Deriving and Presenting Insights from Experience Sampling Method (ESM) Data Through Network Visualization

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Research Problem

Experience Sampling Method (ESM) collects rich real-time data on emotions and behaviors in natural environments, offering advantages over traditional assessments:

- **Real-time data collection** reduces recall bias
- Captures **contextual understanding** of emotion-behavior patterns
- Enables **treatment monitoring** in natural environments

Despite these benefits, ESM data remains underutilized due to:

- **Time constraints** prevent clinicians from analyzing complex ESM datasets
- **Lack of user-friendly tools** for non-technical users

Research Questions

Main Question: How can we derive and present meaningful insights from ESM data to reveal relationships between behaviors/situations and emotions/feelings?

Sub-questions

1. How can we design intuitive visualizations showing complex ESM data relationships?
2. What key considerations ensure insights that are relevant for mental health practitioners?
3. How can we evaluate whether ESM visualization tools are usable and clinically useful?

Methodology

Research Approach

- User-centered design methodology with iterative development
- **Three phases**: data analysis → visualization development → evaluation
- Focus on accessibility for non-technical mental health practitioners

Evaluation Framework

- 6 mental health practitioners and researchers
- Mixed-method evaluation (quantitative + qualitative)
- Synthetic ESM dataset (365 days) for ethical compliance
- Three-block structured questionnaire assessing usability and clinical utility

Network Graph Visualisation

The directed network graph displays relationships between behaviors/contexts and emotional states extracted from ESM data.

Visual Design Elements

- **Behaviors** represented as circles, **emotions** as diamonds
- **Color coding** for valence (green = positive, red = negative, and blue = neutral)
- **Node size** reflects frequency, **edge thickness** shows relationship strength

Interactive Features

- **Node highlighting** reveals connection patterns
- **Filtering system** allows focus on specific categories
- **Hover** interactions enhance pattern discovery

Key Results

Usability Assessment

- **Intuitiveness rating**: 3.8/7 (mixed, but generally positive)
- **Comprehension speed**: 4/6 participants understood "quickly" (< 30 seconds)
- **Visual design rating**: 3.2/5

Comparative Evaluation vs. Traditional Methods

- Equally voted by 2 participants for each (better, about the same, or worse than traditional methods)

Pattern Recognition

- Participants successfully extracted clinically relevant behavior-emotion patterns
- Filtering functionality crucial for reducing visual complexity
- Color coding identified as most effective design element

Conclusions, Limitations & Future Work

Conclusions

- Network visualization successfully reveals behavior-emotion relationships
- Interactive filtering reduces complexity and supports focused analysis
- Color coding proved most effective visual encoding method

Limitations

- Visual complexity and dynamic node movement create cognitive barriers
- Mixed comparative results suggest approach benefits some users more than others
- Missing temporal information integration limits ESM-specific utility
- Small sample size (n=6) limits generalizability

Future Work

- Integrate temporal dynamics to capture ESM's time-based nature
- Evaluation of impact on intervention outcomes and patient engagement