# From answer to question: Coherence analysis with Rezonator

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## Abstract

We present Rezonator as a tool for annotating and visualizing the structure of resonance relations between utterances, with the goal of identifying strategies used by conversational co-participants to create coherence in extended dialogue. To go beyond the predictable sequence of question-to-answer (Q2A), we foreground the reverse case: a progression from answer to question (A2Q). Crucially, A2Q sequences often contribute to building longer stretches of cohesion than those created by Q2A alone. Rezonator provides an intuitive graphical UI/UX for human-in-the-loop markup of structural-functional patterns of harmonic resonance. By providing annotators with tools that respond dynamically to their analytical actions, Rezonator seeks not only to efficient and reliable data collection, but help researchers visualize the strategies interlocutors use to collaboratively construct coherence in extended dialogue.

## 1 Introduction

How do conversational co-participants move from answer to question—coherently? A vast literature has targeted the familiar question-to-answer sequence (Q2A), but the opposite order is effectively invisible in current research. We ask what happens when the order of dialogue acts is (apparently) reversed: What are the consequences for coherence when an answer triggers a question (A2Q)? More generally, what happens when a declarative statement of any kind is followed by a question? In framing the matter in this way, we target an issue which has long challenged state-of-the-art AI and NLP: the hard problem of coherence in extended dialogue (Lai et al. 2018).

While awaiting a solution at the algorithmic level, we present a tool that supports human-in-the-loop annotation and visualization of structural cohesion between successive utterances in naturally occurring conversation. Specifically, we draw on the theory of dialogic syntax (DuBois 2014) to identify the structural patterns and functional strategies that participants use to build coherence. While Rezonator is designed as a general-purpose tool for annotating a broad array of discourse features (including coreference, rhetorical structure, dialogue acts, conversational sequences, etc.), in this paper we specifically target dialogic resonance in A2Q sequences. While analysis of the more familiar Q2A sequences can reveal strong cohesive bonds at the local level of the adjacency pair, with relatively predictable structure, to focus exclusively on such links may miss out on much of the coherence building strategies that users pursue. In contrast, A2Q sequences often appear to contribute to cohesive relationships over longer distances. We illustrate how Rezonator can be used to analyze these patterns, reflecting the overarching goal to analyze structural cohesion relations between utterances to shed light on coherence in extended dialogue.

## 2 Structural parallelism via resonance

Consider the following conversational exchange, representing a naturally occurring conversational exchange drawn from the Santa Barbara Corpus of Spoken American English (DuBois et al. 2000-2005):

(1) *A Book about Death* SBC005: 190.83-206.63)
128 DARRYL; I come up with my own ideas about that stuff.
129 PAMELA; And where do you get the ideas.
130 DARRYL; Thought.
131 PAMELA; And where do you get those thoughts?
132 DARRYL; Processing what goes on around me.
133 PAMELA; Well?
134 Is n't a book part of what goes on around you?



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Figure 1: Stack annotation. A stack is a higher-level discourse unit of any kind, consisting of one or more lines (e.g. multiple intonation units). There is more than one way to stack a discourse, depending on the unit of interest. Here each stack corresponds to a region of maximal internal resonance; each is represented by its own arbitrary but distinctive color. Stacks may be continuous, as in Stack 1 (pink, lines 128-131), or discontinuous, as in Stack 2 (teal, lines 132, 134) and Stack 3 (violet, lines 133, 135). The user can quickly mark a large stack with a single stroke (e.g. dragging over lines 128-131), but also retains the freedom to mark more complex configurations (e.g. clicking on lines one-by-one to collect several of them, discontinuous or not, within a single stack).

Even an excerpt as short as this one can reveal a rich variety of complex discourse phenomena. For example, there are several instances of the Answer-to-Question (A2Q) sequence. Figures 1, 2 and 3 show an analysis of resonance relations in these utterances, as represented in Rezonator. The analysis reveals a high degree of resonance and parallelism in this brief exchange, through which the participants (especially Pamela) create affordances for coherence in extended dialogue.

How to represent such phenomena on the screen has been a driving force behind the design decisions that underlie Rezonator (DuBois 2019), which seeks to present intuitive, efficient, and responsive visualizations that shed light on the linguistic, cognitive, and interactional phenomena that shape the production of spoken dialogue.

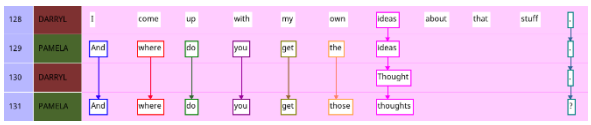


Figure 2: Insistent interrogation as a source of as a self-resonance (self-priming), combining an A2Q move (130→131) and question-to-question parallelism (129→131).


Figure 3: *"Processing what goes on around me"*. In this 2-line excerpt from the conversation in example (1), the diagraph notation shows one strategy for creating coherence, in which the answer to a prior question triggers a new question (A2Q, 132→134), yielding a harmonic resonance array: *what goes on around me : what goes on around you.* Here Rezonator deploys two innovative features designed to support quick capture of the harmonic resonance: (1) So-called right-justification positions the words of each line so that there is vertical alignment of the last word, penultimate word, etc., working backward from the end; (2) With a single stroke, the annotator can capture the alignment of all resonating elements shown above, by dragging the cursor diagonally down from *me* in the first line to *what* in the second line.

Rezonator was designed from the ground up with spoken dialogue in mind, so it is natural that it incorporates structural principles designed to represent the basic units of spoken language, such as intonation units and turns. These units of discourse are accorded conventions which are iconic, familiar, or otherwise readily interpretable. By default, the "unit" displayed on a single line of text is interpreted as representing the intonation unit. But Rezonator is in principle agnostic as to what a line of text is used to represent. It could as well denote a turn-constructional unit, clause. or sentence.

## 3 Stacks: Discourse beyond the IU

While the intonation unit is surely a key unit of discourse, it is not the only one that matters. In fact, discourse is sometimes defined as language beyond the sentence, which naturally implies the existence of units larger than the intonation unit, too. Figure 1 illustrates the discourse-level of the stack, comprised of more than one intonation unit.

### 3.1 Parallelism: Left and right periphery

Figures 2 and 3 both illustrate a version of the A2Q conversational move, but each represents a distinct structural pattern of parallelism, or harmonic resonance. In Figure 2, the speaker resonates with herself, reproducing 5 of 7 words within the the exact same syntactic structure, as she insistently interrogates her partner. Note that the region of maximum resonance begins in the left periphery. In contrast, Figure 3 shows a region

of maximum resonance aligned with the right periphery. Rezonator gives the user tools to easily switch views between highlighting the left or the right periphery, depending on which provides the most effective visualization of the discourse strategy at hand.

## 4 Availability and future development

Plans for future development of Rezonator include the addition of support for annotation of higher discourse-level structures such as Rhetorical Structure Theory, and support for inter-annotator reliability via integration with crowd-source worker platforms such as Mechanical Turk and Prolific.ai.

Rezonator is open source software, distributed under the MIT license. It is currently available in beta form for both PC and Mac at the Rezonator website https://rezonator.com/. Source code and extensive documentation of the project goals are available on GitHub at https://github.com/johnwdubois/rezonator.

## 5 Conclusions

In this paper we have explored how Rezonator can be used to learn how participants exploit the structural affordances of their language to create resonance for coherence in dialogue. While the familiar Question-to-Answer (Q2A) sequence provides local coherence, a One-Off Question may, due to its very success in achieving early closure, fail to build global coherence. In contrast, when an Answer serves as the basis for a new Question (A2Q), speakers may need to rely more on resonance with the prior dialogue, even as they open up new directions for coherence in the emerging discourse.

To gain a deeper understanding of how participants create ad hoc coherence and engagement in dialogue, researchers need tools that respond dynamically to their analytical decisions, supporting the real-time visualization of structural resonance between utterances. We have presented Rezonator as a tool for annotating and visualizing structural parallelism between adjacent utterances, using it to reveal strategies that interlocutors invoke to create coherence in extended dialogue. We suggest that by providing annotators with a rich, resonance-oriented toolkit that responds dynamically to patterns in the data, as mediated by their analytical choices. By gamifying and crowd-sourcing the collection of such data on a large scale in future research, we hope to show how Rezonator can facilitate efficient, reliable, and reproducible results in the collection of human-in-the-loop training data. Just as important, by creatively implementing visualization principles, Rezonator can help researchers gain insight into the specific structural and functional strategies that interlocutors consistently exploit in their collaborative construction of coherence in extended dialogue.

## References


Branigan, H. P., & Pickering, M. J. (2016). An experimental approach to linguistic representation. Behavioral and Brain Sciences, 1-61. doi:10.1017/S0140525X16002028

Cieri, C., Fiumara, J., Liberman, M., Callison-Burch, C., & Wright, J. (2018, May 7-12, 2018). Introducing NIEUW: Novel incentives and workflows for eliciting linguistic data. Paper presented at the Language Resources and Evaluation Conference (LREC 2018), 11th Edition, Miyazaki, May 7-12.

Du Bois, J. W. (2014). Towards a dialogic syntax. Cognitive Linguistics, 25(3), 359–410. doi:10.1515/cog-2014-0024

Du Bois, John W. (2019). Rezonator: Visualizing resonance for coherence in dialogue. Proceedings of the 23rd Workshop on the Semantics and Pragmatics of Dialogue. London: SEMDIAL.

Du Bois, John W., Chafe, Wallace L., Meyer, Charles, Thompson, Sandra A., Englebretson, Robert & Martey, Nii (2000-2005). Santa Barbara corpus of spoken American English, Parts 1-4. Philadelphia: Linguistic Data Consortium.

Garrod, S., & Pickering, M. J. (2004). Why is conversation so easy? Trends in Cognitiv3e Sciences, 8(1), 8-11.

Ginzburg, J. (2012). The interactive stance: Meaning for conversation. Oxford: Oxford University Press.

Habernal, I., Hannemann, R., Pollak, C., Klamm, C., Pauli, P., & Gurevych, I. (2017, 19 July 2017). Argotario: Computational argumentation meets serious games. Paper presented at the Proceedings of the 2017 Conference on Empirical Methods in Natural Language ….

Jurgens, D., & Navigli, R. (2014). It's all fun and games until someone annotates: Video games with a purpose for linguistic annotation. Paper presented at the Transactions of the Association for Computational Linguistics.

Lai, A., & Tetreault, J. R. (2018, July 2018). Discourse coherence in the wild: A dataset, evaluation and methods. Paper presented at the Proceedings of the 19th Annual SIGdial Meeting on Discourse and Dialogue.

Li, J., Monroe, W., Ritter, A., & Jurafsky, D. (2016). Deep reinforcement learning for dialogue generation. EMNLP.

Moscoso del Prado Martín, F., & Du Bois, J. W. (2015). Syntactic alignment is an index of affective alignment: An information-theoretical study of natural dialogue. Paper presented at the Proceedings of the 37th Annual Conference of the Cognitive Science Society, San Jose, California.

Osborn, Joseph Carter, Samuel, Benjamin & Mateas, Michael (2018). Visualizing the strategic landscape of arbitrary games. Information Visualization.

Plass, Jan L., Mayer, Richard E. & Homer, Bruce D. (Eds.) (2019). Handbook of game-based learning. Cambridge, MA: MIT Press.

Poesio, M., Chamberlain, J., Paun, S., Yu, J., Uma, A., & Kruschwitz, U. (2019, June 2019). A crowdsourced corpus of multiple judgments and disagreement on anaphoric interpretation. Paper presented at the Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers), Minneapolis.

Shneiderman, Ben (1996). The eyes have it: A task by data type taxonomy for information visualizations. Proceedings., IEEE Symposium on Visual Languages. Harvard: IEEE. 336-343.

Tufte, Edward R. (2006). Beautiful evidence. Graphics Press.

Ware, Colin (2013). Information visualization: Perception for design. Elsevier.