While Shepards Watched Their Flocks At Night

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Dynamic Data-Flow Programming with Sig

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Abstract.   The Sig language and system prototype embodies the total functional data-flow programming paradigm, for the purpose of clocked synchronous, numeric and symbolic, abstract and efficient, real-time data processing. Building on a semantically pure and elegant core, we successively add well-known and experimental high-level features. The present work demonstrates the use of two such features; namely higher-order functions in the shape of staged meta-programming, and multi-clock-rate systems with implicit synchronization and explicit resampling. This combination can express a pervasive pattern of advanced signal-processing systems, namely low-rate components dynamically (re)configuring high-rate components. The combined expressive power and possible interactions are illustrated with a Sig implementation of the Shepard Tone, a well-known acoustic illusion naturally modeled as a dynamic many-rate signal generator.