

Aiding Clinicians through Summarization of Perinatal Data

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Abstract

Exploratory analysis has focused on developing summarized views of monitor-captured perinatal data to support adherence to established clinical protocols. In addition to facilitating rapid access to significant clinical trends and reducing subjective interpretation of monitor-captured data, combining data summaries with traditional monitor review may assist in the anticipation of complications.

Introduction

Current fetal monitor devices:

Capture important physiological characteristics including Fetal Heart Rate (FHR) and uterine contractions

Lack sophisticated decision support and the ability to integrate clinical guidelines into the data display.

Present data elements side-by-side, relinquishing inference and interpretation of relationships between monitored features to subjective clinician judgment.

Enhanced presentation and summarization of monitor data provides:

Rapid “at-a-glance” access to significant trends

Opportunity for improving patient safety and clinician workflow through the reduction of subjective clinician interpretations¹.

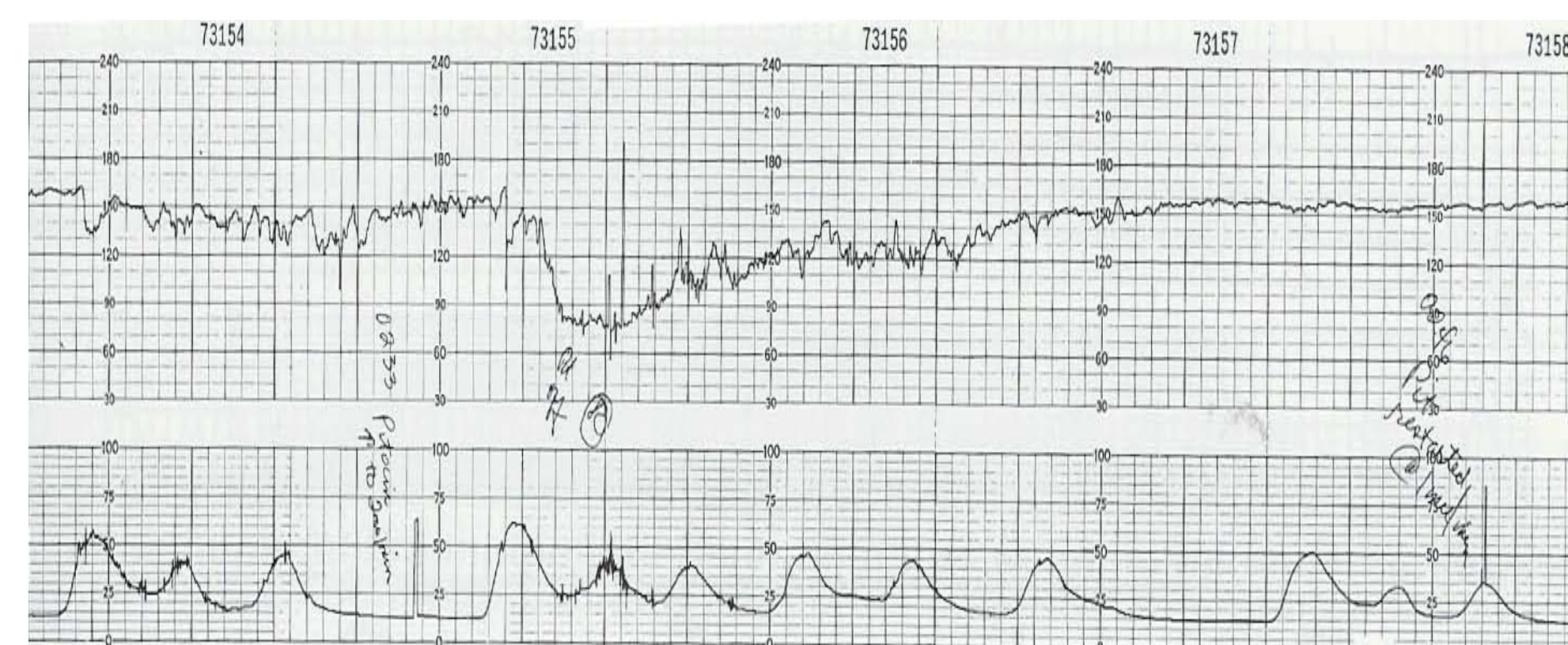


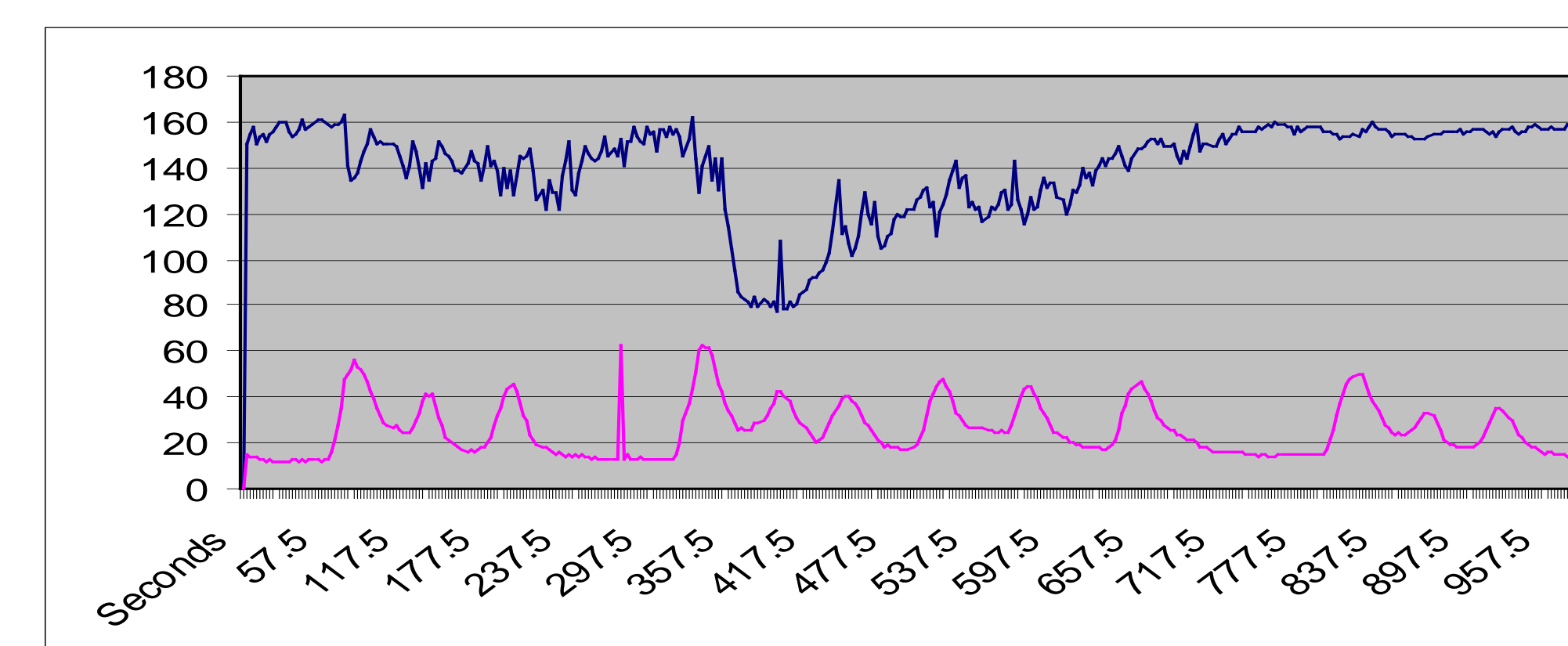
Figure 1. Traditional paper-based fetal heart and uterine contraction tracings.

Methods

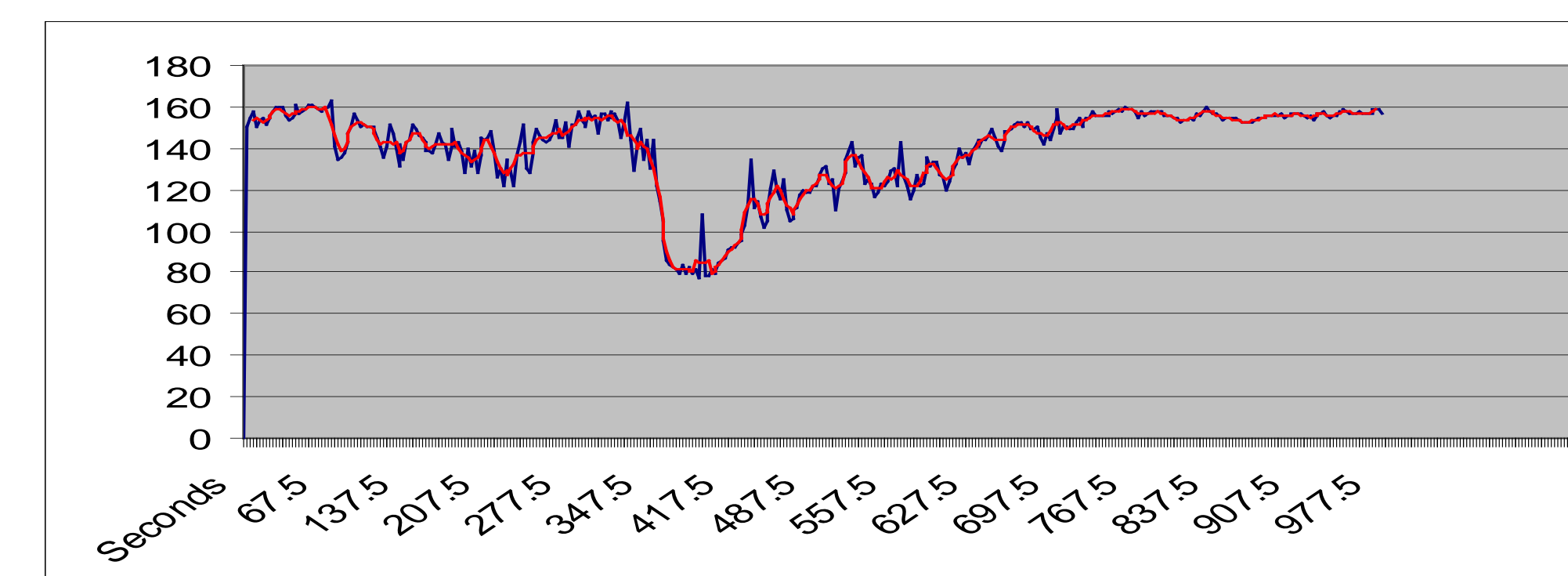
Exploratory analysis of graphical properties and information processing techniques applied to digitized perinatal monitoring data² focused on the development of a time-compressed summary view of synchronized FHR and uterine contraction data.

1) Long-term variability of the Fetal Heart Rate (FHR)

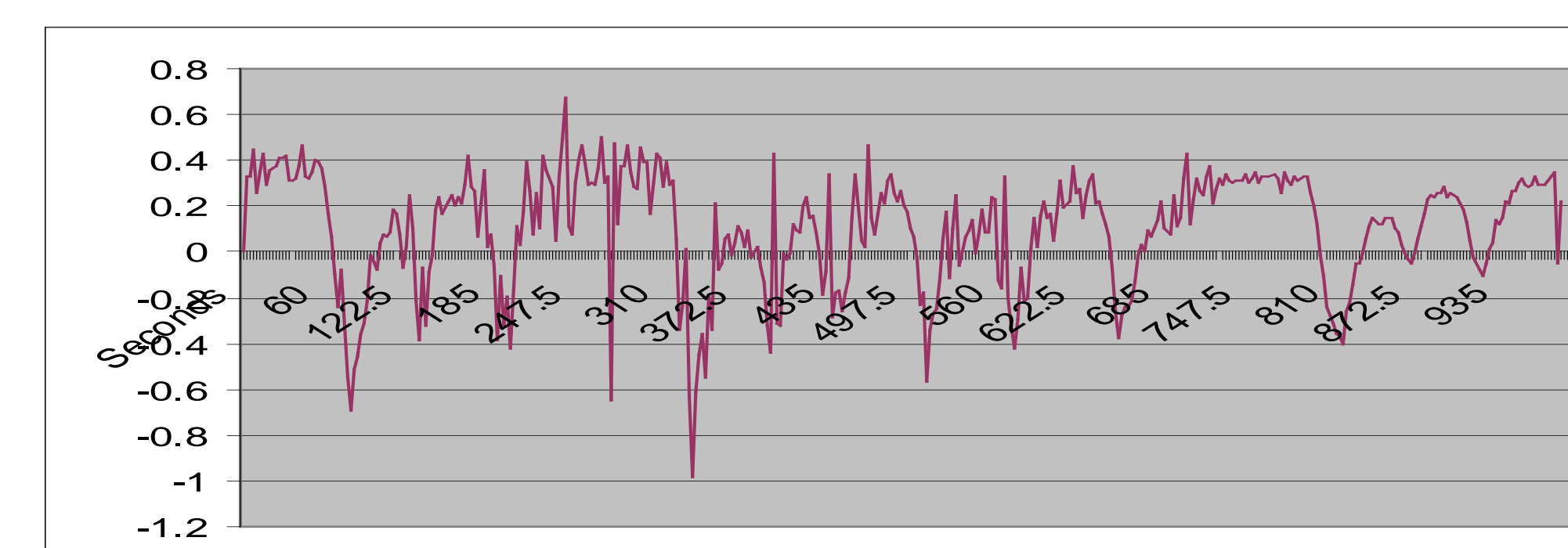
Data Processing



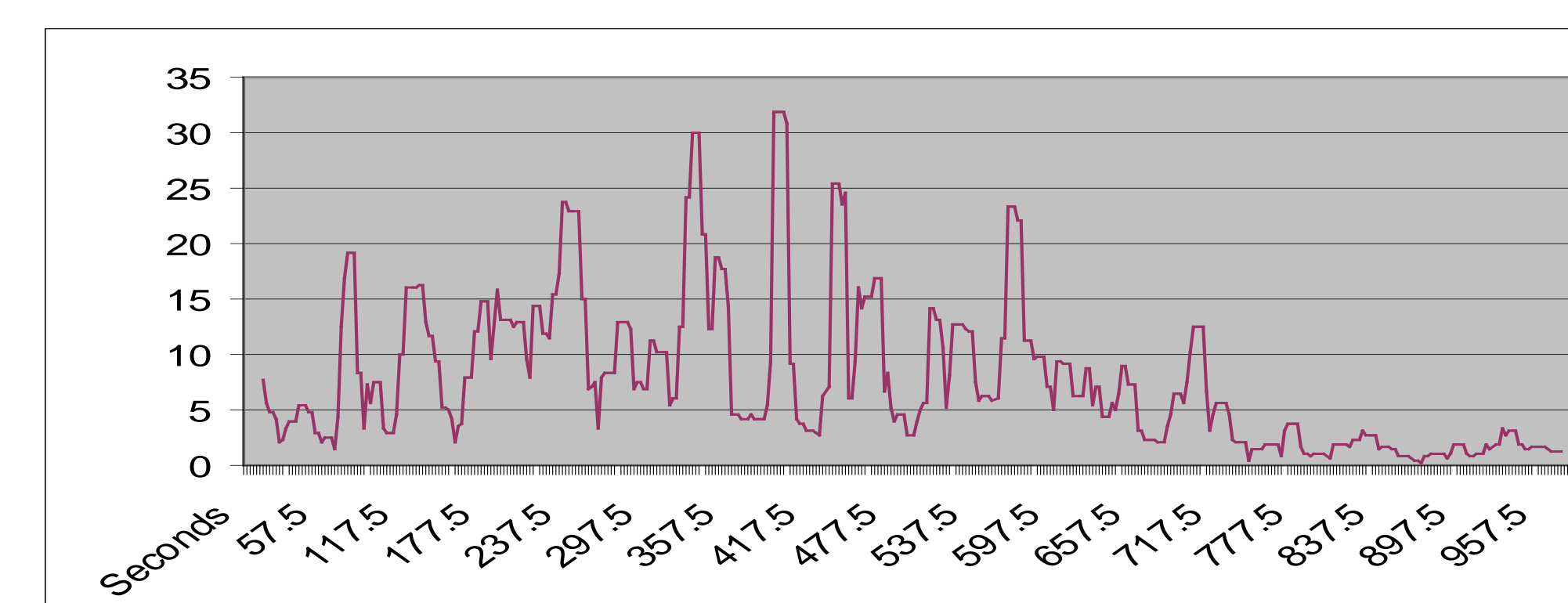
Digitize Data



Smooth Fetal Heart Rate Data

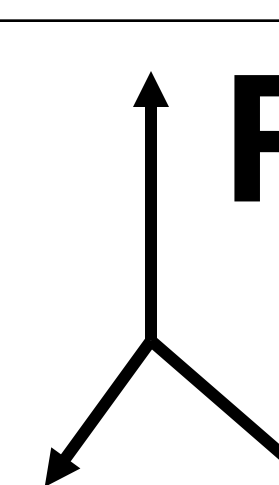
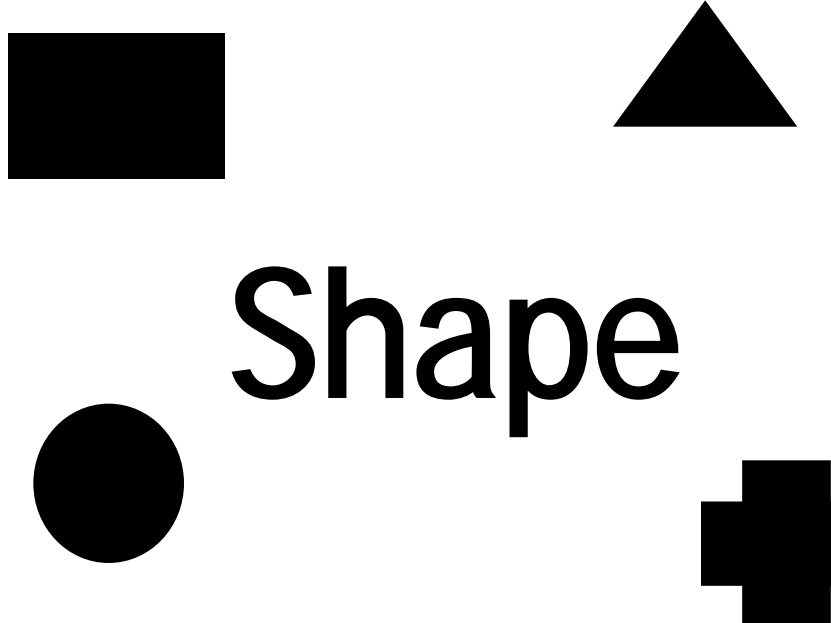


Variation from Smoothed Fetal Heart Tracing



Ten Second Average Amplitude – Showing Good Variability

2) Occurrence, timing, and duration of FHR decelerations corresponding to uterine contractions

Graphical Dimensions Considered	Representation
 Position	<p>X-axis location presents temporal occurrence of FHR deceleration.</p> <p>Y-axis location shows occurrence of FHR deceleration <i>relative</i> to a maternal contraction.</p>
 Shape	<p>Dots were chosen as they represent single events.</p> <p>Additional data could be included on the same plot using a different shape for each type of event.</p>
Color	<p>Additional colors, or grades of colors on a spectrum, could reflect another dimension of data corresponding to decelerations. For example red dots could represent troubling events as determined by a decision support algorithm, whereas blue dots could represent benign events. Grades of colors could represent various levels of seriousness.</p>
size	<p>The length of deceleration is represented using various intensities of dot size. Prolonged decelerations will be more evident as they appear larger.</p>

Results

The solid tracing represents FHR variability, with the level of variation at a particular time identified by the right vertical axis. The occurrence of each FHR deceleration is represented by a single dot. Vertical dot position, quantified by the left vertical axis, expresses the timing of the deceleration corresponding to a contraction. Lastly, dot size conveys the duration of the particular deceleration.

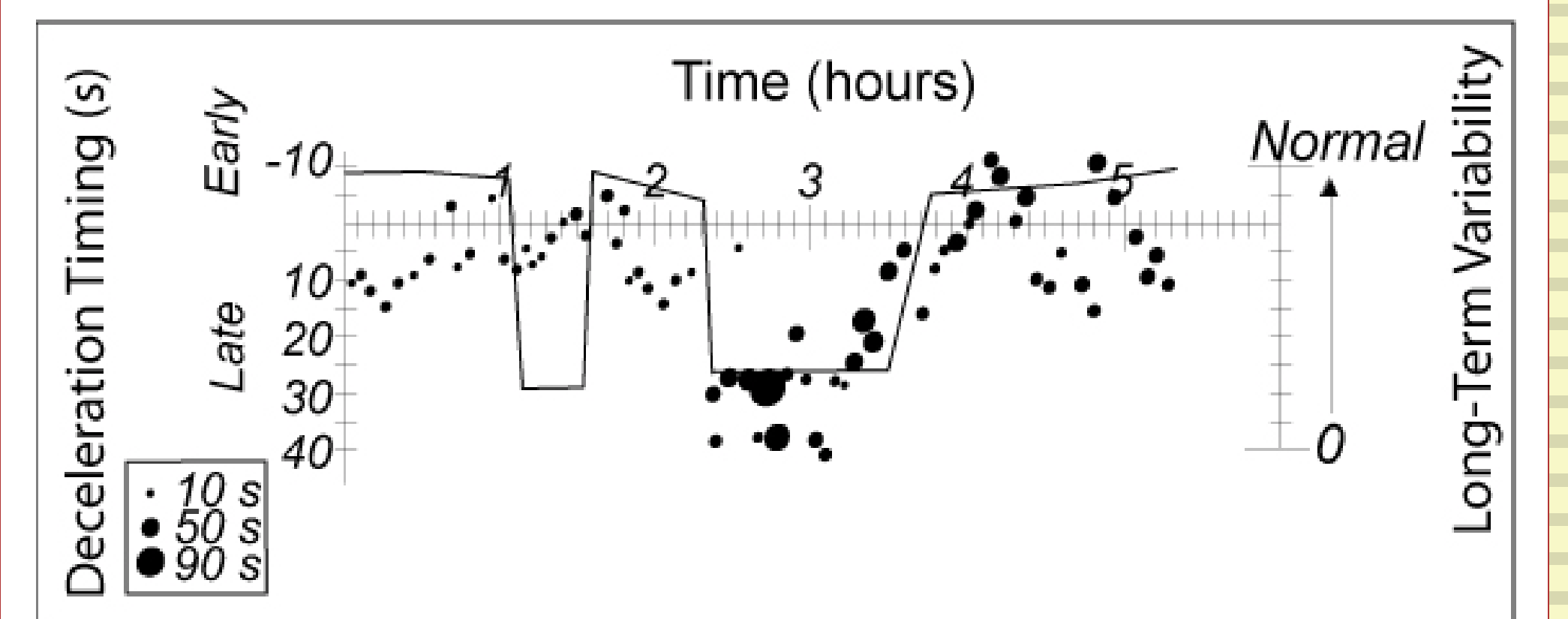


Figure 2. Time-Compressed View of Variability and Decelerations

Summary of Conclusions

Variability and deceleration attributes can be extracted into a single time-compressed summarized view. This summary data view lends itself to guideline support, though usefulness of the summary is limited to general trending as opposed to pinpointing specific problems. Thus, in combination with the distinct fetal monitoring curves, the clinician is potentially aided. As clinical usability and acceptance grows, additional features can potentially be added to the “at-a-glance” summary of the perinatal monitor data.

References

- Greenwald LM, Mondor M. Malpractice and the perinatal nurse. *J Perinat Neonatal Nurs* 2003;17(2):101-9.
- Freeman RK, Garite TJ, Nageotte MP. *Fetal heart rate monitoring*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2003.

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