ShapeWordle: Tailoring Wordles using Shape-aware Archimedean Spirals

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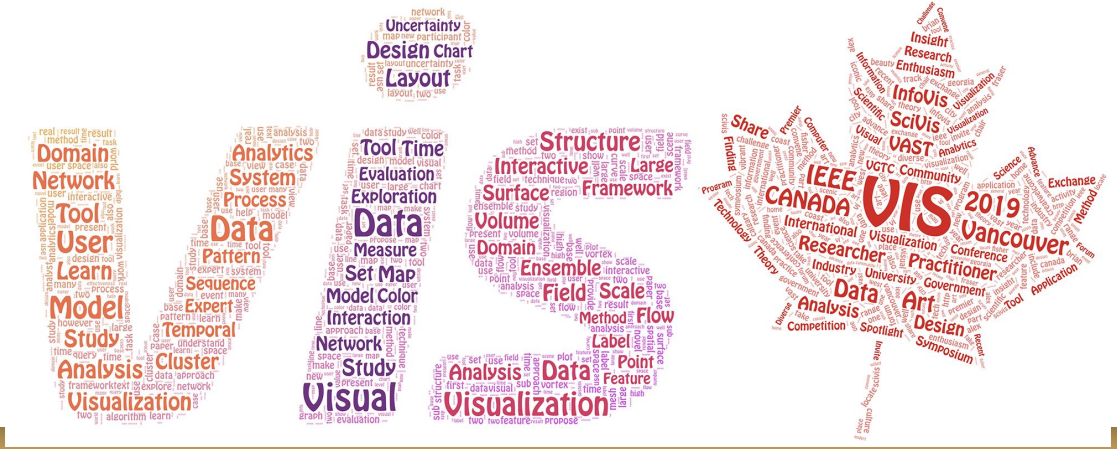
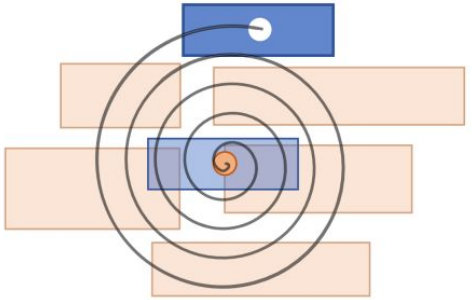
INTRODUCTION

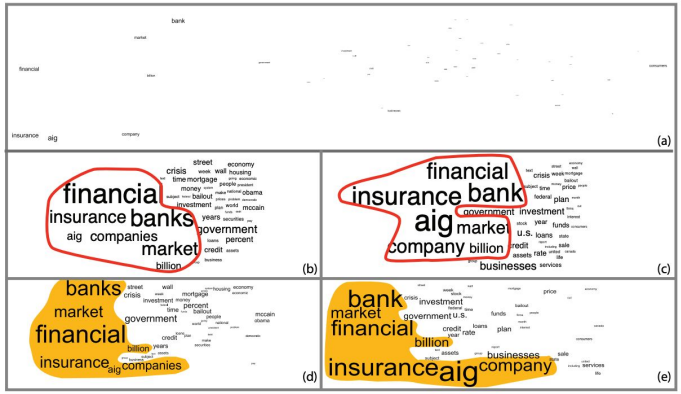
- We present a new technique to enable the creation of shape-bounded Wordles, we call *ShapeWordle*
- We fit words to form a given shape
- We extend the traditional Archimedean spirals to be shape-aware
- We formulate a shape-aware Archimedean spiral to guide and align Wordle layouts with arbitrarily-given shapes and to facilitate us to create multi-centric Wordles, where different words are placed in different parts of the given shape;
- We introduce a set of shape-aware Wordle editing interactions based on the coherent combination of rigid body operations and pixel-based placements;

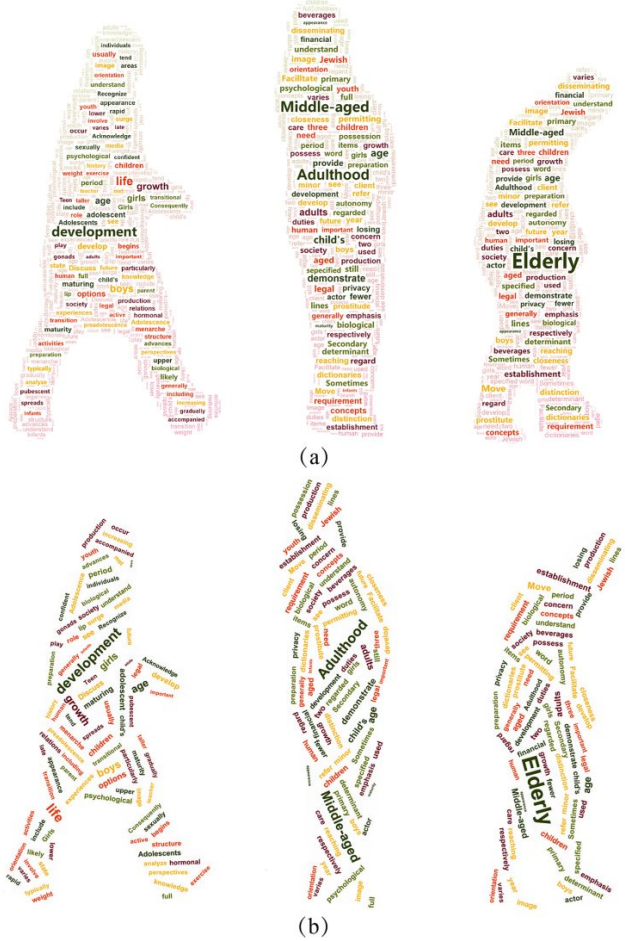




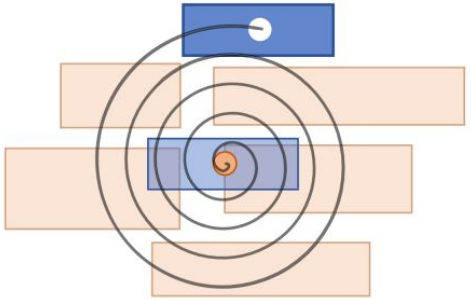
RELATED WORK

- Word Cloud Visualization
  - Semantic-Preserving Word Clouds by Seam Carving
  - Morphable Word Clouds for Time-Varying Text Data Visualization





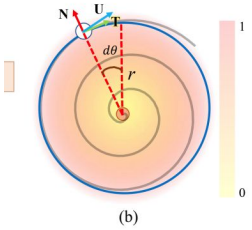
BACKGROUND



1. Initialize: pick a random position around the center of the canvas

2. Search-and-update: create a spiral started from the picked random position, and search along the spiral for a location to place the next word, such that the next word does not overlap with any already-placed word;

SHAPE-AWARE WORDLE



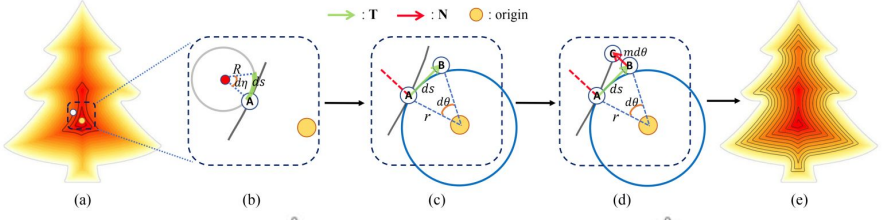
N and T are the unit normal vector and unit tangent vector

$$\begin{pmatrix} x \\ y \end{pmatrix} = r(\theta) \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}.$$

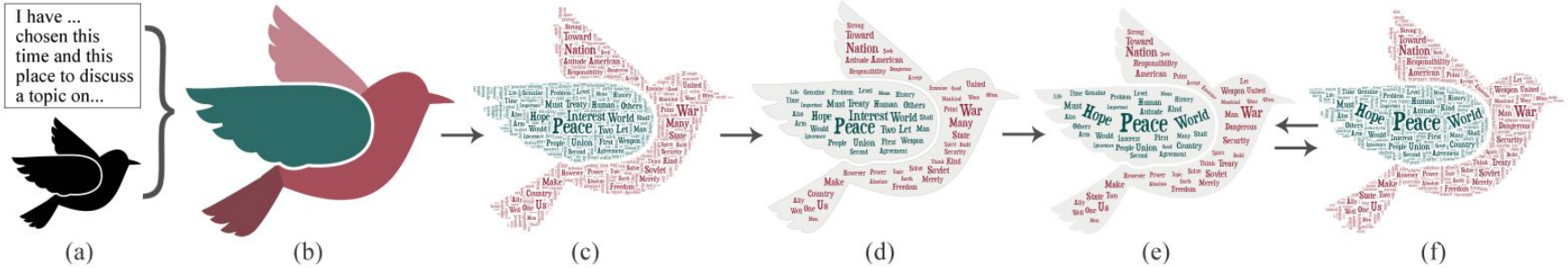
$$\mathbf{U} = m \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix} + r(\theta) \begin{pmatrix} -\sin\theta \\ \cos\theta \end{pmatrix} = m\mathbf{N} + r(\theta)\mathbf{T}, \quad (3)$$

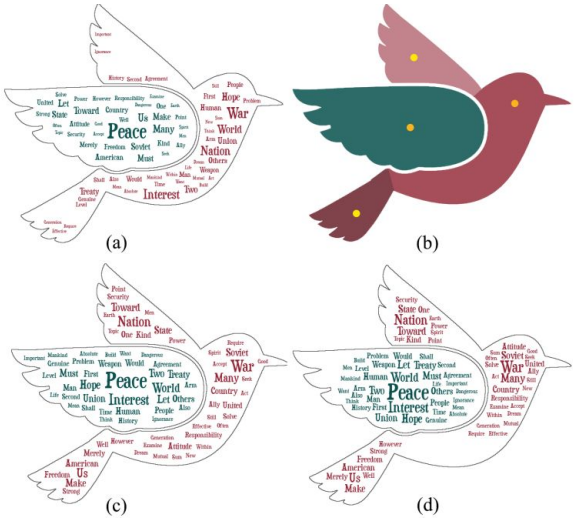
$$\begin{pmatrix} dx \\ dy \end{pmatrix} = md\theta\mathbf{N} + rd\theta\mathbf{T},$$

For a wordle of 60 words, our method finishes in less than 5s.



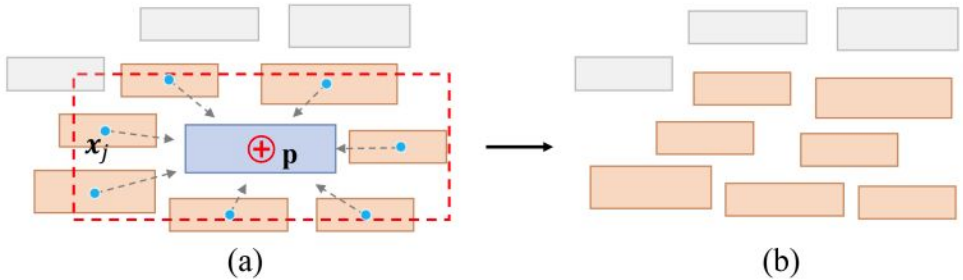
SHAPE-AWARE WORDLE





INTERACTIVE SHAPEWORDLE CREATION SYSTEM

- Two-step Wordle Layout
  - First, the large number of tiny marginal words are mainly used for filling the small empty regions remaining in the shape; they need not align with the shape.
  - Second, computing the shape-aware Archimedean spirals for a large number of tiny marginal words is time-consuming, and unnecessary.
- Shaped Wordle Editing(move, rotate, resize, delete)
  - Boundary constraint
  - Uniform constraint

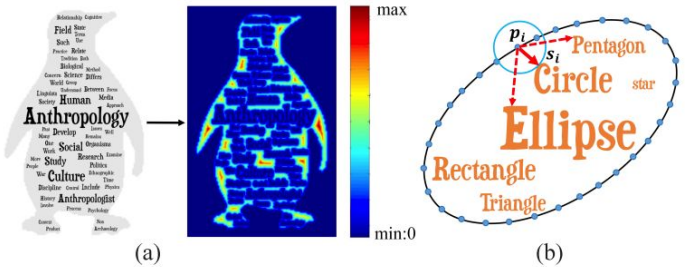


EVALUATION

- Layout coverage (LC): measuring the overall proportion of empty space in the generated layout.
- Layout uniformity (LU): from another aspect, measures the distribution uniformity of the gaps among the words in the layout
- Shape similarity (SS):The third metric SS aims to measure how good the generated wordle aligns with the given shape

$$\mathrm{LU} = \frac{1}{n_{\mathrm{nontext}}} \sum_i \varphi(\mathbf{p}_i)^2 \,, \tag{9}$$

$$\mathrm{SS} = \frac{1}{n_{\mathrm{contour}}} \sum_{\mathbf{p}_i \in \Omega_B} \rho(\mathbf{p}_i)^2 \,. \tag{10}$$



EVALUATION

ShapeWordle

(a) LC:0.22, LU:53, SS:503

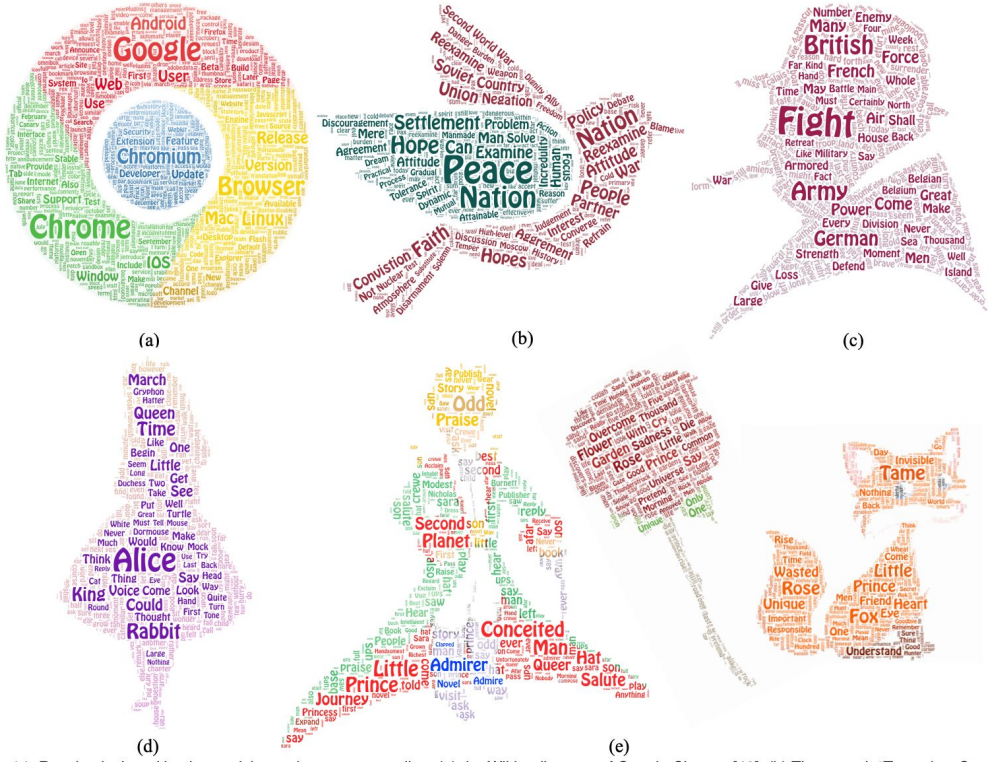
WordArt

(b) LC:0.17, LU:106, SS:1126

(c) LC:0.16, LU:83, SS:1398

(d) LC:0.15, LU:99, SS:1458

Results



http://www.yunhaiwang.net/infoVis2019/shapewordle/index.html