Modelling Interestingness:
Stories as L-Systems and Magic Squares

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Presentation outline

- Introduction
- Modelling Interestingness
- Stories as L-Systems
- Stories as Magic Squares
- Proof of concept
- Conclusive remarks

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Introduction

Introduction

Premises

- Automatic Story Generation (ASG), by using symbolic as well subsymbolic approaches, succeeds in achieving human-like results [1] on the lexical level, whereas the macro-planning of the event sequence is yet frequently evaluated against coherence and built upon logic rules [2];

- Currently, despite the successes of the field towards full automation and realism, the practical use of ASG is nowadays limited as support to content creation, or even as pure intellectual game (in the groove of potential literature).

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Introduction

Problem statement

- The discrepancy between the general goal of ASG and its actual usage calls for a shift in focusing efforts in this domain;
- Since the results in lexical interestingness are already satisfactory, it would be valuable to find a way to model interestingness also on the level of events sequence.

Modelling Interestingness

Modelling Interestingness

Related Work - Statistical measures for Self-Information

$$wow_i = log_2 \frac{1}{(p_i|Kontext)}$$

$$KL(P(M|D), P(M)) = \int P(M|D) log \frac{P(M|D)}{P(M)} dM$$

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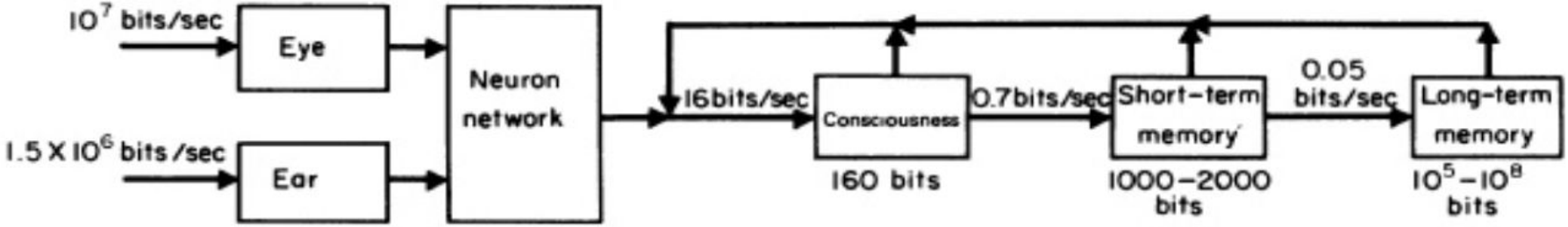
Modelling Interestingness

Related Work - Franke's information flow from sense organs to brain



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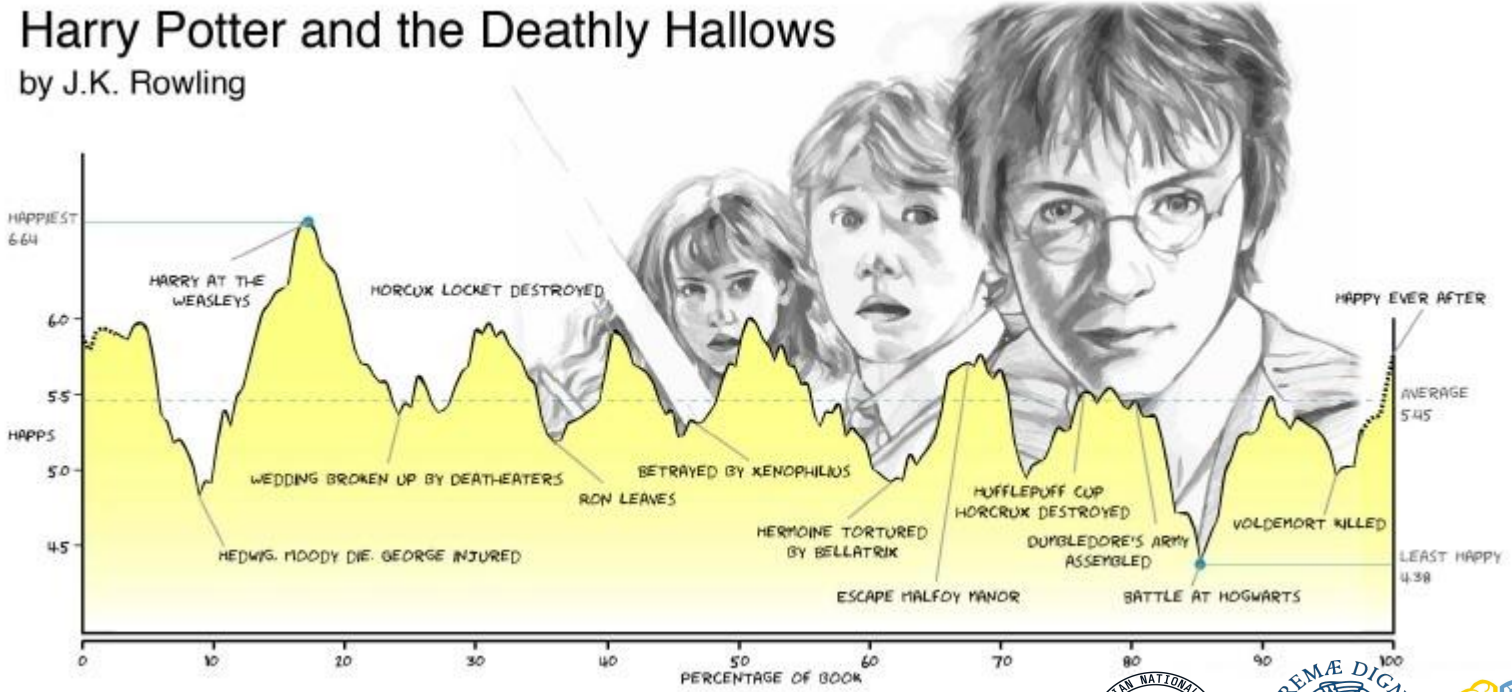
Modelling Interestingness

Related Work - Emotional arc of Harry Potter VII



[5]

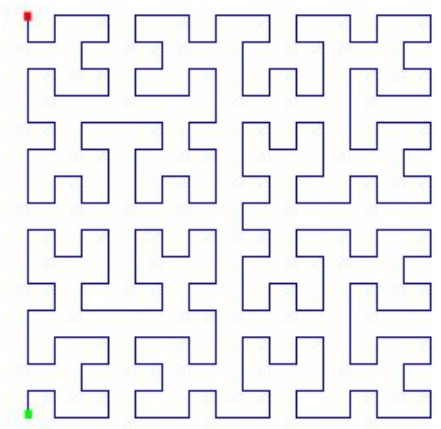
Stories as L-Systems

Stories as L-Systems

The Thue-Morse sequence and the Hilbert's curve

$$
\begin{aligned}
V &\rightarrow & 0, 1\,; \\
\omega &\rightarrow & 0\,; \\
P &\rightarrow & (0 \rightarrow 01), (1 \rightarrow 10).
\end{aligned}
$$

$$
\begin{aligned}
V &\rightarrow & A, B; \\
S &\rightarrow & f, l, r; \\
\omega &\rightarrow & A; \\
P &\downarrow & \\
A &\rightarrow & lBfrAfArfBl; \\
B &\rightarrow & rAflBfBlfAr\ .
\end{aligned}
$$



[6]

Stories as L-Systems

A fairy-tale modelled according to the L-System notation

$$E = (C, P, F, \alpha, \omega, Z);$$

$$C = (d, k, l);$$

$$C^1 = (1, 2, 3);$$

$$C \vDash C^1;$$

$$P = \bigcup_{i=1}^{size(C)^{size(C)}} p_i;$$

$$p \in P = ccc,\ c \in C^1;$$

$$F = vec(p_1 \xrightarrow{z \in Z} p_2 \xrightarrow{z \in Z} \ldots \xrightarrow{z \in Z} p_n);$$

$$f \in F = subvec(F);$$

$$\alpha = [ddd] = [111];$$

$$\omega = [lll] = [333];$$

$$Z:$$

$$[c * 1] \rightarrow [c * (2 \vee 3)];$$

$$[c * 2] \rightarrow [c * 3];$$

$$[c * 3] \rightarrow [c * (c + 1) * 1] \vee \omega.$$

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Stories as Magic Squares

Stories as Magic Squares

The Thue-Morse sequence and the Magic Square of the Sun

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & A \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & B \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & B \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & A \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & A \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & B \\ 1 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & B \\ 0 & 1 & 1 & 0 & 1 & 0 & 0 & 1 & A \end{bmatrix} \quad \begin{bmatrix} 6 & 32 & 3 & 34 & 35 & 1 \\ 19 & 7 & 11 & 27 & 28 & 8 \\ 30 & 14 & 16 & 15 & 23 & 24 \\ 19 & 20 & 22 & 21 & 17 & 18 \\ 25 & 29 & 9 & 10 & 26 & 12 \\ 36 & 2 & 33 & 4 & 5 & 31 \end{bmatrix} \quad \begin{bmatrix} 12 & 14 & 15 & 16 & 17 & 17 \\ 11 & 7 & 9 & 10 & 10 & 12 \\ 1 & 4 & 2 & 3 & 5 & 6 \\ 5 & 2 & 4 & 3 & 1 & 0 \\ 7 & 11 & 9 & 8 & 6 & 6 \\ 18 & 16 & 15 & 14 & 13 & 13 \end{bmatrix}$$

Stories as Magic Squares

Lévi-Strauss' matrix with bundle of relationships

Kadmos seeks his sister Europa ravished by Zeus			
		Kadmos kills the dragon	
	The Spartoi kill each other		
			Labdacos (Laios' father) = *lame* (?)
	Oedipus kills his father Laios		
			Laios (Oedipus' father) = *left-sided* (?)
		Oedipus kills the Sphinx	
Oedipus marries his mother Jocasta			
	Eteocles kills his brother Polynices		
			Oedipus = *swollen-foot* (?)
Antigone buries her brother Polynices despite prohibition			

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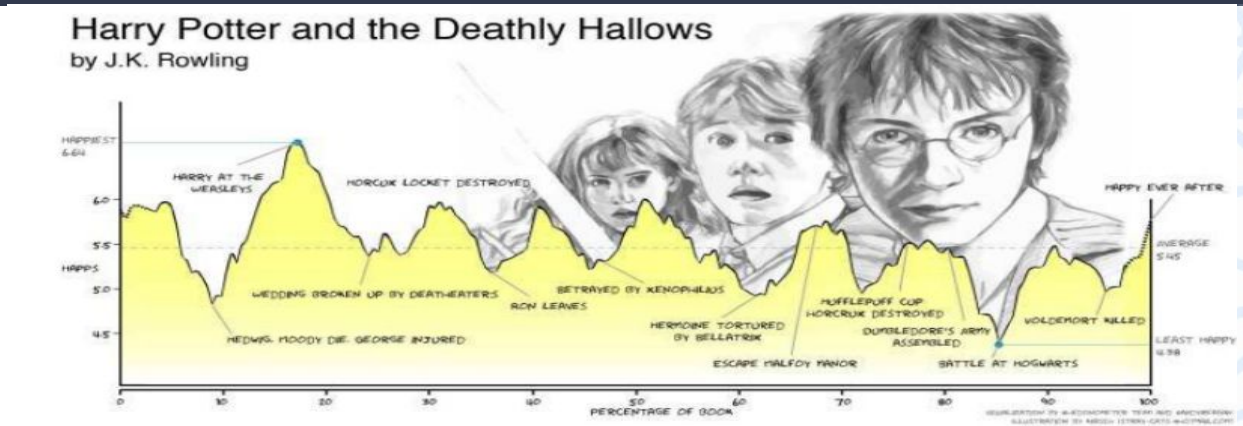
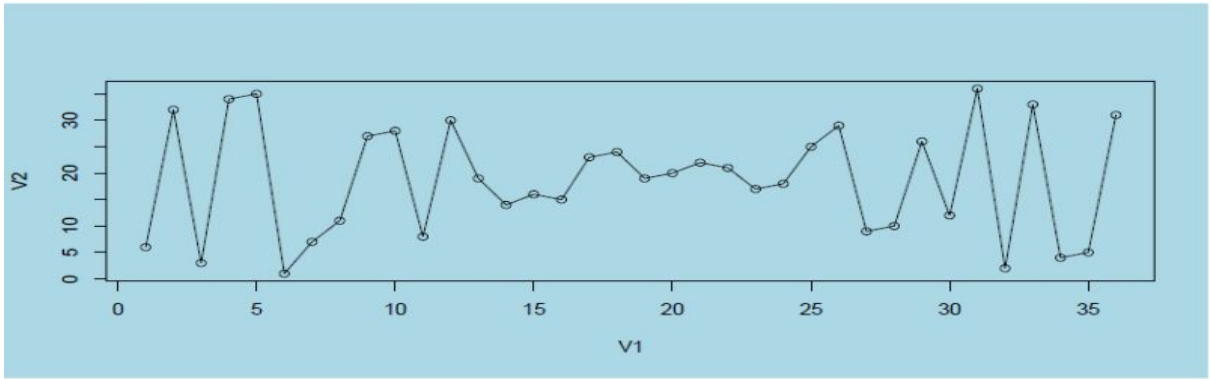
Stories as Magic Squares

The Thue-Morse sequence and the Magic Square of the Sun

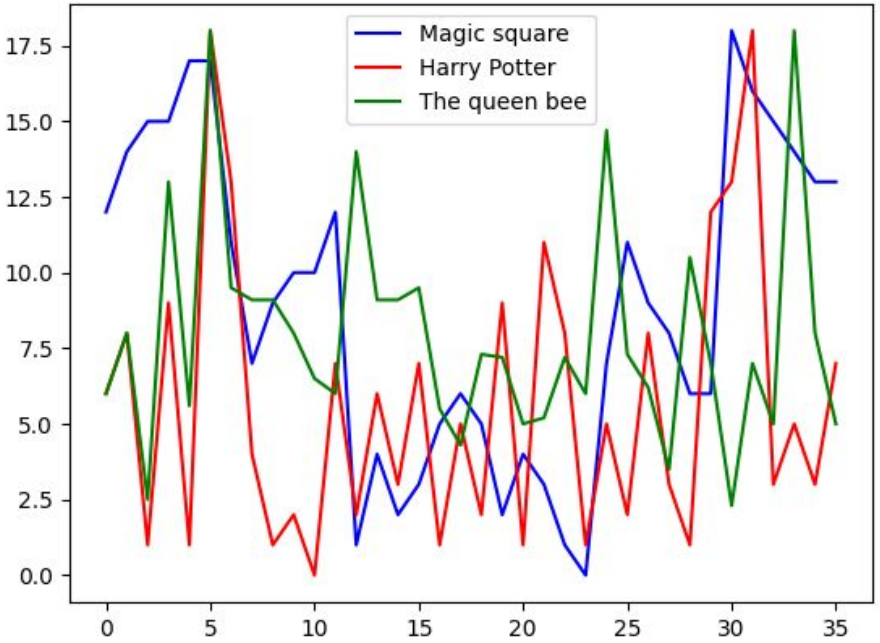




Proof of concept

Proof of concept

A long and a short story modelled as time-series of self-information values



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Proof of concept

A long and a short story modelled as time-series of self-information values

In the following, the Kolmogorov-Smirnov (KS) and the Epps-Singleton (ES) test statistics performed on the vectors 1 and 2 ('Magic Square' and 'Harry Potter'):

```
KstestResult(statistic=0.3055, pvalue=0.0689)
Epps_Singleton_2sampResult(statistic=10.4553, pvalue=0.0334)
```

The KS and the ES tests performed on the vectors 1 and 3 ('Magic Square' and 'The Queen Bee'):

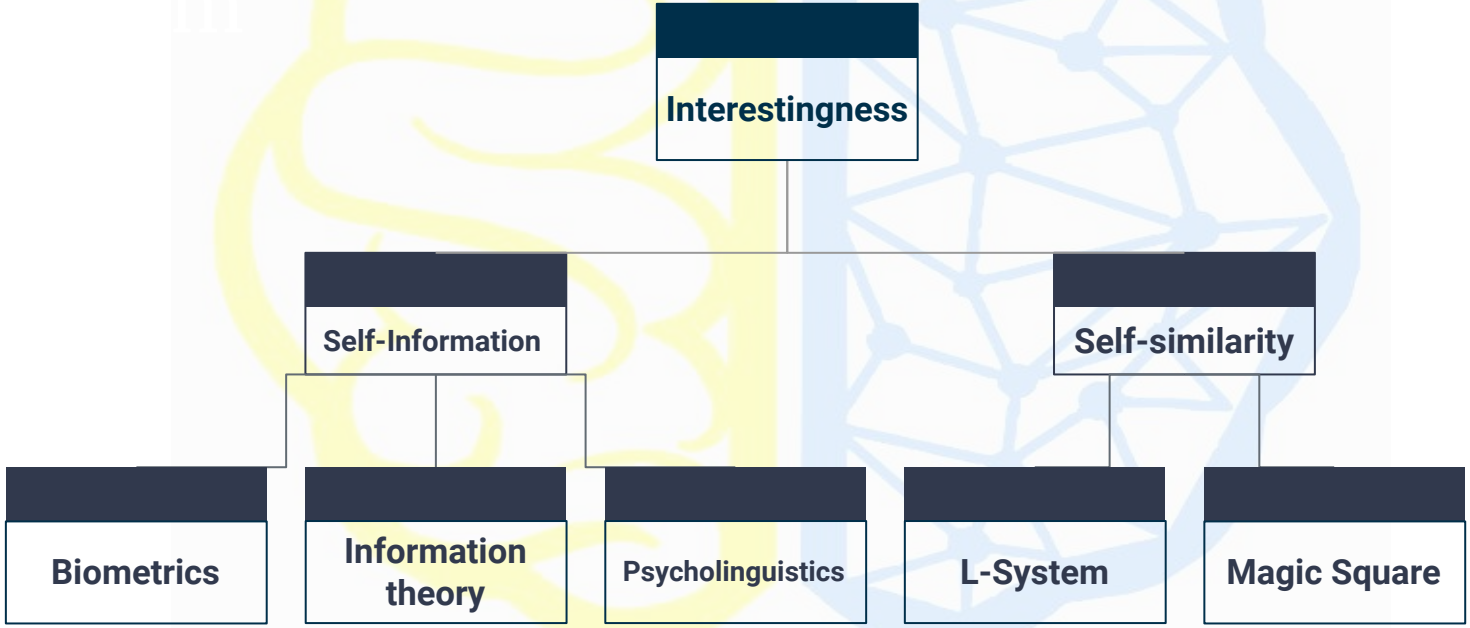
```
KstestResult(statistic=0.3055, pvalue=0.0684)
Epps_Singleton_2sampResult(statistic=17.2947, pvalue=0.0017)
```

The KS and the ES tests performed on the vectors 2 and 3 ('Harry Potter' and 'The Queen Bee'):

```
KstestResult(statistic=0.3888, pvalue=0.0081)
Epps_Singleton_2sampResult(statistic=18.1595, pvalue=0.0011)
```

Conclusive remarks

Conclusive remarks



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Everyone lived happily ever after

Thank you for the attention