



## Comparative Mythology

As in statistical physics, notions of universality exist within the field of comparative mythology. However there is no quantitative classification system to facilitate comparison of myths. Here, we apply frequency-rank distributions and network theory to a variety of mythologies to quantify their characteristics. In this way, myths can be compared across different cultures and to other networks, both actual and fictitious in an effort to discover where they are positioned along the spectrum from the real to the imaginary.

## Beowulf

Beowulf is an Old English heroic epic poem, set in Scandinavia. It is an "Ising model" for Anglo-Saxon literature. A single manuscript survives. It dates from between the 8<sup>th</sup> and early 11<sup>th</sup> centuries. In the poem, Beowulf, a Gaetish hero, vanquishes Grendel, a monster who had been attacking the mead hall of Hrothgar, king of the Danes. He then defeats Grendel's mother. After returning to Geatland in Sweden, he finally battles a dragon and is fatally wounded. The poem concerns legends – tales couched in a definite historical period. Archaeological excavations in Denmark and Sweden support historicity of the human characters.



First page of Beowulf



Beowulf's burial ground (Skalunda, Sweden)



Map for Beowulf



The dragon

## Táin Bó Cúailnge

The Táin is an Irish epic, surviving in three 12<sup>th</sup> and 14<sup>th</sup> century manuscripts. It describes the invasion of Ulster by the armies of Connaught and the defence by Cúchulainn, Ireland's most famous hero. Before it was committed to writing, the Táin had an extensive oral history. It was dated by medieval Irish scholars to the first centuries BC, but this may have been an attempt by Christian monks to artificially synchronise oral traditions with biblical and classical history. The historicity of the Táin is questioned. Jackson (1964) argues that such narratives corroborate Greek and Roman accounts of the Celts and offer us a "window on the iron age"; O'Rahilly (1964) objects that such tales have no historical basis whatsoever.



Lebor na hUidre (Book of the Dun Cow)



Clochafamore (stone of the big man): According to mythology Cúchulainn, fatally wounded, strapped himself to this stone so that he could face the Connaught armies, even in death.



Map for Táin Bó Cúailnge



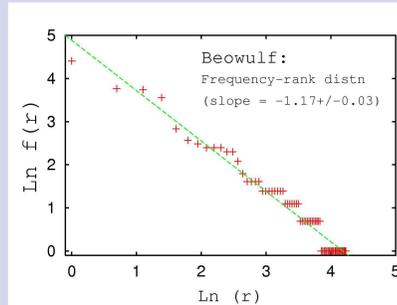
The Morrigan frequently appears on the form of a raven.

## Comparison of Beowulf and the Táin

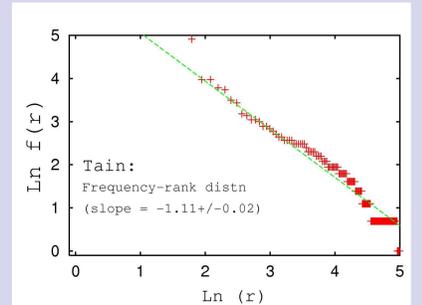
Here, we compare Beowulf with the Táin using methods from quantitative linguistics (frequency-rank analyses and Pareto-type measurements). We also construct and analyse the complex network of relationships between characters. This is part of a broader quantitative comparative study where mythologies from around the world are compared to each other and to real and fictitious networks.

## Frequency-rank analyses

Zipf's law states that in a body of text, the frequency  $f$  of a given word decreases exponentially as its rank  $r$  increases:  $f(r) \sim r^{-\alpha}$ . Related to this is the Pareto principle. This states that for many events, roughly 80% of the effects come from 20% of the causes. These laws are often found in physical and social systems.



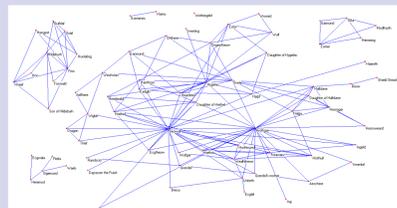
For Beowulf,  $\alpha \approx 1.17$ . Also, 75% of occurrences of names are associated with 25% of characters.



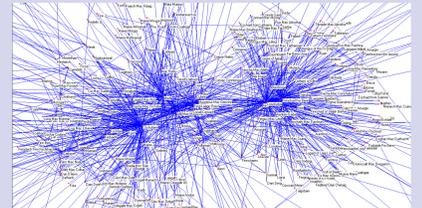
For the Táin,  $\alpha \approx 1.11$ . Also, 85% of occurrences of names are associated with 15% of characters.

## Network analysis

Most realistic networks have non-trivial topologies, with connections between nodes neither regular nor random. We construct mythological networks by establishing whether there are relationships between characters.

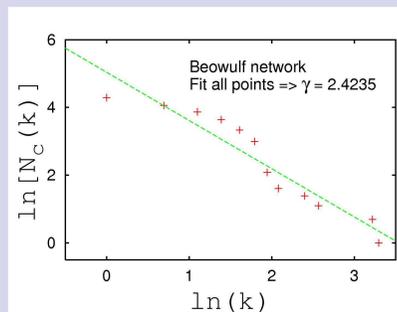


Beowulf contains 74 characters, mostly Geats, Danes and Swedes.

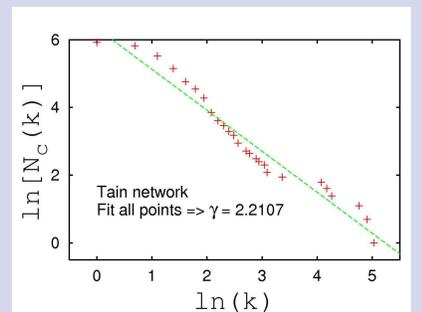


This is a portion of the Táin network. The Táin has 374 characters predominantly from Ulster and Connaught.

Scale-free and small-world networks are characterized by power-law degree distributions ( $p(k) \sim k^{-\gamma}$ ) and high clustering.



The Beowulf degree distribution has  $\gamma = 2.42 \pm 0.15$ .



The Táin degree distribution has  $\gamma = 2.21 \pm 0.06$ .

For Beowulf and the Táin, the degree distribution is power-law, indicating the networks are scale free (preferential attachment).

## Comparison of networks

Myth	N	L	$\alpha$	$\gamma$	$\langle k \rangle$	$\langle k^2 \rangle$	$l_{max}$	$\langle l \rangle$	$C_b$	Pareto
Beowulf	74	164	1.17	2.42	4.45	38	6	2.40	11.35	75:25
Táin	374	985	1.12	2.21	5.27	199	10	2.81	117.11	85:15

Compare to the intentionally fictitious network of characters in the Marvel Universe, which has  $\gamma \approx 0.66$ .

## References and acknowledgement

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