In this study, we model the causal links between the lexical and grammatical complexities of child language (CL) and child-directed language (CDL). We consider pairs of sequences of measurements of the quantity and diversity of the lexical and grammatical properties of CL and CDL obtained from a longitudinal study. Each child-mother pair of sequences is considered as an instance of the trajectory of a high-dimensional dynamical system, some of whose dimensions are unknown. We then use Multispatial Convergent Cross Mapping to ascertain the directions of causality between the pairs of sequences, that is, whether the complexity of CL drives that of CDL, the complexity of CDL drives that of CL, both, or neither. Our results are twofold: On the one hand, we find that children are responsive to the amount of speech and the diversity of words produced by their mothers (i.e., more language and more diverse words used by the mother causes the child to produce more language and more diverse words, but not vice-versa). On the other hand, crucially, the grammatical richness of the utterances produced by the children explicitly drives the syntactic diversity of the mothers' utterances. These results are interpreted as evidence for fine-grained fine-tuning of CDL in response to the specific properties of concurrent CL.