participation of both academics and practitioners in the field.