Multi-user Interface for Co-located Real-time Collaborative Work with Digital Mock-up

Virtual Concept Workshop 2016 Bordeaux, France on 17 - 18, March 2016

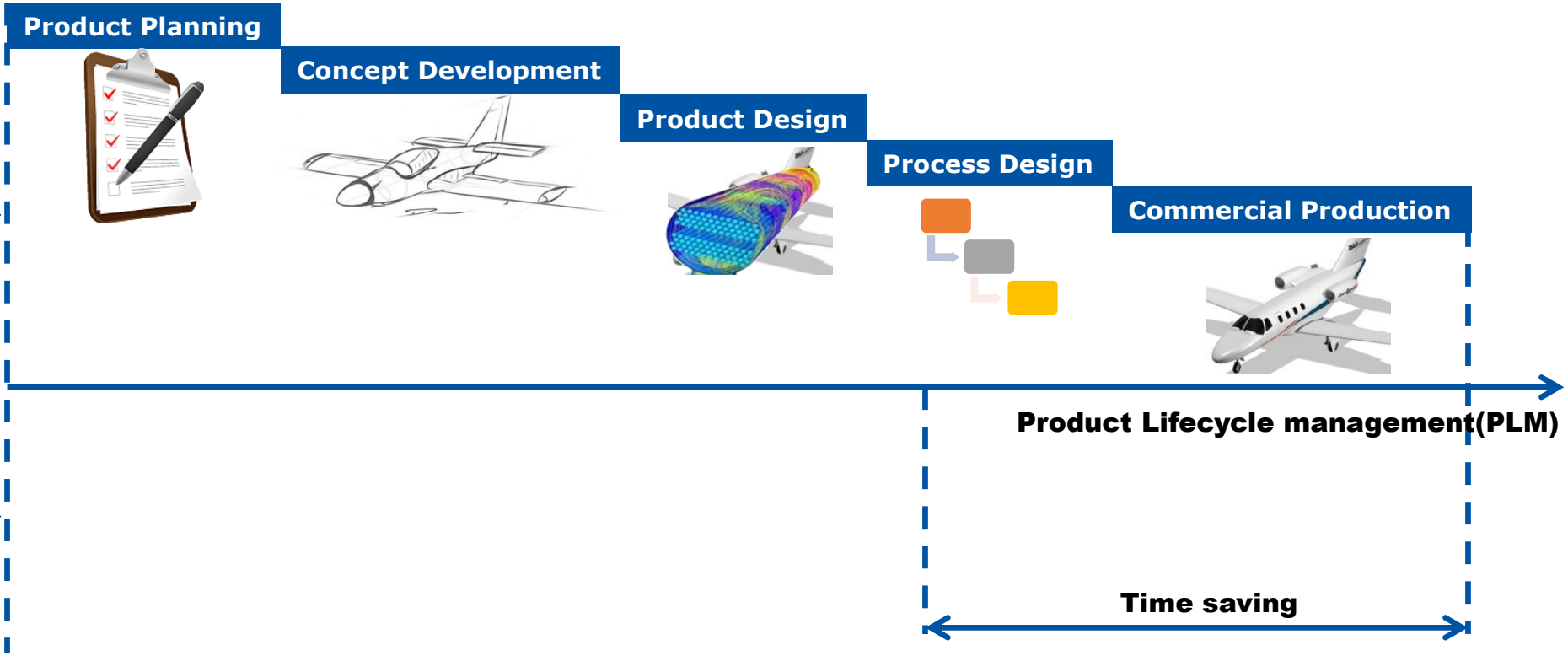
Bo LI, Ruding LOU, Frédéric SEGONDS, Frédéric MERIENNE

BO.LI@ensam.eu

CONTENTS

Concurrent Engineering

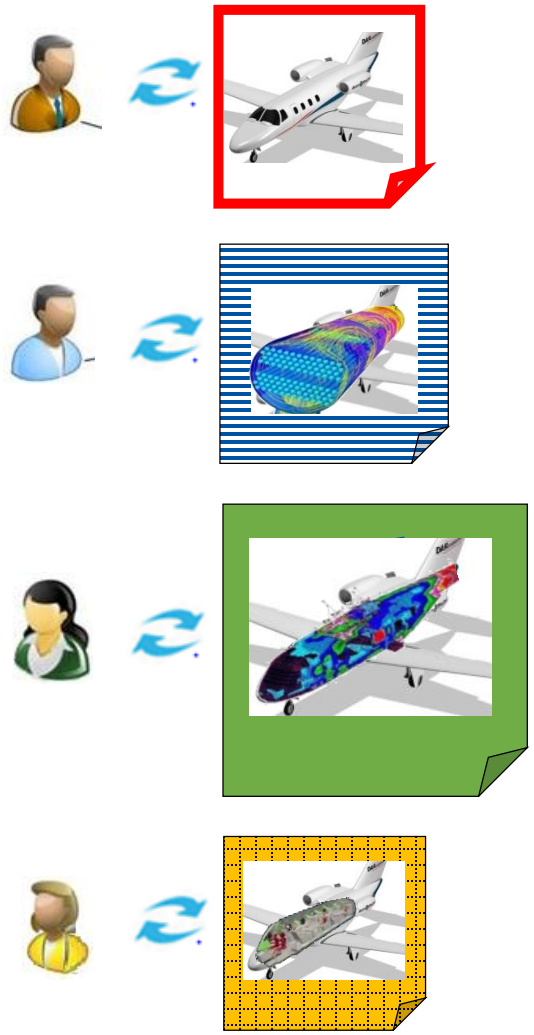
Sequential Engineering



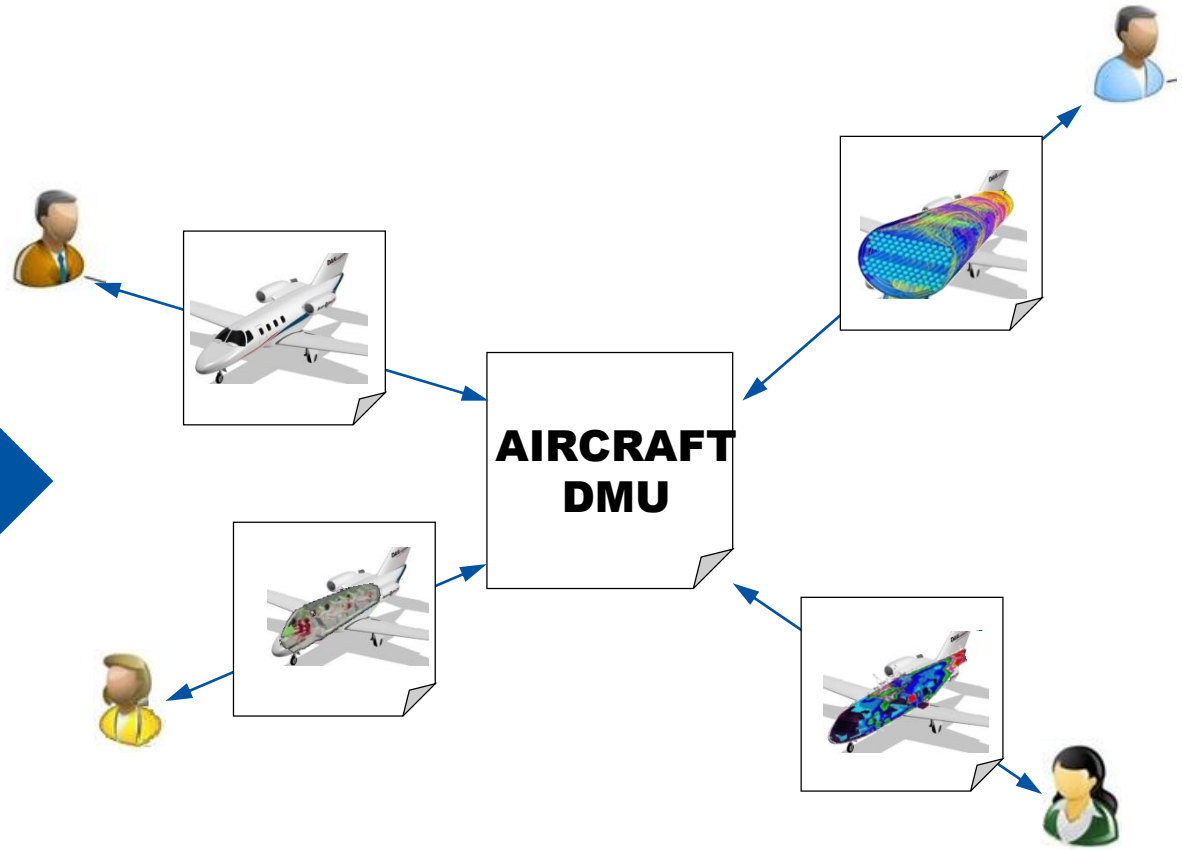
Concurrent Engineering

(Segonds, Nelson et al. 2012)

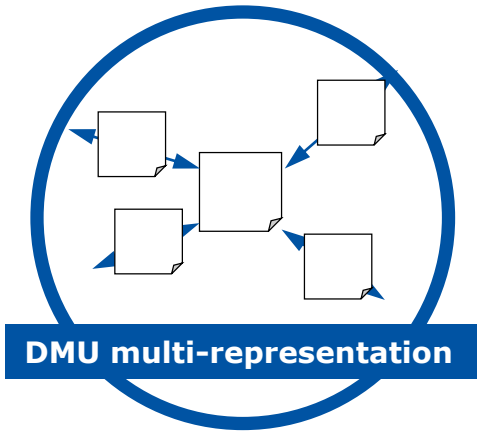
Interoperability



Interoperability

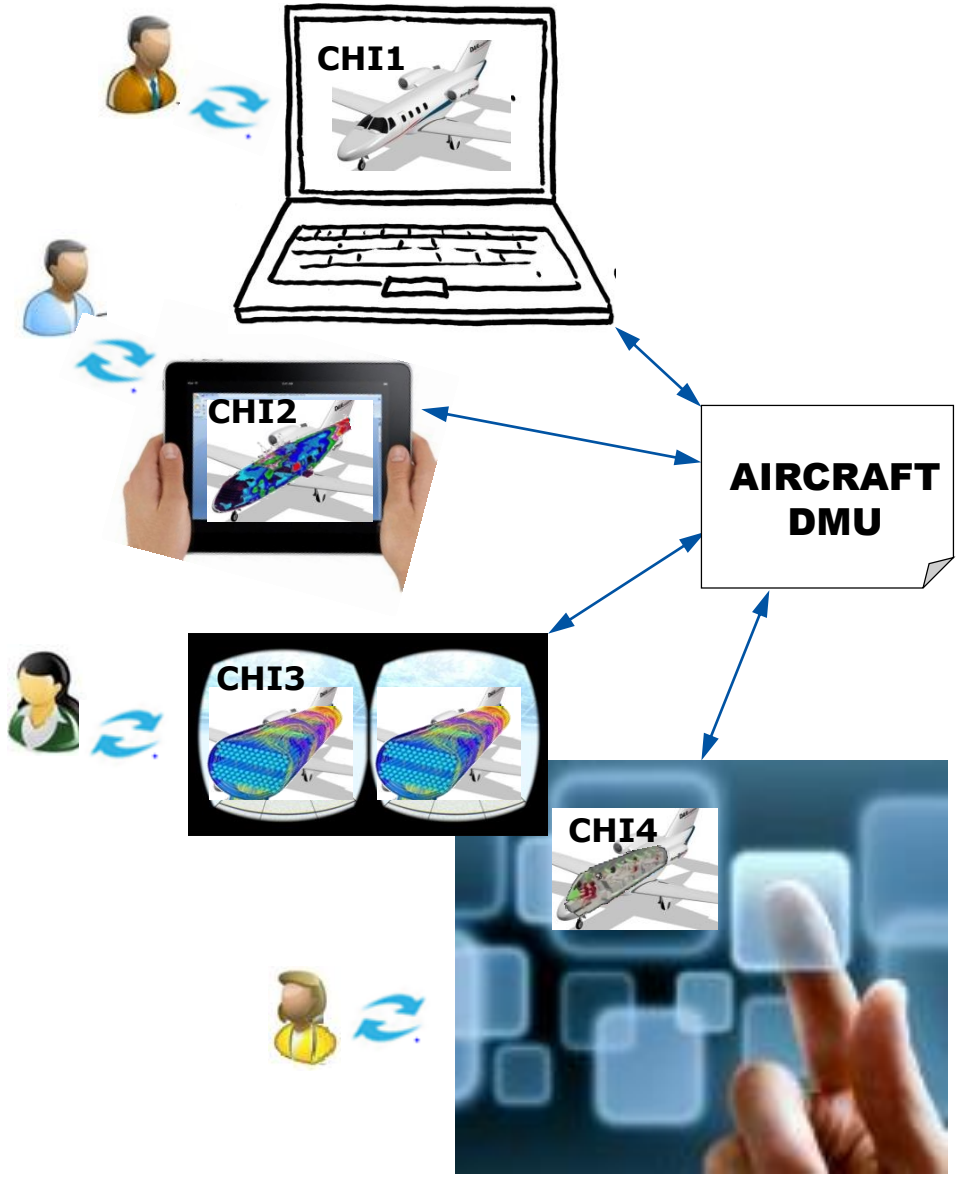


Collaborative work

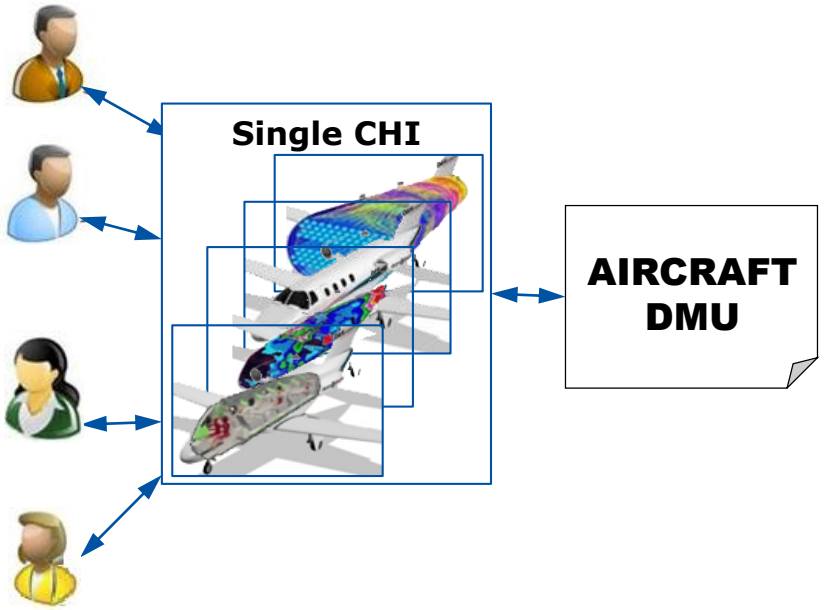


(Johansen 1988)

Scientific issue



Interoperability

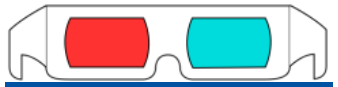


Research question

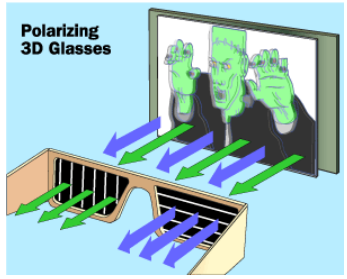
?

A multi-view CHI support system for multiple users could improve the collaborative work efficiency?

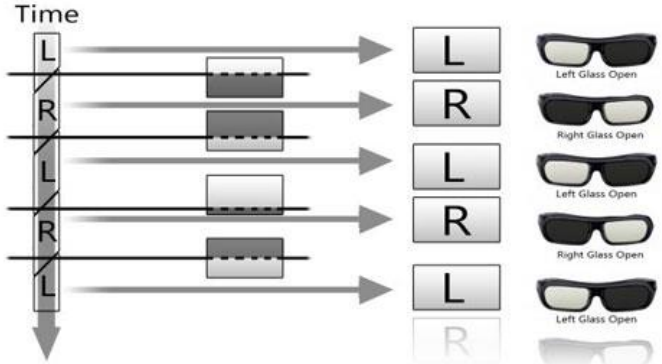
Multi-view Device



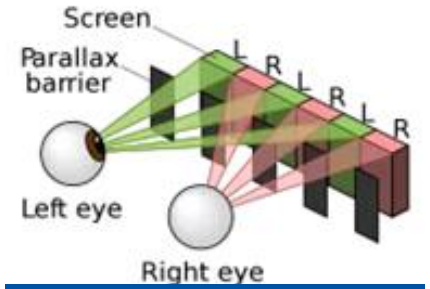
Anaglyph glasses



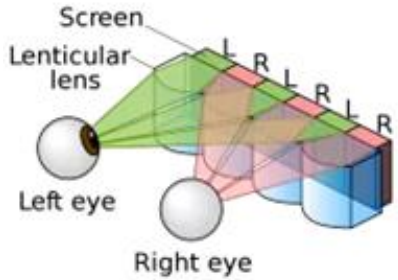
Polarized glasses



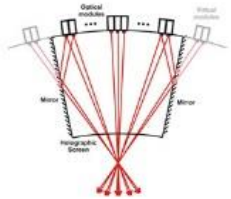
Shutter glasses



Parallax barrier screen



Lenticular lens screen



Holographic

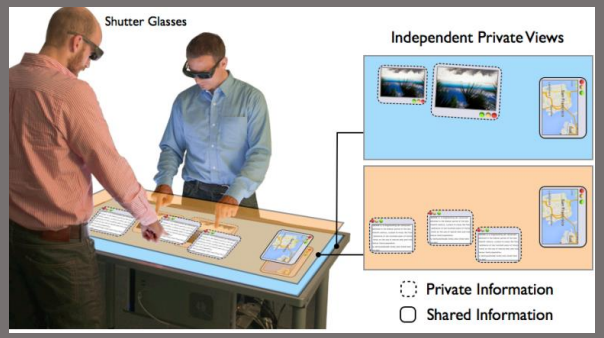
Multi-view Application

A DMU-like collaboration

- Relationships inside and limit by constrains

If change Multi-view system into Seperated Systems, the result is ?

Even better



(LISSERMANN,2014)

The same

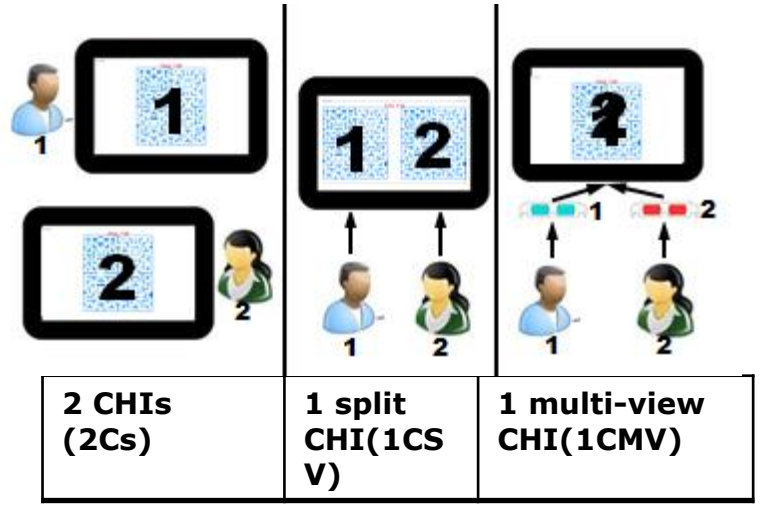
(OLED TV SUMSUNG and Sony Play Station SimulView, 2013)

Others

(NAGANO K. 2010)

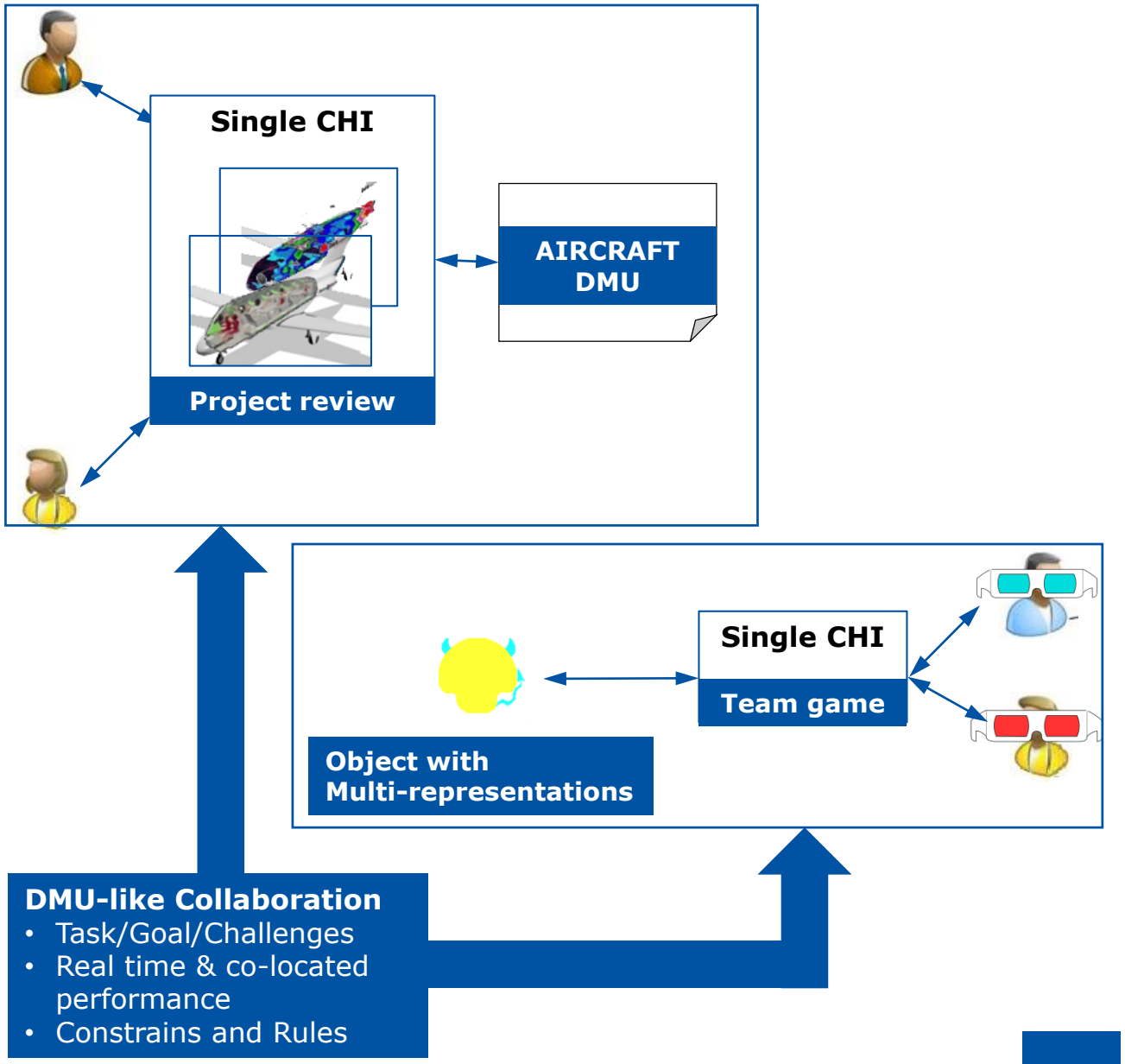
(Seokhwan K,2012)

A quantitative experiment

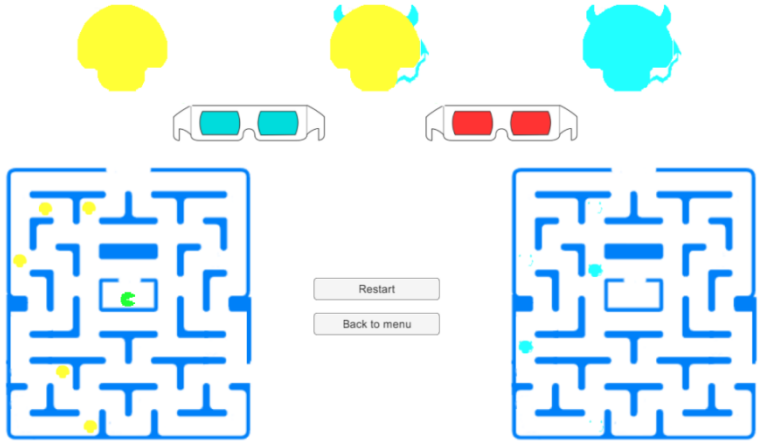


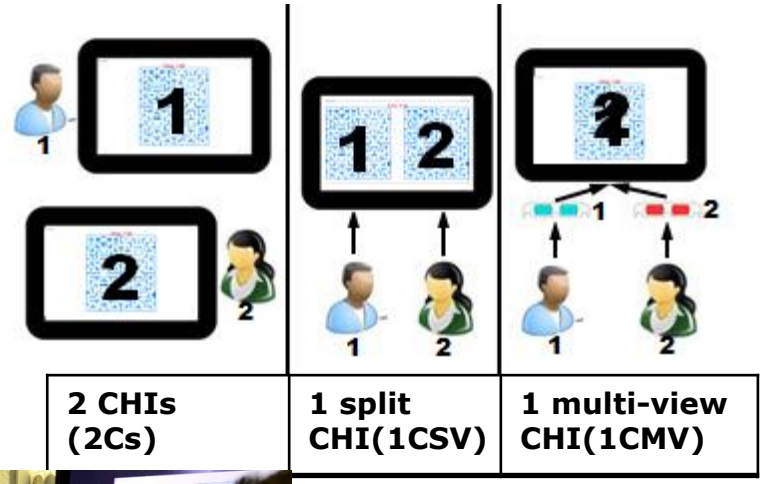
2 CHIs (2Cs)	1 split CHI(1CSV)	1 multi-view CHI(1CMV)

H1: multi-view system provides higher collaboration efficiency.
H2 : the requirement of mutual awareness of where the other's constrains are,
H2.1: for the user who is checking constrains, does considerably vary across the systems (decline when using multi-view CHI than using 2 CHIs or 1 split CHI).
H2.2: for the user who is modifying the application, does not considerably vary across multi-view CHI, 2 CHIs and 1 split CHI.

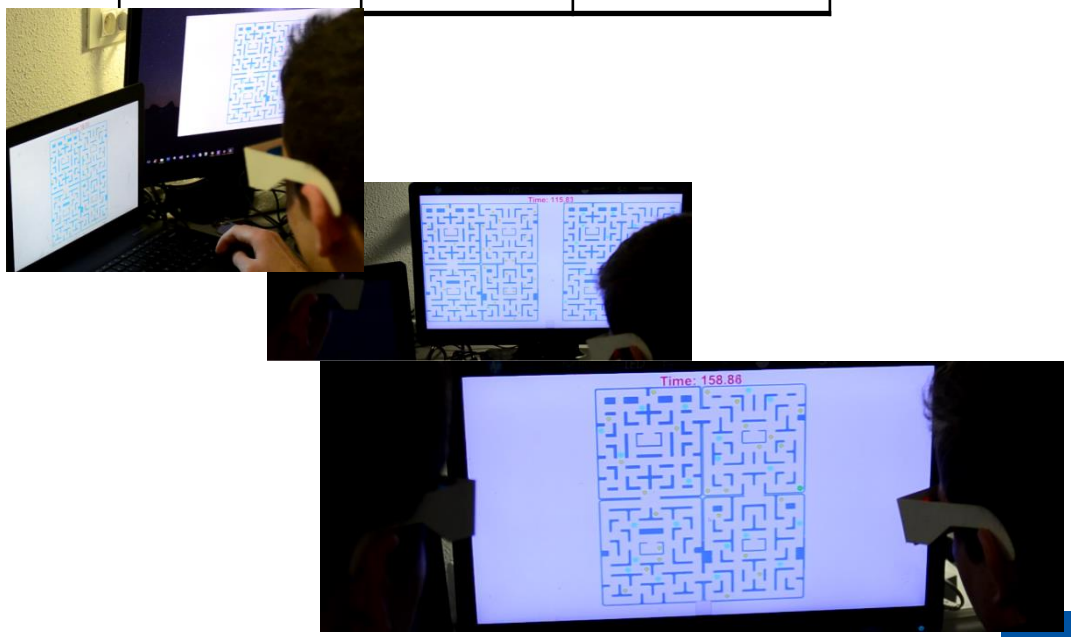


Experiment setup

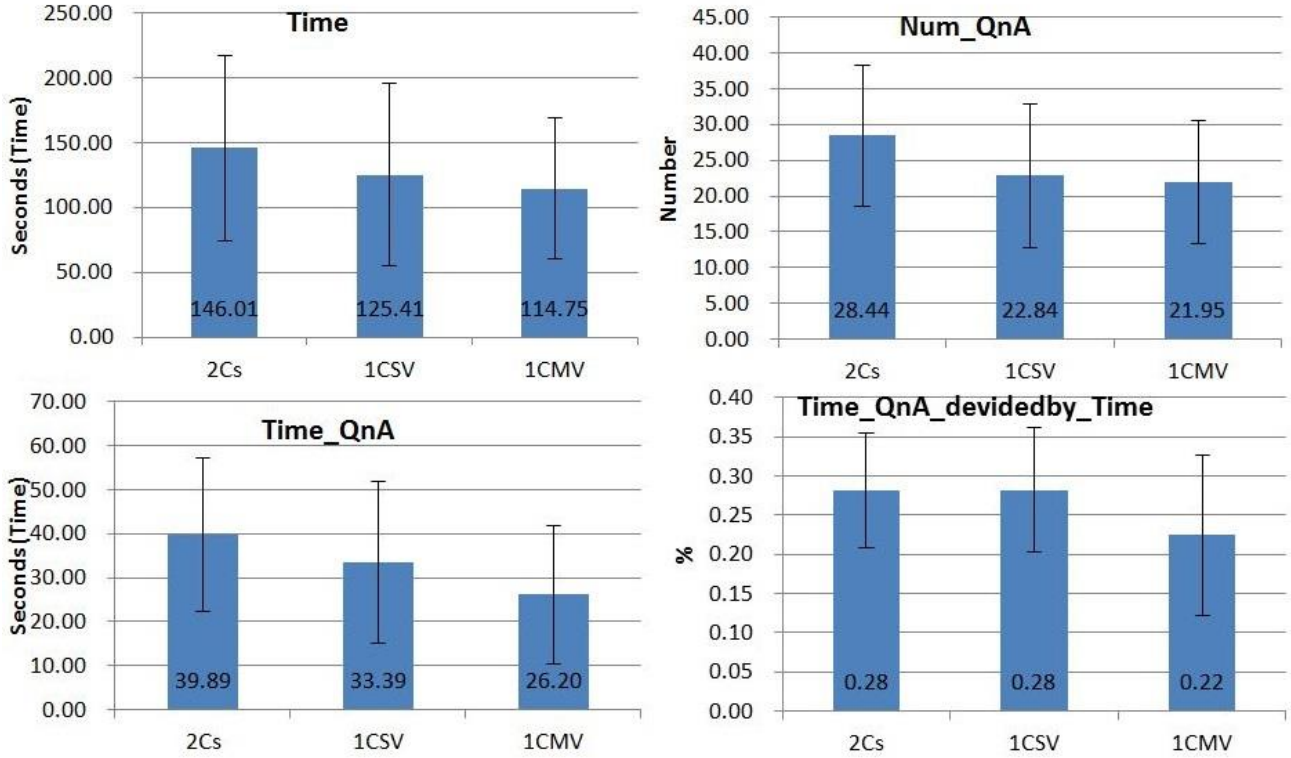




Time	Finish time
Time_QnA	Sum of response time that helper answers player's questions (all the question/answer pairs).
Num_QnA	Number of question/answer pairs
Time_QnA_devidedby_Time	Ratio of communication time to finish time



Experiment results



Users achieve more efficiently the collaborative task using the multi-view system than without it, with less number of communications (H1).

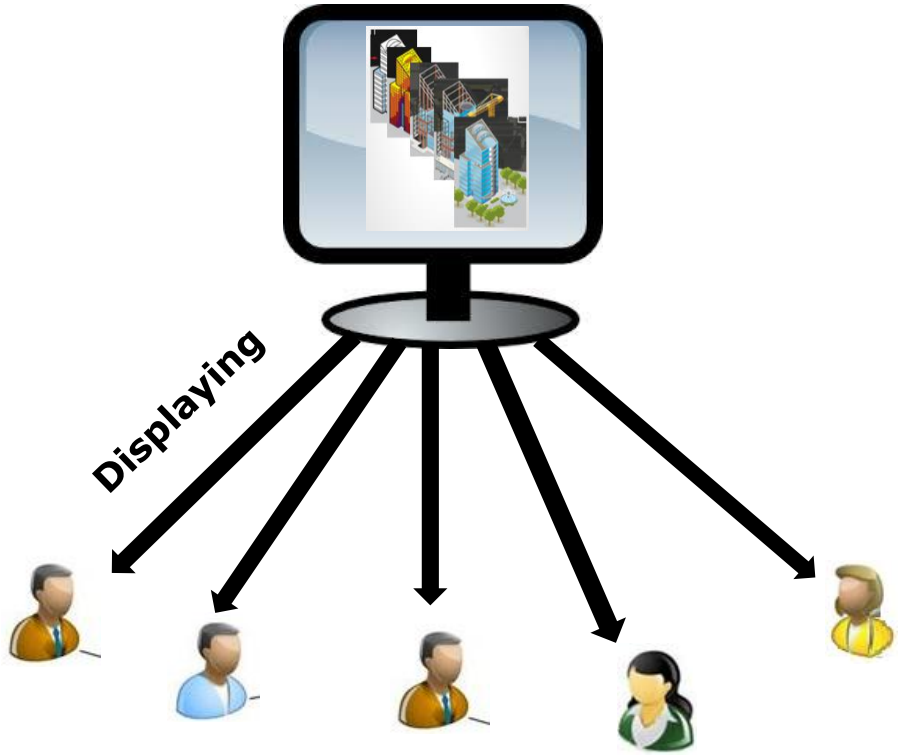
For a player who is always focus on asking questions, the demand of mutual awareness may always keep on a high level (H2.1).

For a helper, he has feeling of different demands of knowing of player's position (H2.2). But this is only significant comparing multi-view CHI to the other two CHIs.

Conclusion

Multi-view CHI system

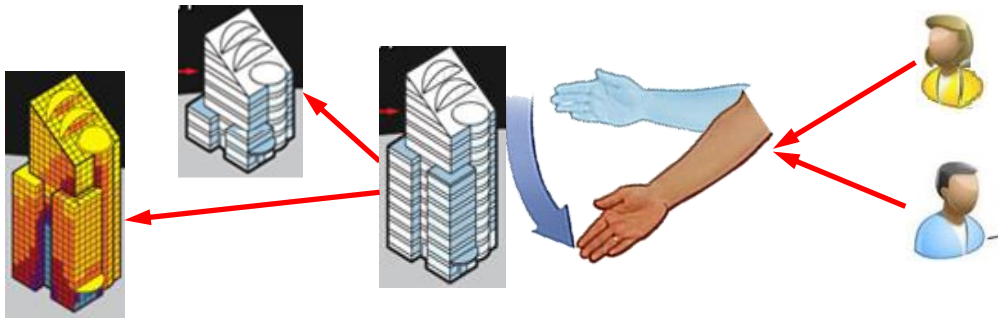
can support multiple users in co-located and real-time working condition. It increases the collaborative efficiency among different users from various domains comparing to Two CHIs and One split CHI working conditions.



Perspective

Multi-interaction CHI system

with imposed interaction VS. user-centered interaction metaphor is proposed. We are going to make another experiment.



Reference

- Segonds, F. e., d\'e,ric, J. Nelson and A. e. Aoussat, ziane (2012). "PLM and architectural rehabilitation: a framework to improve collaboration in the early stages of design." International Journal of Product Lifecycle Management 6(1): 1-19.
- Dolezal, W. R. (2008). "Success factors for digital mock-ups (DMU) in complex aerospace product development." Technische Universität München, Genehmigten Dissertation, Munich, Germany.
- France, R. and B. Rumpe (2007). Model-driven development of complex software: A research roadmap. 2007 Future of Software Engineering.
- Rio, M., T. Reyes and L. Roucoules (2013). "Toward proactive (eco) design process: modeling information transformations among designers activities." Journal of Cleaner Production 39: 105-116.
- Johansen, R. (1988). Groupware: Computer support for business teams, The Free Press.
- Martin, P., P. Bourdot and D. Touraine (2011). A reconfigurable architecture for multimodal and collaborative interactions in Virtual Environments. 3D User Interfaces (3DUI), 2011 IEEE Symposium on.
- Kulik, A., A. e. Kunert, S. Beck, R. Reichel, R. Blach, A. Zink and B. Froehlich (2011). "C1x6: a stereoscopic six-user display for co-located collaboration in shared virtual environments." ACM Transactions on Graphics (TOG) 30(6): 188.
- Matusik, W., C. Forlines and H. Pfister (2008). Multiview user interfaces with an automultiscopic display. Proceedings of the working conference on Advanced visual interfaces.
- Nagano, K., T. Utsugi, M. Hirano, T. Hamada, A. Shirai and M. Nakajima (2010). A new multiplex content displaying system compatible with current 3D projection technology. ACM SIGGRAPH 2010 Posters.
- Kim, S., X. Cao, H. Zhang and D. Tan (2012). Enabling concurrent dual views on common LCD screens. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.
- Lissermann, R., J. Huber, M. Schmitz, J. u. Steimle, rgen and h. a. M\"u, user, Max (2014). Permulin: mixed-focus collaboration on multi-view tabletops. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.
- Sreng, J., F. Bergez, J. e. Legarrec, r\'e,mie, c. L\'e, Anatole and C. Andriot (2007). Using an event-based approach to improve the multimodal rendering of 6DOF virtual contact. Proceedings of the 2007 ACM symposium on Virtual reality software and technology.
- Bell, M., T. Chennavasin, C. H. Clanton, M. Hulme, E. Ophir and M. Vieta (2008). Processing of Gesture-Based User Interactions.

THANKS