



Breathe Easy EDA: a MATLAB toolbox for psychophysiology data management, cleaning, and analysis

John C. Ksander^{1,2}, Christopher R. Madan¹, Sarah M. Kark¹ & Elizabeth A. Kensinger¹

¹Boston College, Chestnut Hill, MA; ²Brandeis University, Waltham, MA



Introduction

Electrodermal Activity (EDA) assess fluctuations in the skin's electrical conductance

- Caused by changes in sweat gland production
- Sweat glands are innervated by the sympathetic nervous system
- EDA is thought to measure sympathetic nervous system arousal (Bach, Friston, & Dolan, 2010)

Respiration also influences EDA

- Irregular breathing causes EDA fluctuations which cannot be unambiguously attributed to changes in psychophysiological arousal (Schneider, et al., 2003)

Controlling for EDA respiration artifacts is a crucial methodological consideration (Boucsein et al., 2012)

- Typically via manually identifying EDA responses which co-occur with irregular breathing patterns

Toolbox Solutions

Streamlined artifact removal interface (ARI)

- Expedites EDA analysis without compromising analysis integrity

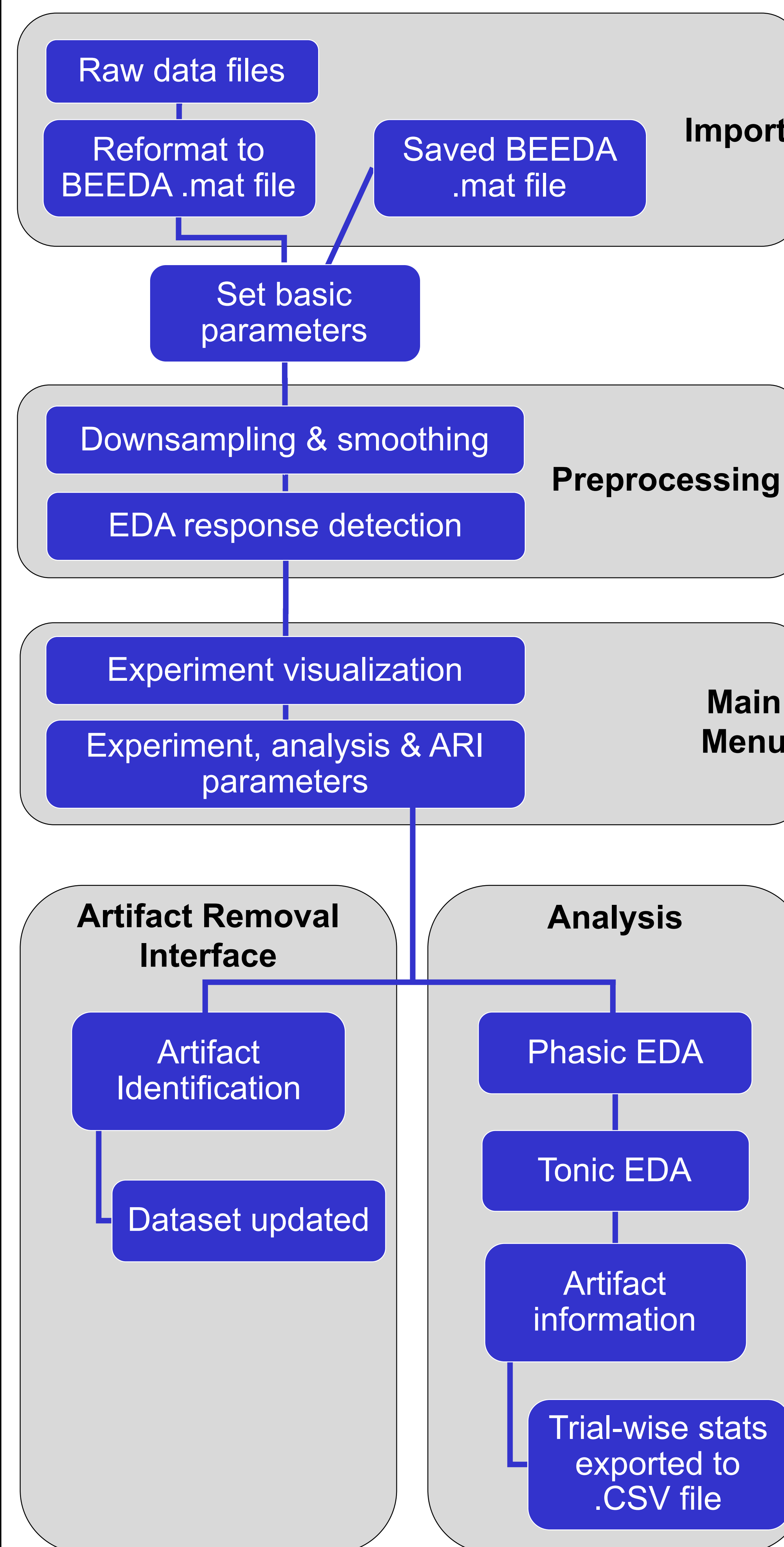
Integrated analyses

- Standard methodological implementations of tonic and phasic analyses are fully supported

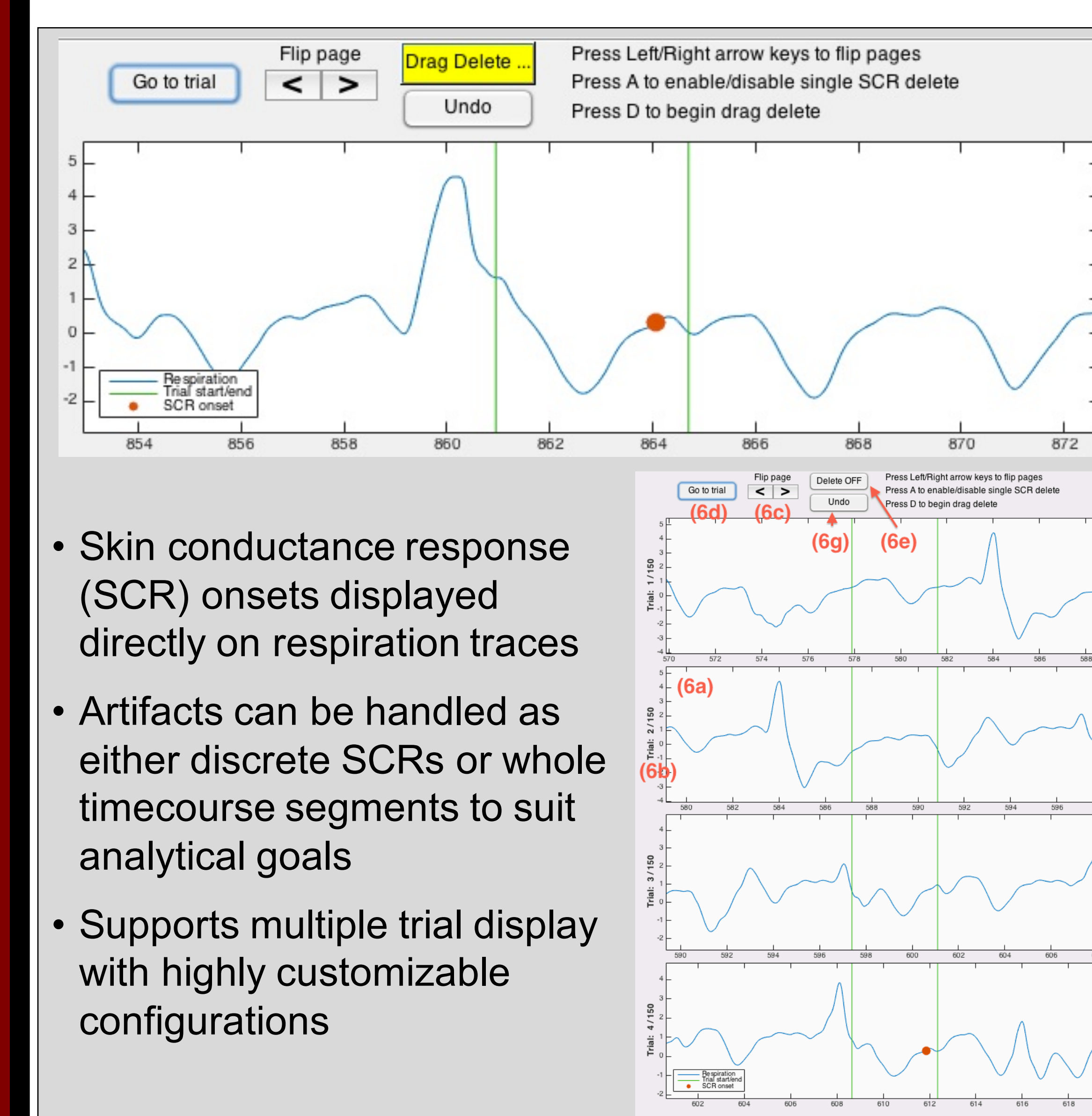
Simple, flexible, interoperable, and tolerant

- Any (or all) functionality may be used without restricting the use of complementary software
- Suitable for any experiment where both EDA and respiration data were collected
- Adapts to experiment-specific parameters (e.g., trial structure and analysis options)

Workflow



Artifact Removal Interface



- Skin conductance response (SCR) onsets displayed directly on respiration traces
- Artifacts can be handled as either discrete SCRs or whole timecourse segments to suit analytical goals
- Supports multiple trial display with highly customizable configurations

Analysis

Phasic EDA measurements are determined via the trough-to-peak detection of SCRs (Boucsein et al., 2012)

- Configurable time-locked stimulus response window
- Conventional user-defined SCR amplitude threshold or data driven SCR thresholding (Kim et al, 2004)

Results include respiration artifact information, which may be used to compare the interrater reliability of multiple artifact scorers within a dataset

Trial-wise EDA statistics

- *SCRs (phasic)*: response count, average amplitude, maximum amplitude, and cumulative amplitude
- *Skin conductance level (tonic)*: standard deviation and mean EDA signal
- *Flagged artifacts*: artifact identification Boolean

Future Directions

Data cleaning supported by automated respiration artifact identification

- Currently proposed algorithmic approaches still require manual parameter adjustment (e.g., Blain et al., 2010)

A sequence classification model (e.g. hidden Markov model) will be trained on datasets labeled by multiple artifact scorers.

- This trained model will be distributed with the toolbox after successful validation, enabling data cleaning with user-specified levels of automation
- This modeling strategy may overcome the limitations of unsupervised or simpler rule-based artifact detection algorithms

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