

## Improvising With Self-Observing Systems: a Duet For Cellist and Adaptive Delay Network

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**Alice Eldridge**

alice@ecila.org

University of Sussex, Brighton, UK

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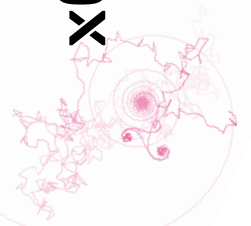
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**Abstract:** Feedback is a fundamental organising principle of living systems, adaptive systems and creative activity. This is an obvious point of fact, but a rich and inspiring point of departure for activity at the intersection of computation, communication and aesthetics. The proposed performance is an improvisation for cellist and an adaptive circular delay network coupled via acoustic feedback in the concert hall environment.

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## 1. Introduction

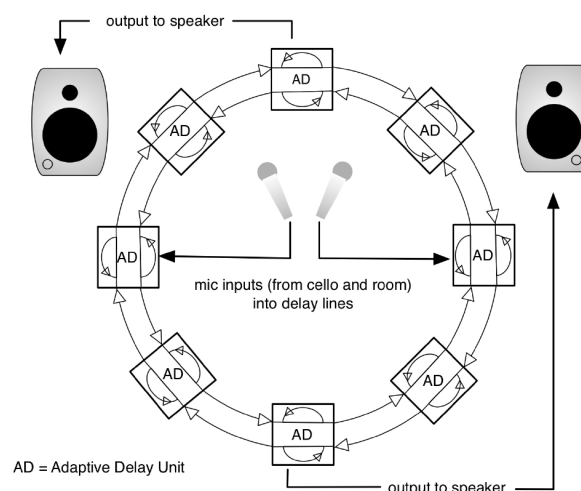
I am interested in the cross-talk between analogue and digital sound in live performance and the mediation of this conversation with adaptive systems. Systems theory taught us to think above and beyond the specifics of any particular media and highlights certain organisational principles which can be observed in biology and instantiated in silico. From this systemic perspective, the design of Live Algorithms (Blackwell et al, 2012) for musical improvisation — software capable of sustaining a responsive and inspiring live conversation — starts from the conception of the human performer and performance software as two adaptive systems coupled via a shared acoustic environment (cf Di Scipio's 'composing interactions', Di Scipio, 2003).

## 2. Improvisation for cello and adaptive feedback circuits

*ISOS* (Improvising with Self-Observing Systems) is an ongoing project exploring the performance possibilities for a human improviser and self-observing digital systems. The performance system builds upon some earlier experiments with self-controlling feedback circuits<sup>1</sup>. These experiments were driven by an interest in eco-systemic principles (McCormack et al, 2009) as powerful metaphors for the design of generative and interactive systems.

1. [http://www.ecila.org/ecila\\_files/content/academic\\_files/project\\_files/selfdirectingfeedback.html](http://www.ecila.org/ecila_files/content/academic_files/project_files/selfdirectingfeedback.html)

The system is based on a circular network of delay lines as shown in Fig.1. A similar set up has been explored previously (e.g. Burns, 2003). In this case however, the delay units are adaptive: rather than peak limiting via compression or even non-linear wave-shaping (ibid), each unit contains a watt-governor style spring model which alters the length of the delay line if the input amplitude exceeds a pre-specified limit. This creates a basic homeostatic mechanism (Ashby, 1952) whereby the positive feedback created by the Larsen effect is stabilised by the adaptive delay mechanism.



**Fig. 1.** Schematic of the performance software: Eight digital delay lines are connected in a bi-directional circular fashion and fed by two microphones. Two outputs are fed to a stereo PA. The network induces a Larsen effect which is fed and perturbed by the performer. The circular set up of delay lines and adaption of delay times creates an unpredictable yet coherent response and reinterpretation of the cellists' input.

The sonic complexities arising from the circular delay network and the adaptive behaviour of the self-observing delay modules create a dynamic environment which at once reacts to and provokes the human improviser, creating a beguiling digital-analogue coupling between human and machine.

## References

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