

Ph.D. proposal: Nolwenn Maudet

Title: **Substrates and Co-Adaptive Instruments**

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Host lab: INSITU, LR Université Paris-Sud & INRIA Saclay

We are developing a novel theoretical framework, based on the concepts of *substrates* and *co-adaptive instruments*, in which we treat the interaction between people and computers as a first class object. Co-adaptation refers to how users both adapt their behavior to manage novel technologies, through learning, and adapt these technologies for their own purposes, through appropriation (Mackay, 2002, Mackay, 2008). Instrumental interaction (Beaudouin-Lafon, 2000, Beaudouin-Lafon & Mackay, 2000), identifies a set of principles for creating simpler, yet more powerful tools for interacting with computers. We have also begun exploring the concept of substrates to support music composition (Garcia et al., 2013), in which instruments are made more powerful through the use of interactive musical structures, under the user's control.

The focus of this Ph.D. is to explore how we can use *substrates* and *co-adaptive instruments* to design interactive tools that support creative professionals, particularly industrial and graphic designers. We are particularly interested in supporting creative activities before users have a clear idea of the final task, as they explore and generate ideas that can then be addressed computationally. Our goal is to provide simpler, more universal interaction instruments that support flexible, yet powerful forms of interaction.

The PhD candidate will explore the theoretical issues related to substrates in the context of co-adaptive instruments. After an initial review of the literature, the student will work with designers to develop a set of novel co-adaptive instruments and substrates that support early and mid-term creative activities. These instruments should enhance the interaction between users and the objects-of-interest, providing a mix of user-defined constraints and flexibility. The student will test these instruments with designers in both field and laboratory settings. Ideally, this work will contribute to a deeper understanding of the phenomena of co-adaptation, instruments and substrates.

**Skills required:** The Ph.D. candidate requires formal training in industrial or graphic design, as well as skills in computer science and a willingness to learn participatory design and evaluation techniques. Programming in C, C++, Java, or Javascript is also required.

**References:**

Beaudouin-Lafon, M. (2000) Instrumental Interaction. In *Proceedings of ACM CHI 2000 Conference on Human Factors in Computing Systems*.

Beaudouin-Lafon, M. and Mackay, W. (2000) Reification, Polymorphism and Reuse: Three Principles for Designing Visual Interfaces. In *Proceedings of the International Conference on Advanced Visual Interfaces (AVI 2000)*. ACM, pages 102-109.

Garcia, J., Tsandilas, T., Agon, C. and Mackay, W. (2012) Interactive Paper Substrates to Support Musical Creation. In *Proceedings of ACM CHI 2012*

*Conference on Human Factors in Computing Systems*, pp. 1825-1828.

Mackay, W. (2000) Responding to cognitive overload: Co-adaptation between users and technology. *Intellectica*. Vol. 30 (1), pp. 177-193.

Mackay, W. (2008) From Gaia to HCI: On Multi-disciplinary Design and Co-adaptation. In *HCI Remixed, Reflections on Works That Have Influenced the HCI Community*, pages 247-251. MIT Press.