IAT'13
Atlanta, Nov. 17-20, 2013

The Best-partitions Problem

How to Build Meaningful Aggregations

Laboratoire d'Informatique de Grenoble

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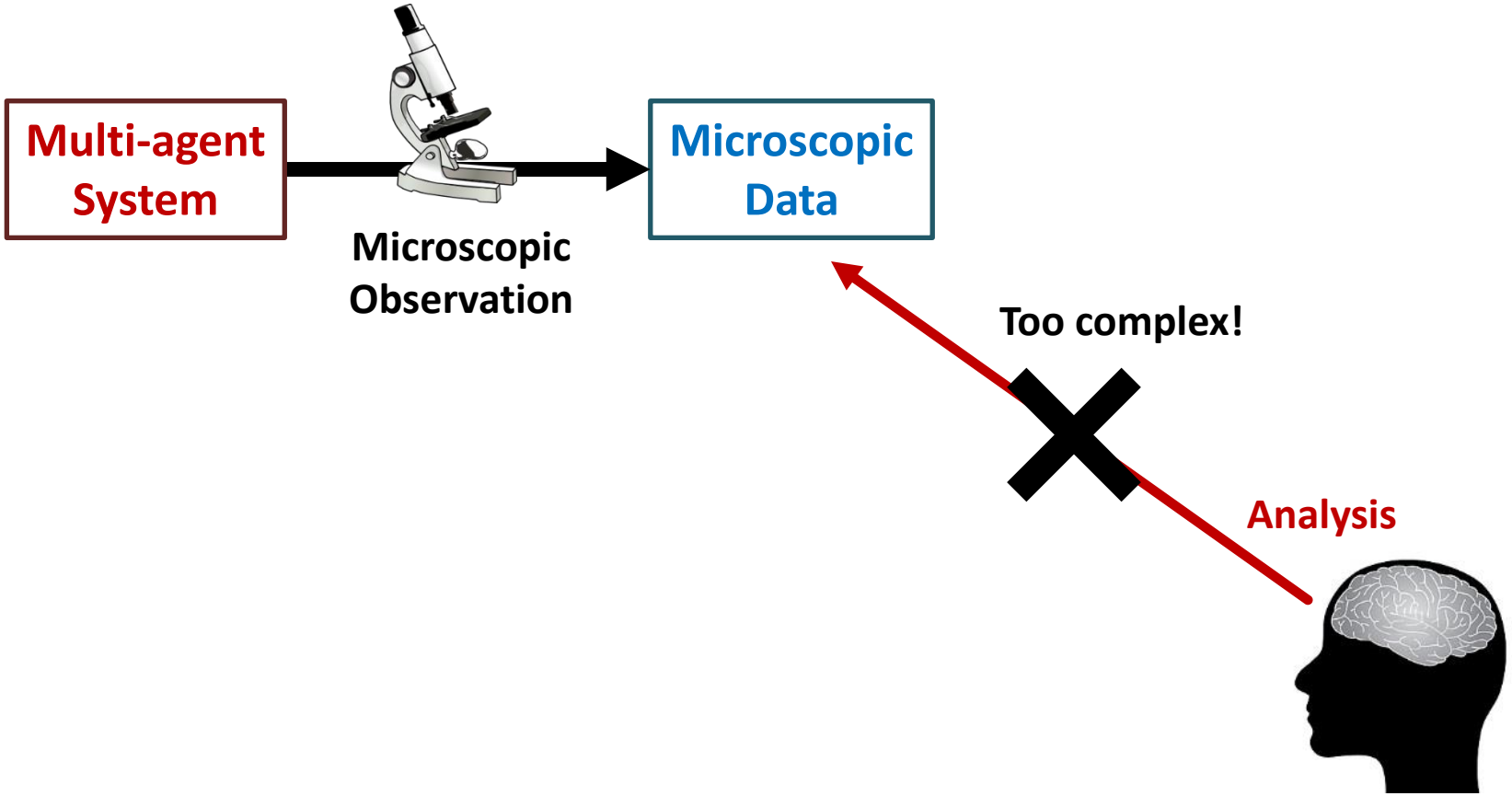
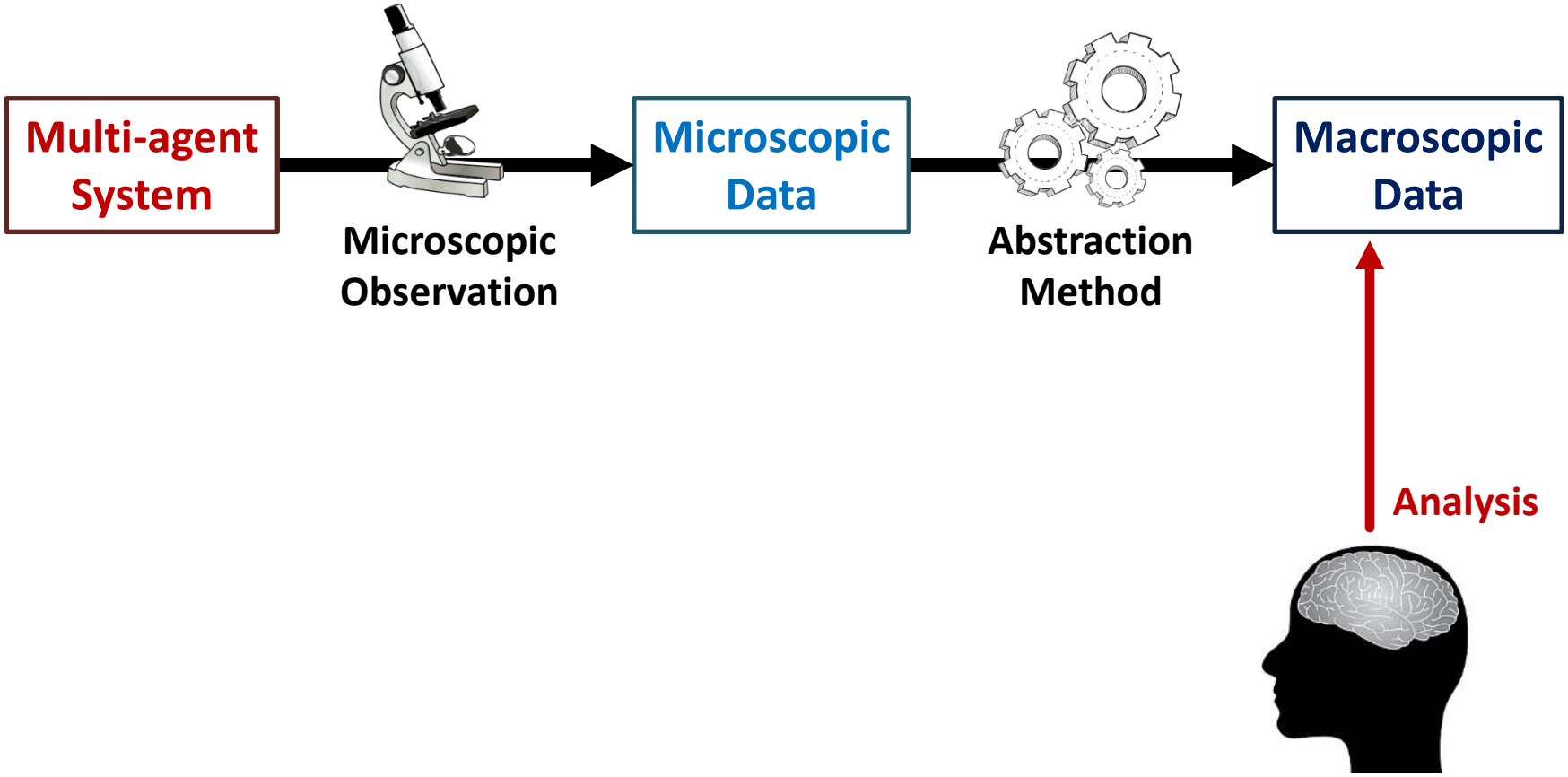
Yves Demazeau	CNRS
Jean-Marc Vincent	Univ. Grenoble Alpes

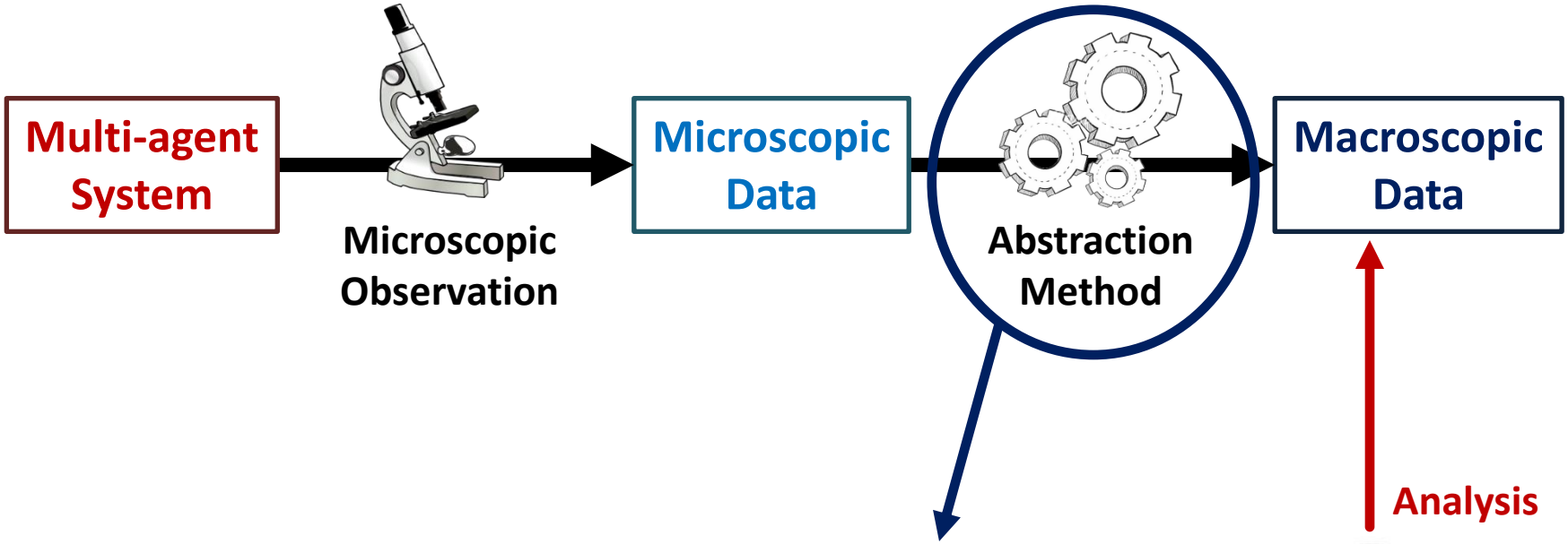
The Analysis of Large-scale Systems



The Analysis of Large-scale Systems



The Analysis of Large-scale Systems

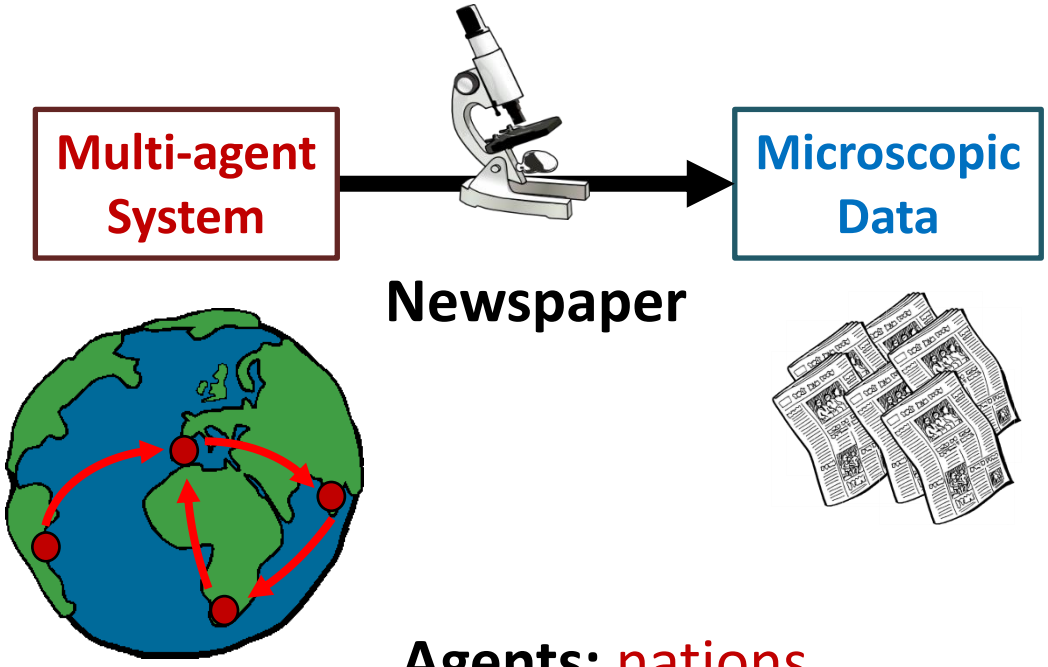


How to build meaningful abstractions out of microscopic data?

The GEOMEDIA Project

Analysis of **international relations**

through **print media** observation

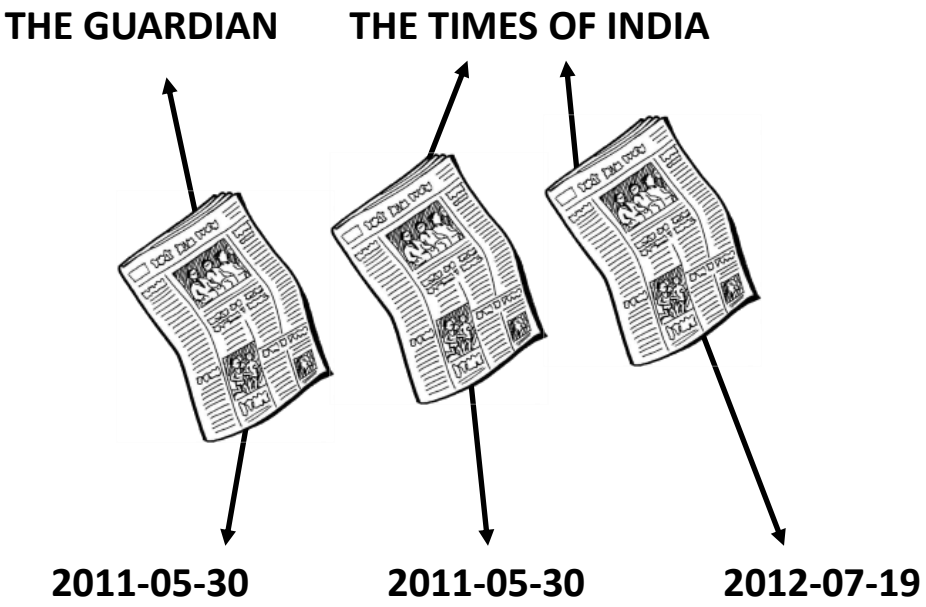


Agents: nations

Interactions: international relations

Organisation: geopolitical context

Counting Citations



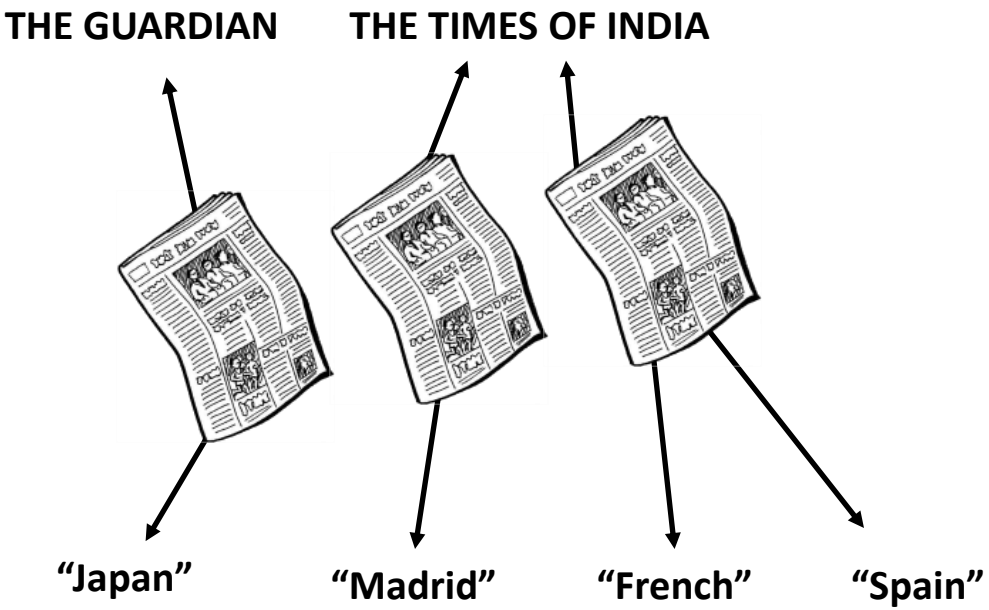
150 Newspapers

1,530,000 Articles

TEMPORAL INFORMATION

630 Days or 90 Weeks
(from 2011-05-03 to 2013-01-20)

Counting Citations



150 Newspapers

1,530,000 Articles

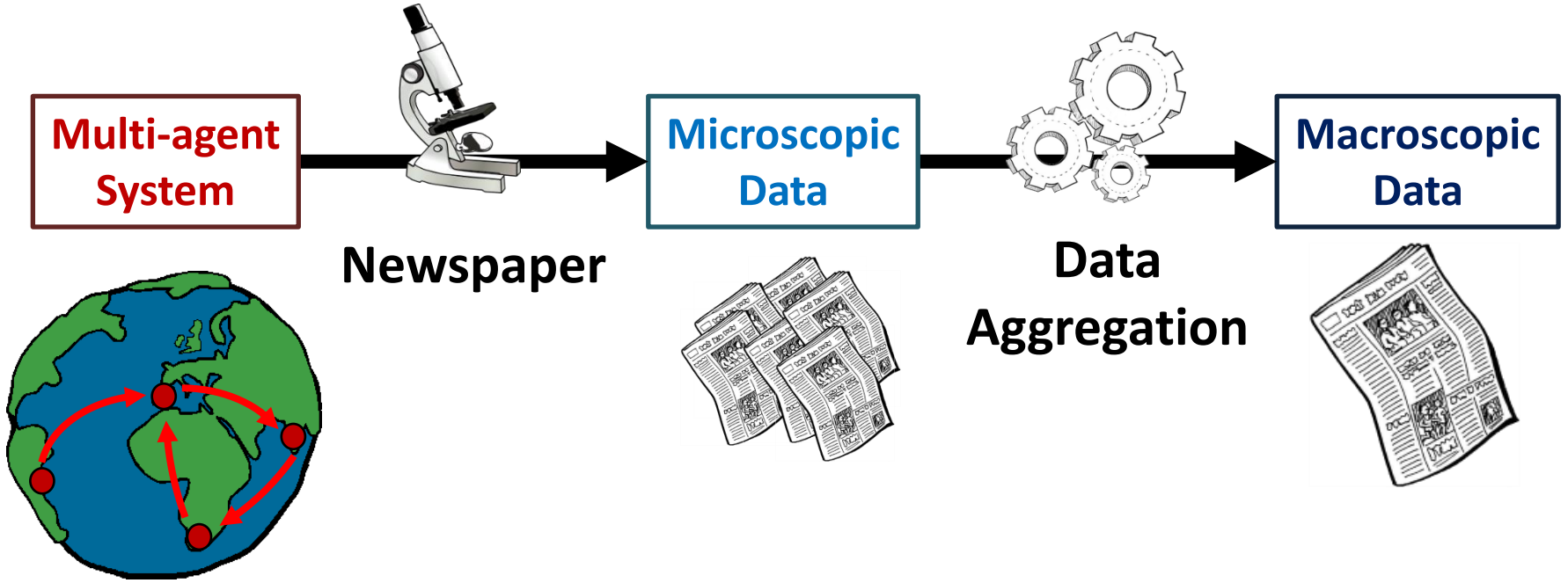
SPATIAL INFORMATION

193 Countries
(United Nation members)

The GEOMEDIA Project

Analysis of **international relations**

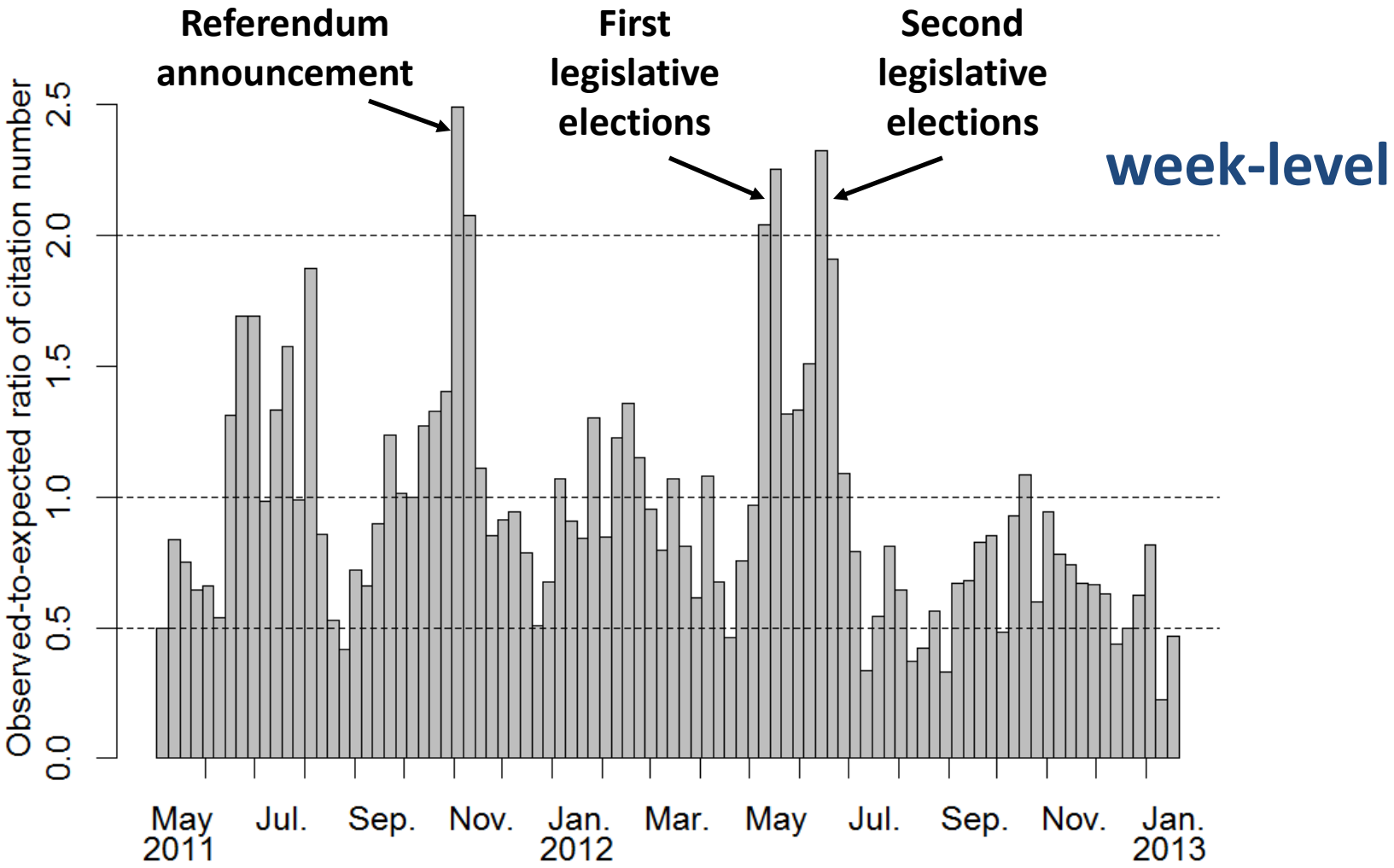
through **print media** observation



EXAMPLE OF TEMPORAL AGGREGATION

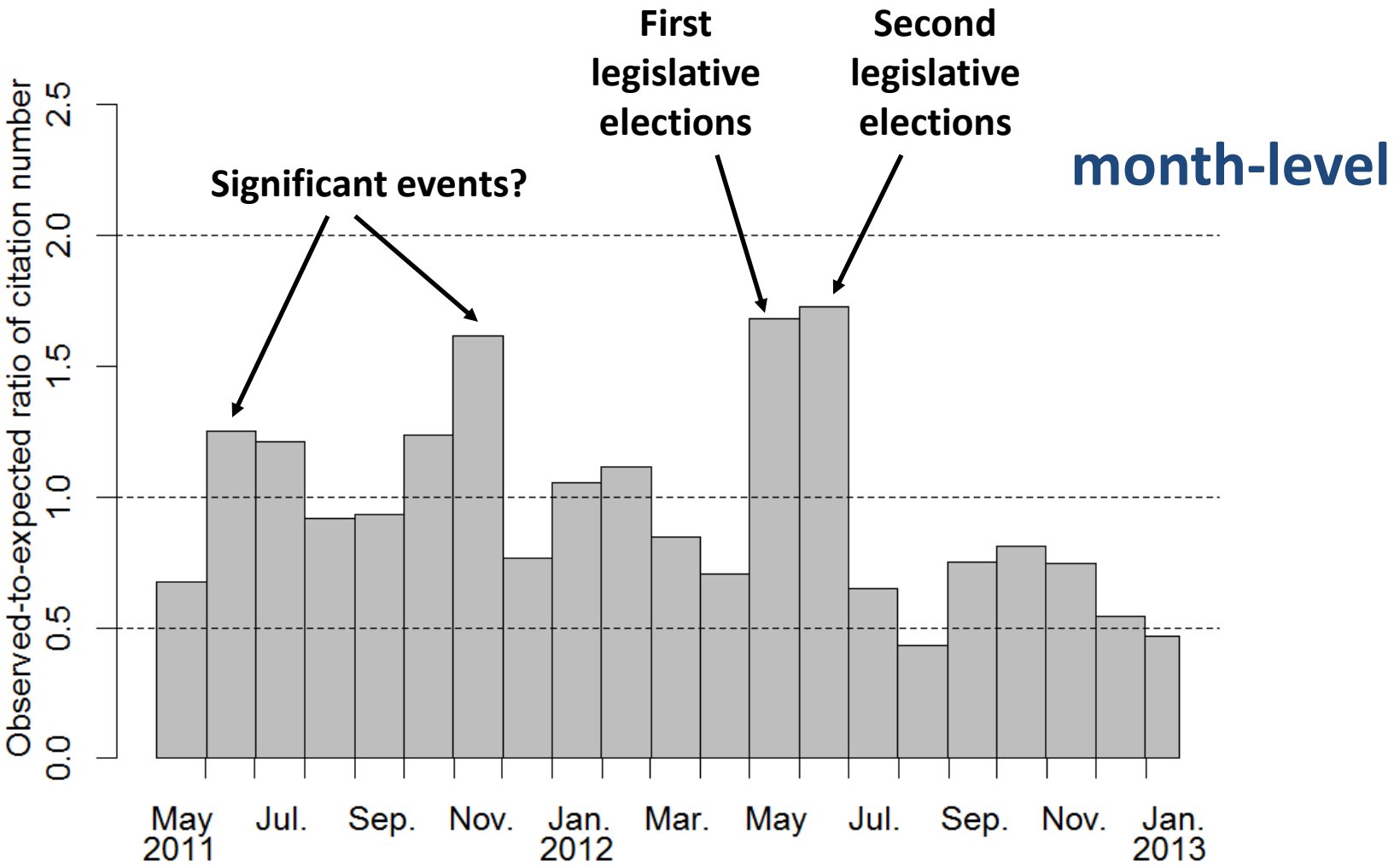
Citation number of Greece

THE GUARDIAN from May 2011 to Jan. 2013



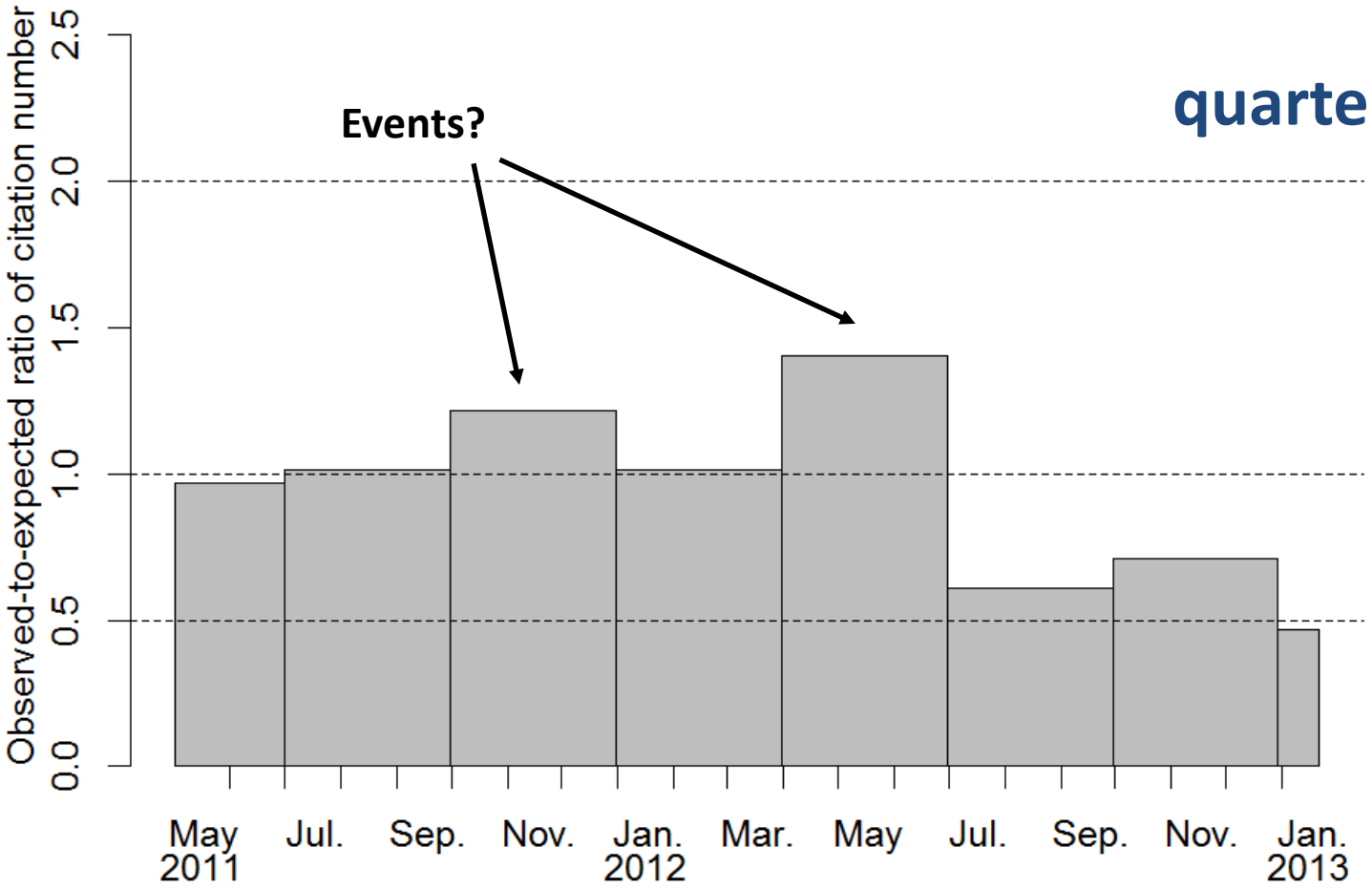
Citation number of Greece

THE GUARDIAN from May 2011 to Jan. 2013



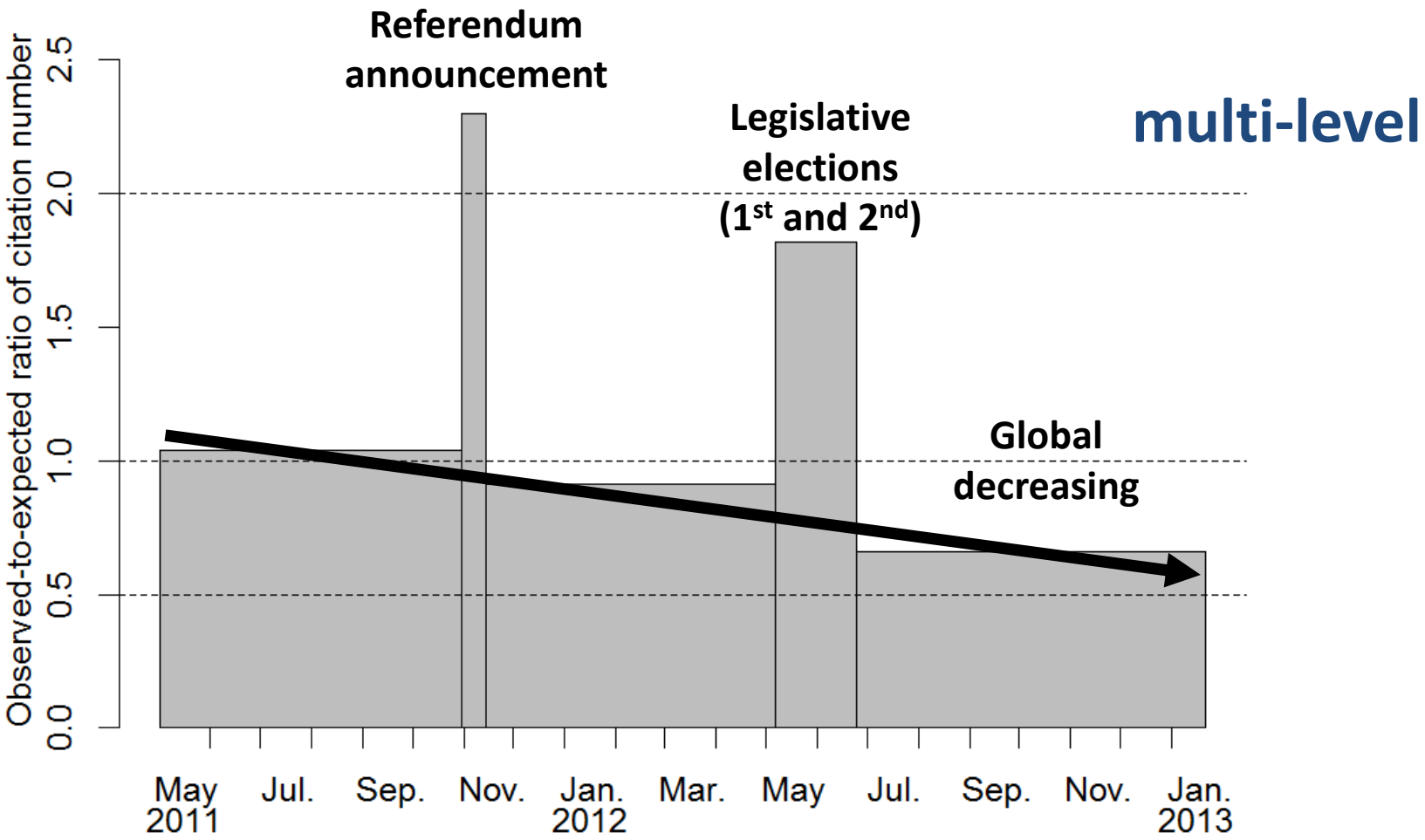
Citation number of Greece

THE GUARDIAN from **May 2011** to **Jan. 2013**



Citation number of Greece

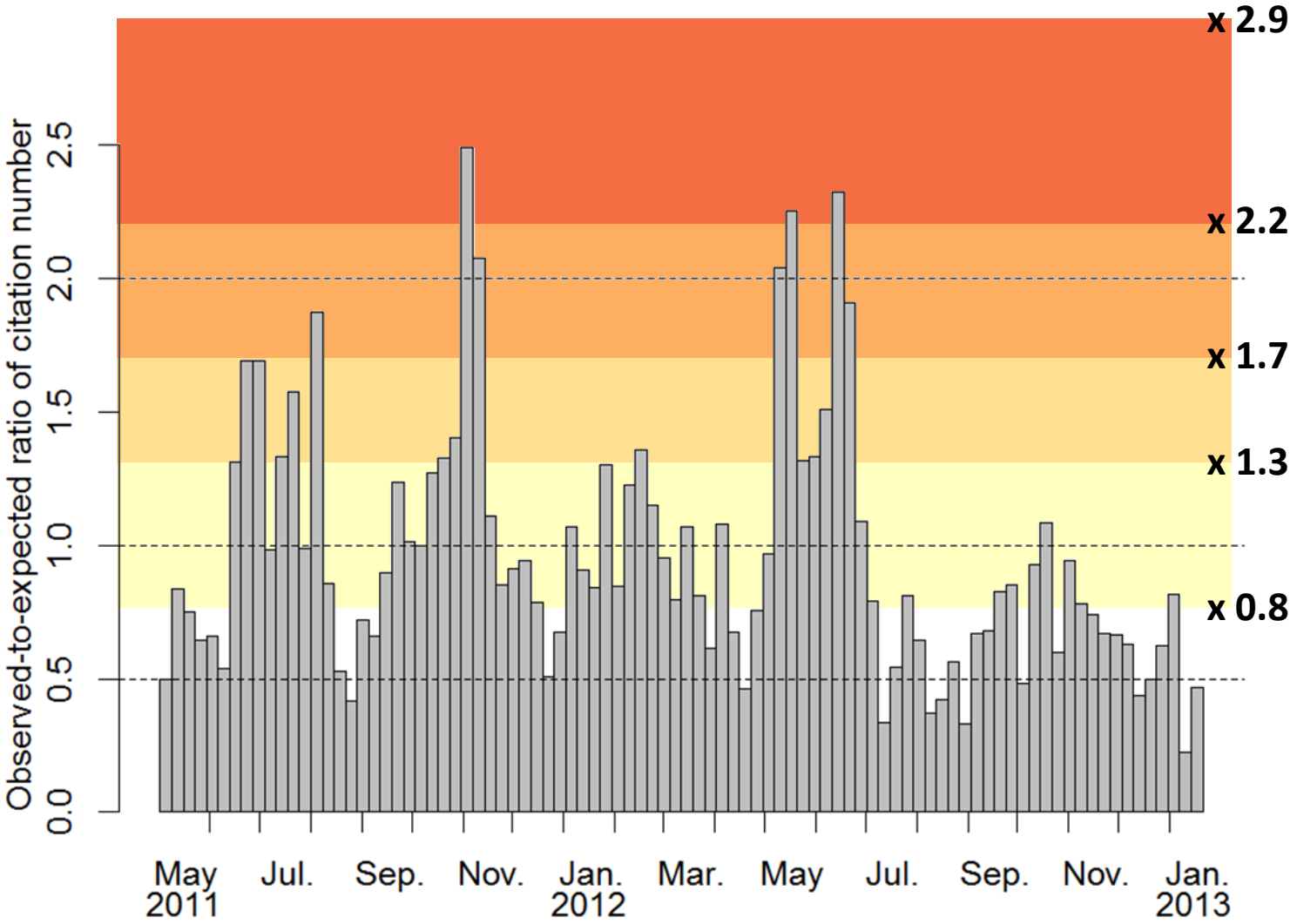
THE GUARDIAN from May 2011 to Jan. 2013



EXAMPLE OF SPATIAL AGGREGATION

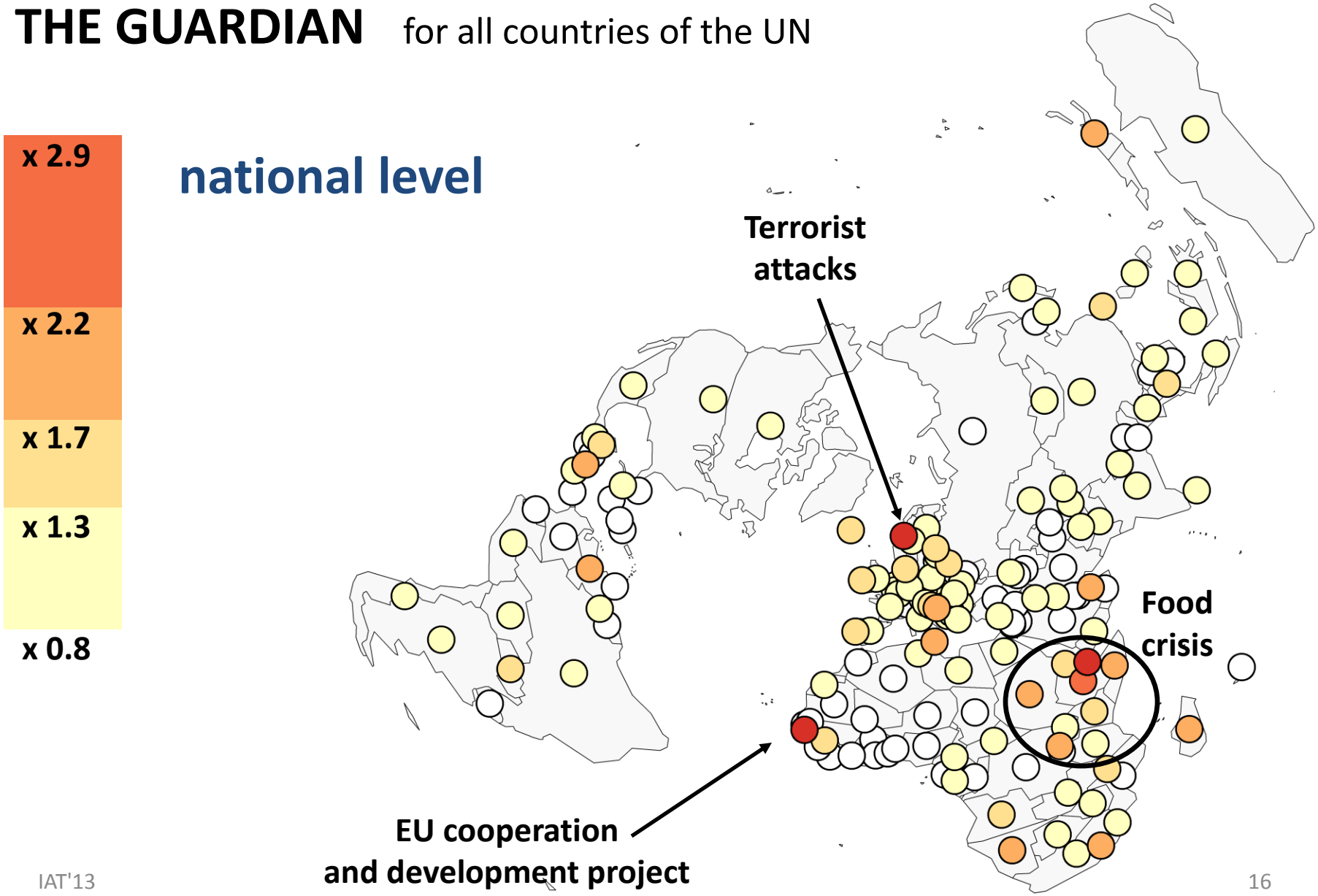
Citation number of Greece

THE GUARDIAN from **May 2011** to **Jan. 2013**



Citation number during July 2011

THE GUARDIAN for all countries of the UN



Citation number during July 2011

THE GUARDIAN for all countries of the UN

x 2.9

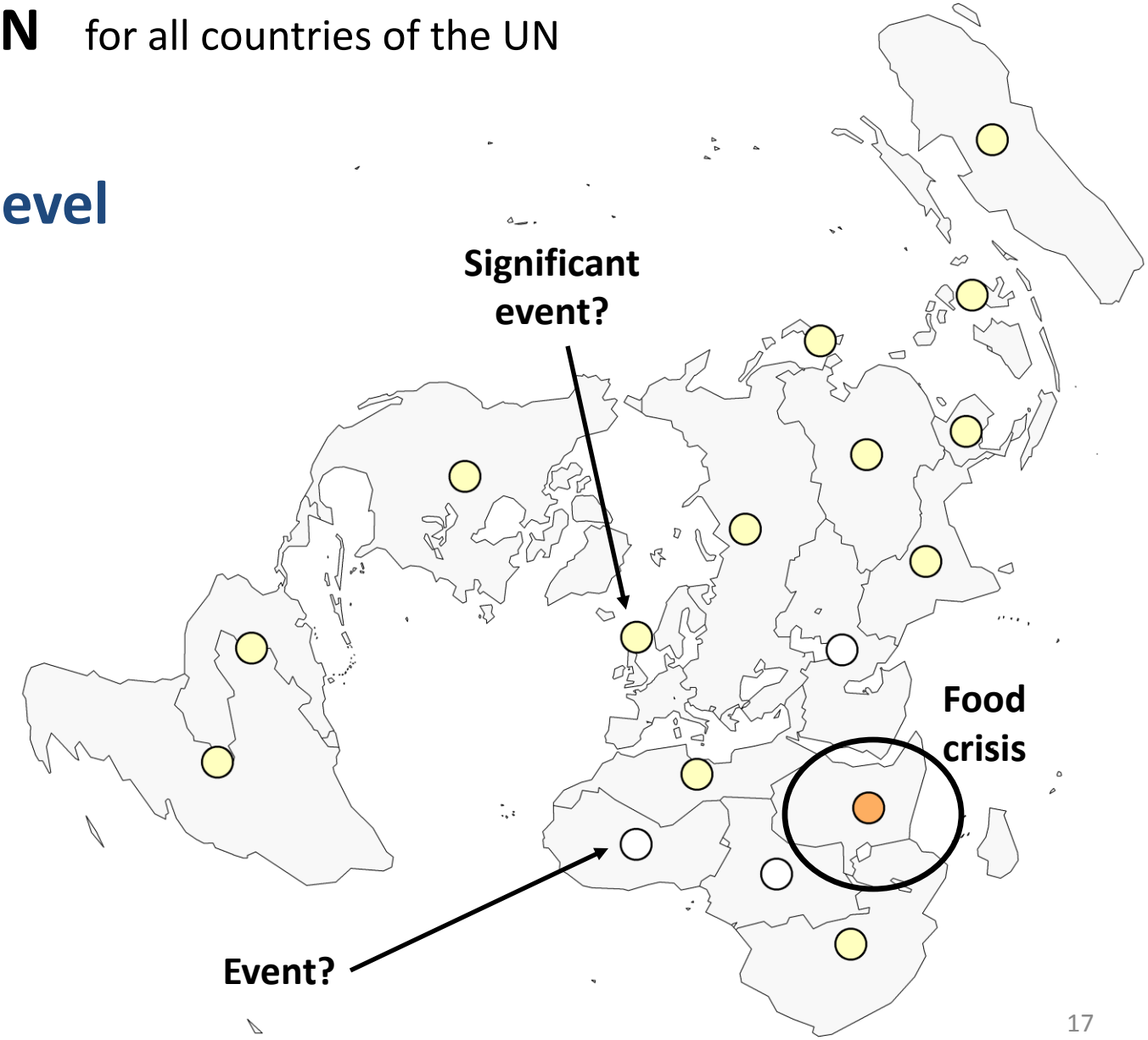
x 2.2

x 1.7

x 1.3

x 0.8

meso-level



Citation number during July 2011

THE GUARDIAN for all countries of the UN

x 2.9

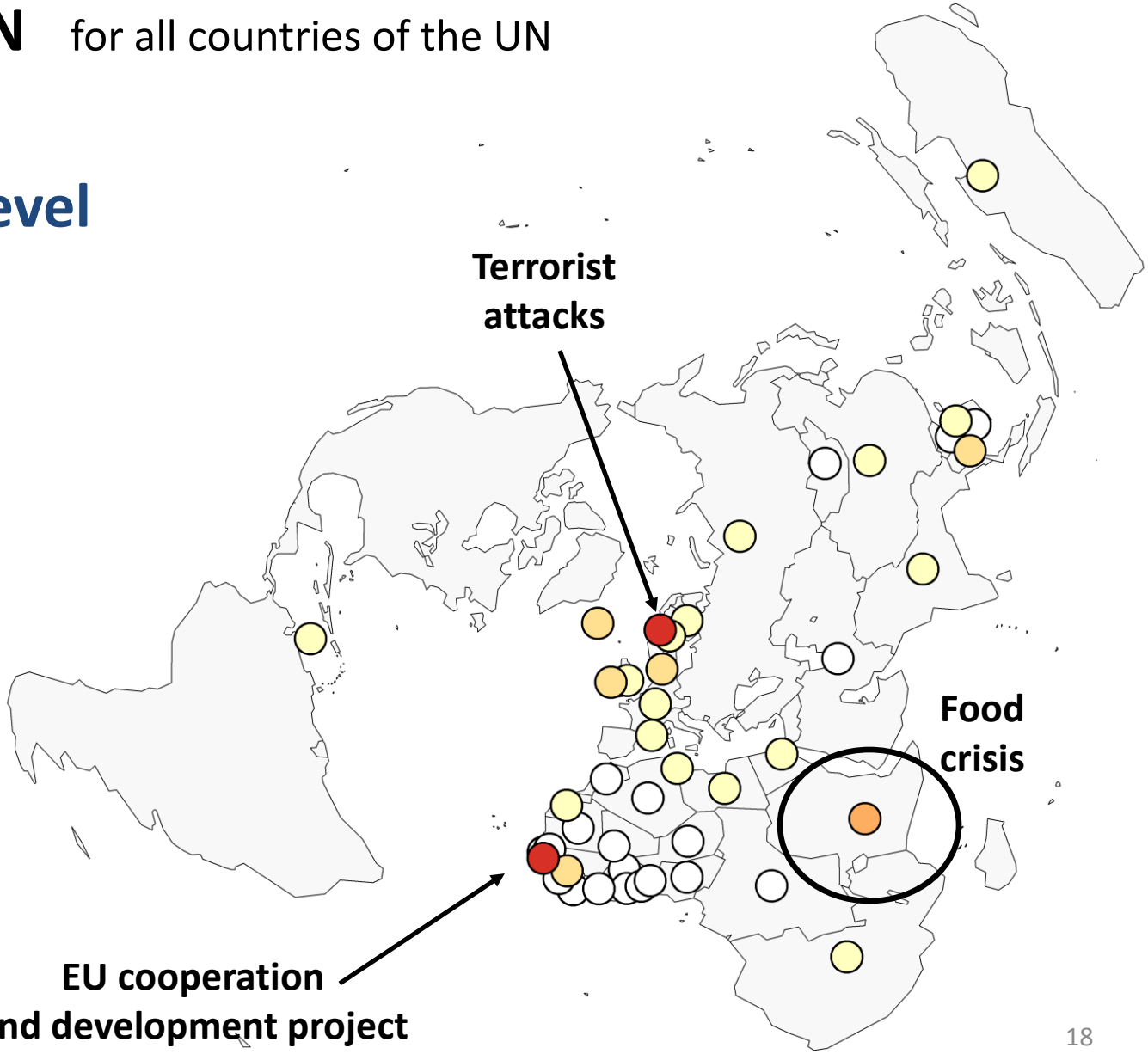
x 2.2

x 1.7

x 1.3

x 0.8

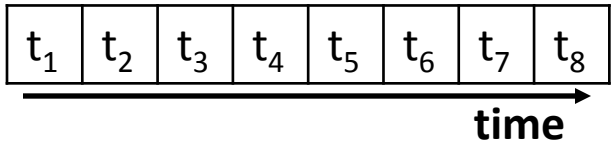
multi-level



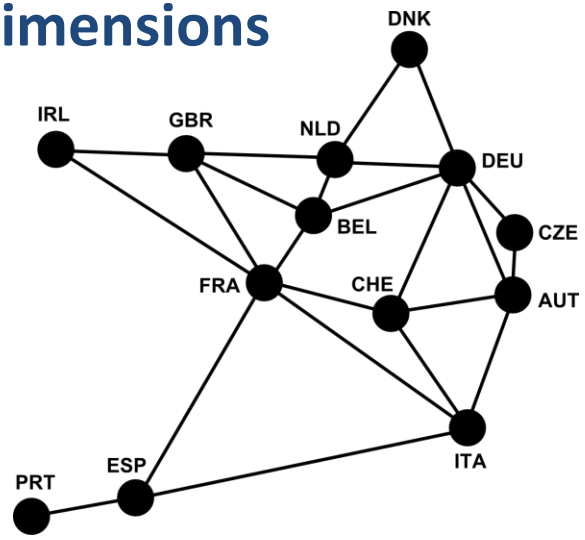
The General Problem

A **generic aggregation algorithm** that can be applied to the various system's dimensions

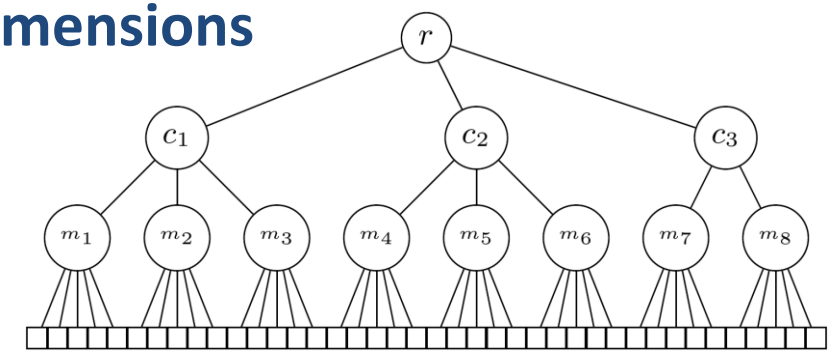
Ordered dimensions



Network-like dimensions



Hierarchically organized dimensions



The General Problem

A **generic aggregation algorithm** that can be applied to the various system's dimensions

Given a **fitness function** on parts:

1. Which partition optimizes this function?
2. How to preserve the topological properties?
3. How to be computationally efficient?

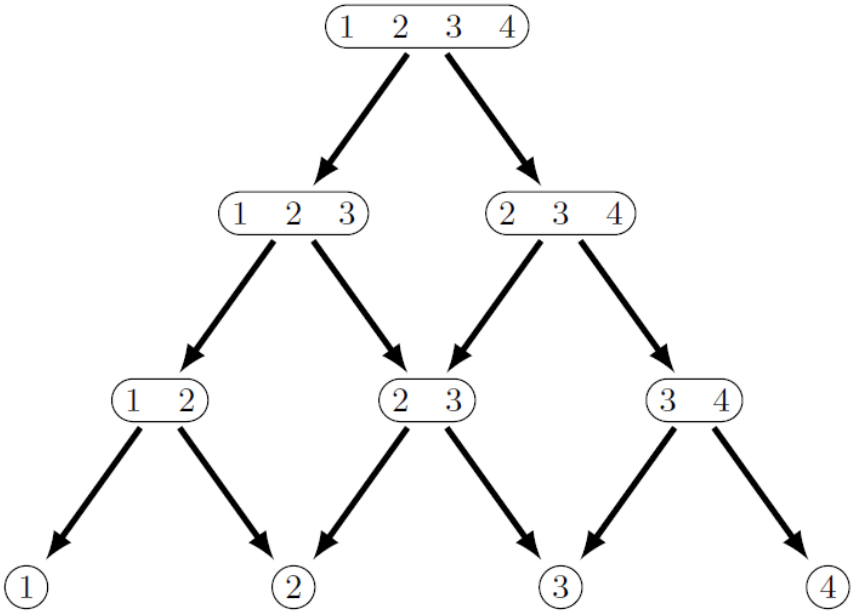
Constrained algorithm

Admissible partitions

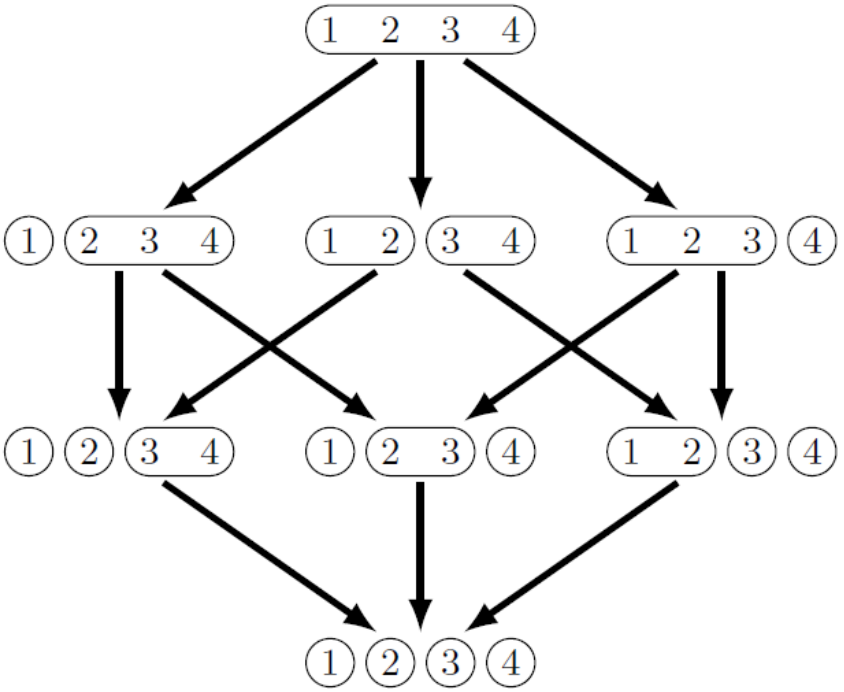
TOPOLOGICAL PROPERTIES

Structure of Ordered Dimensions

Admissible parts

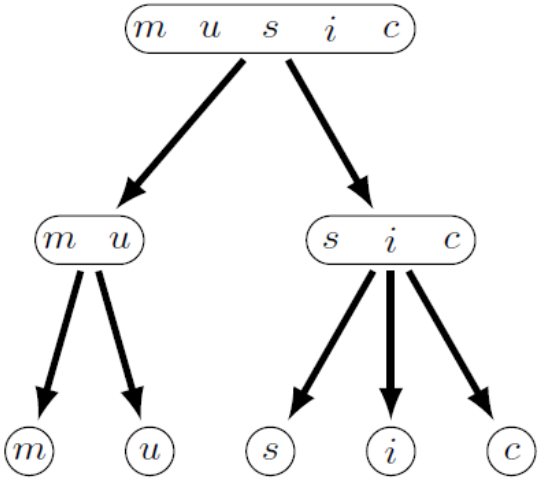


Admissible partitions

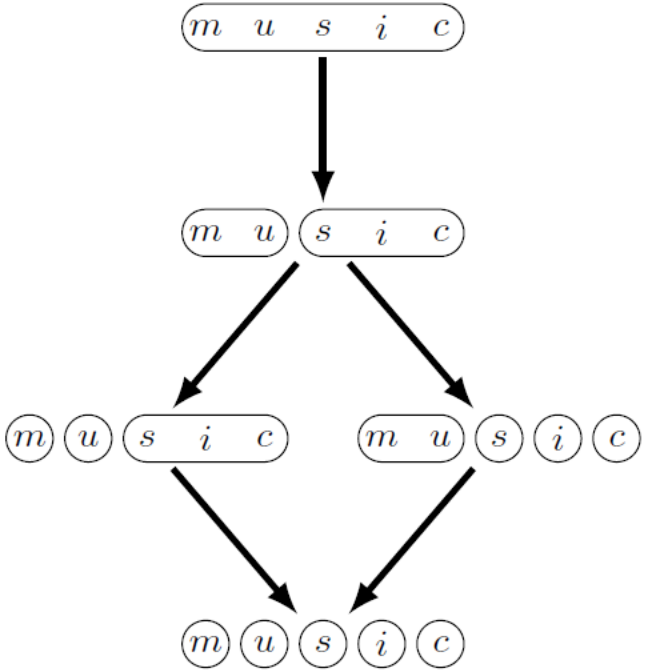


Structure of Hierarchical Dimensions

Admissible parts



Admissible partitions

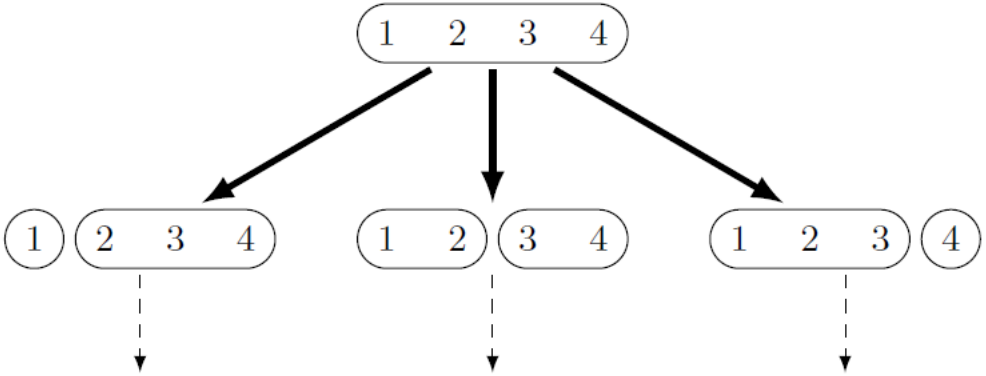


AGGREGATION ALGORITHM

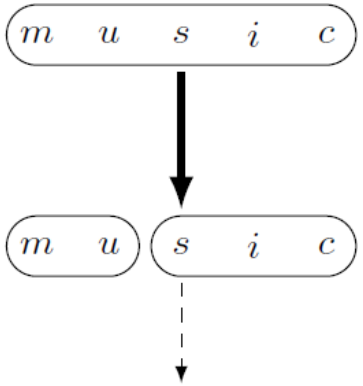
Divide and Conquer

Covering relation: covered partitions correspond to the smallest disaggregations in the set of admissible partitions

Decomposition of an ordered dimension



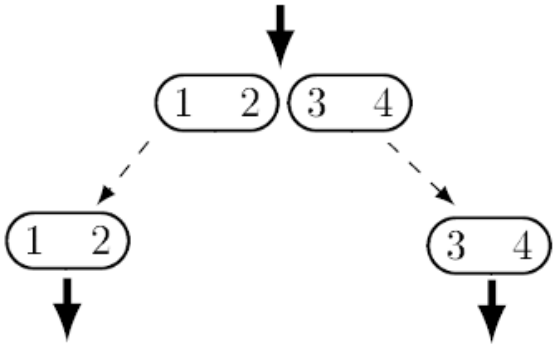
Decomposition of a hierarchical dimension



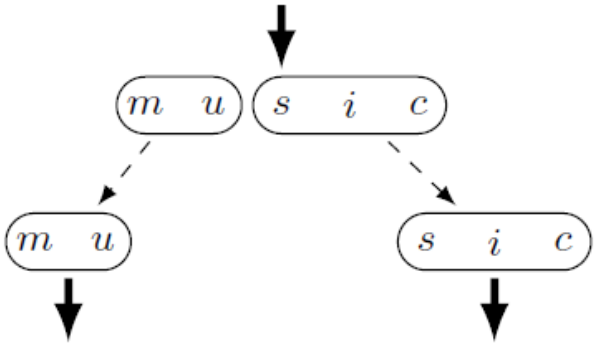
Divide and Conquer

Sum property: the quality of a partition is the sum of the qualities of its parts

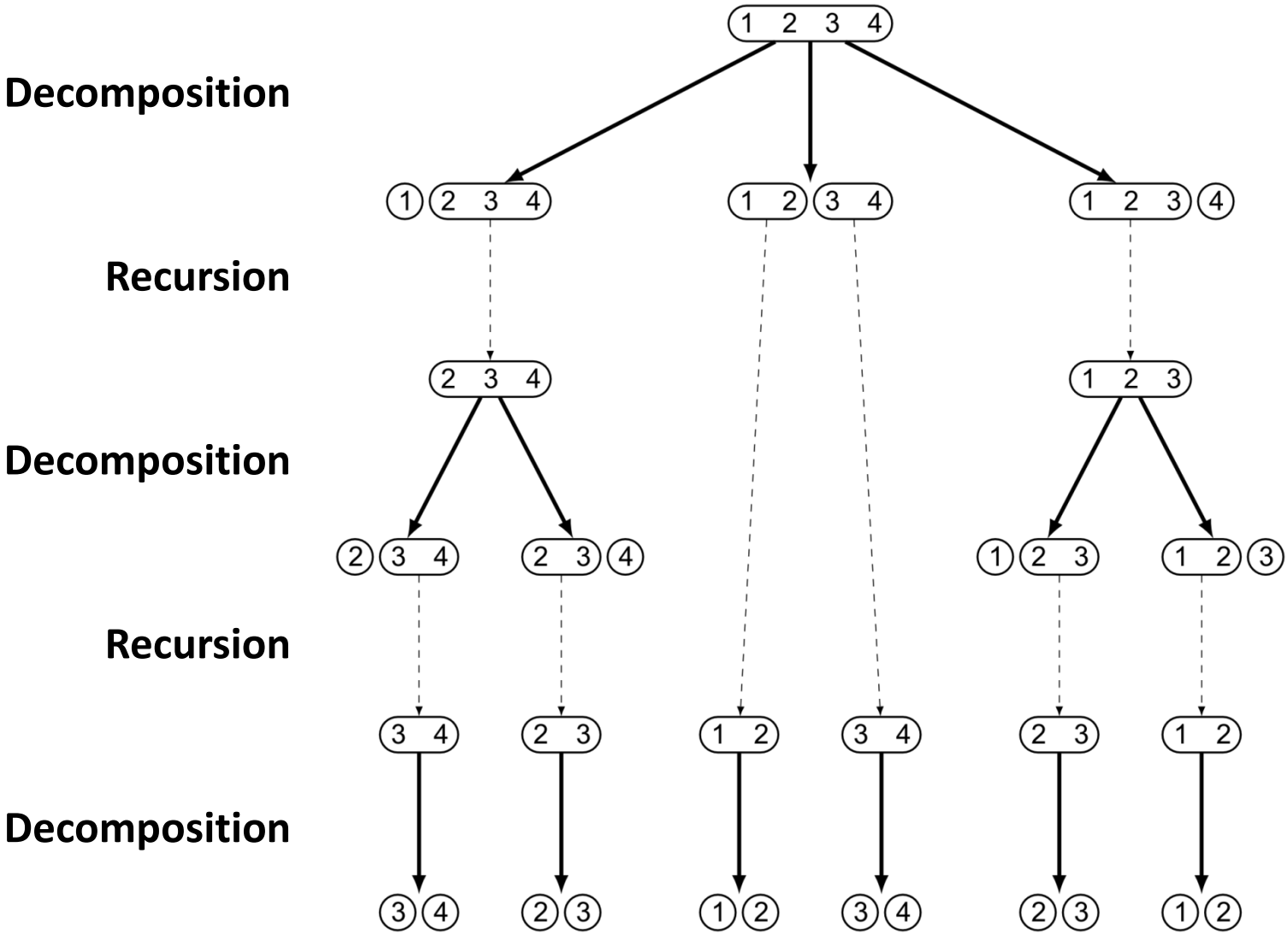
Recursion on an ordered dimension



Recursion on a hierarchical dimension

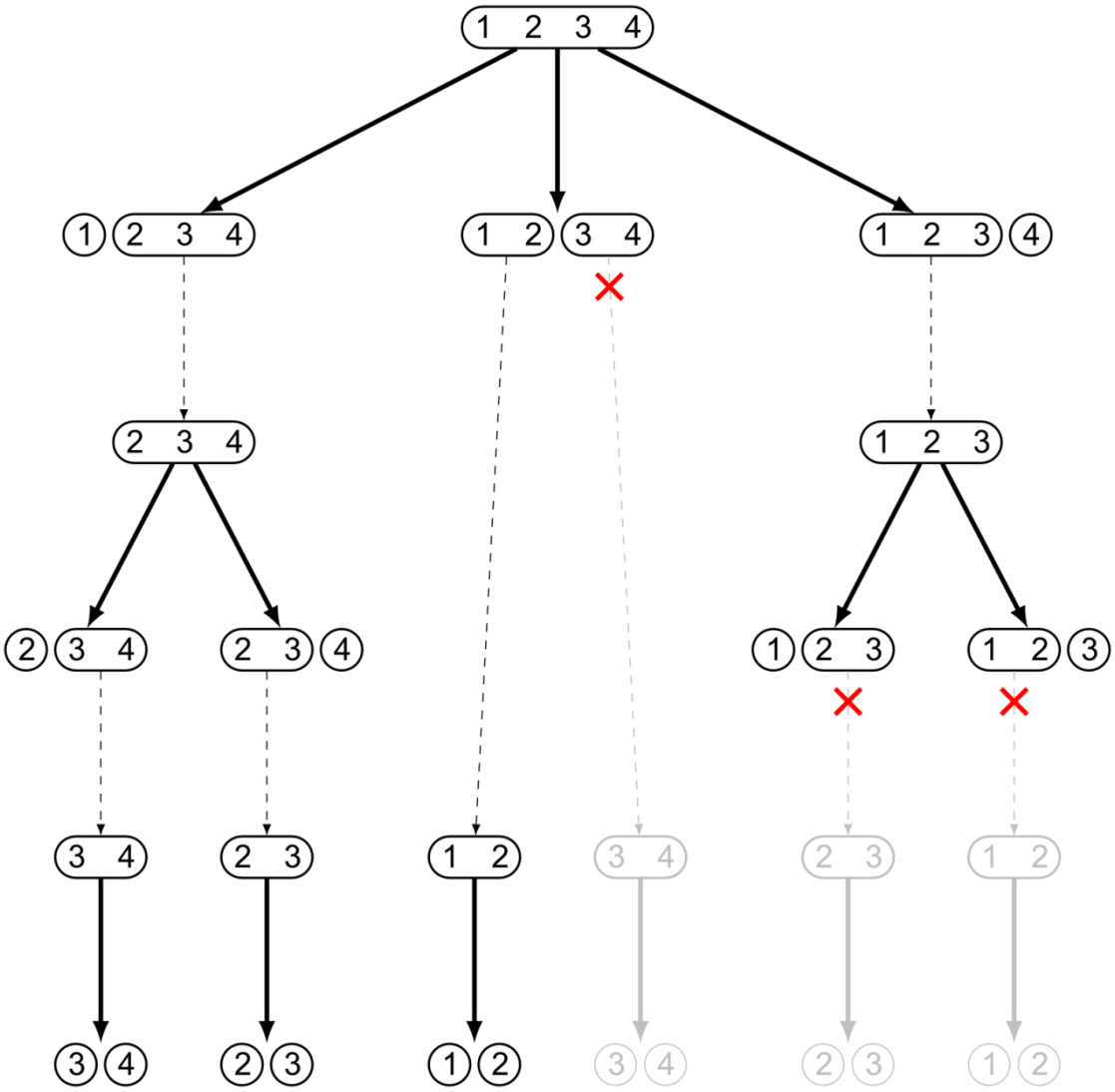


Example of Execution



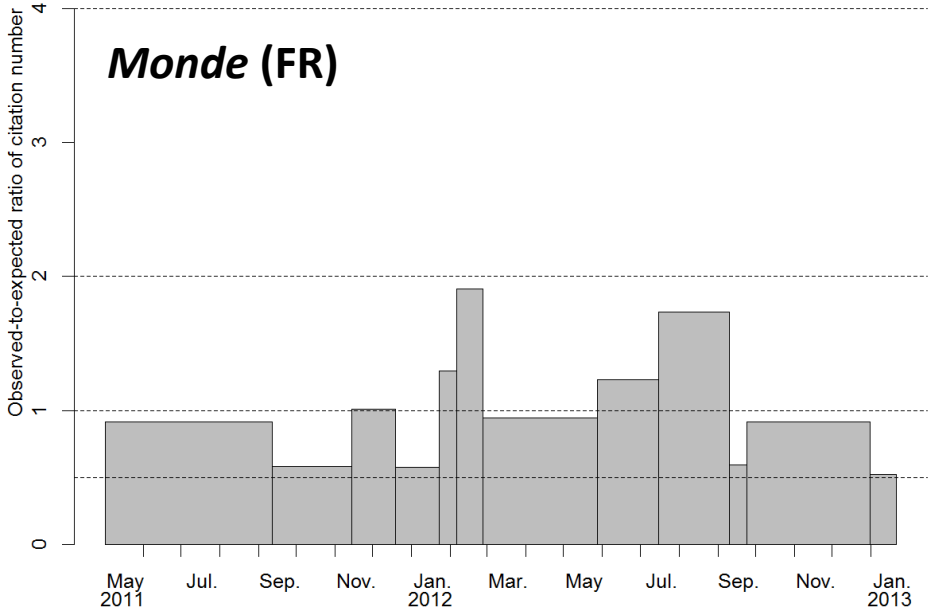
Optimization of the Algorithm

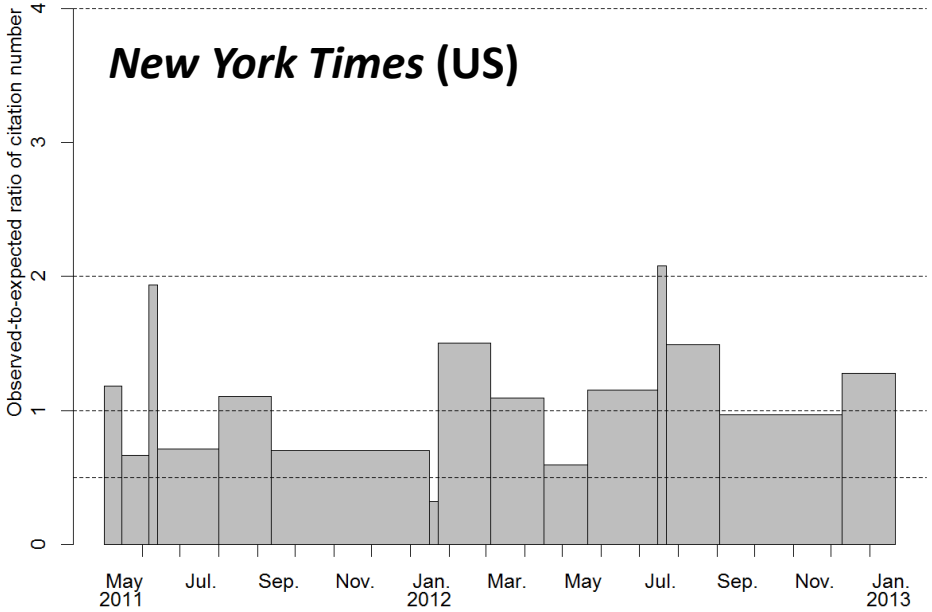
Once the optimal sub-partition of a given part has been computed, it can be used in the next recursive calls

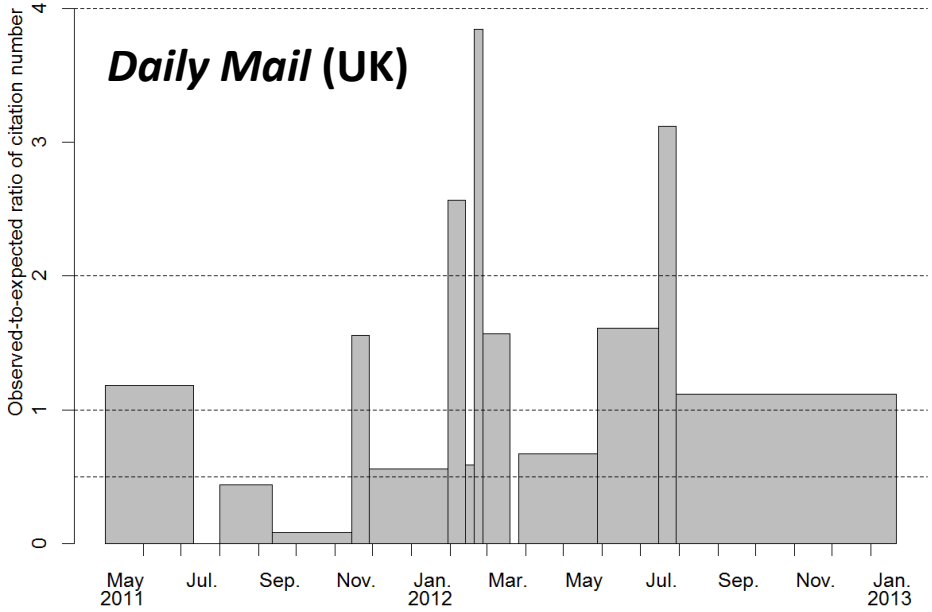


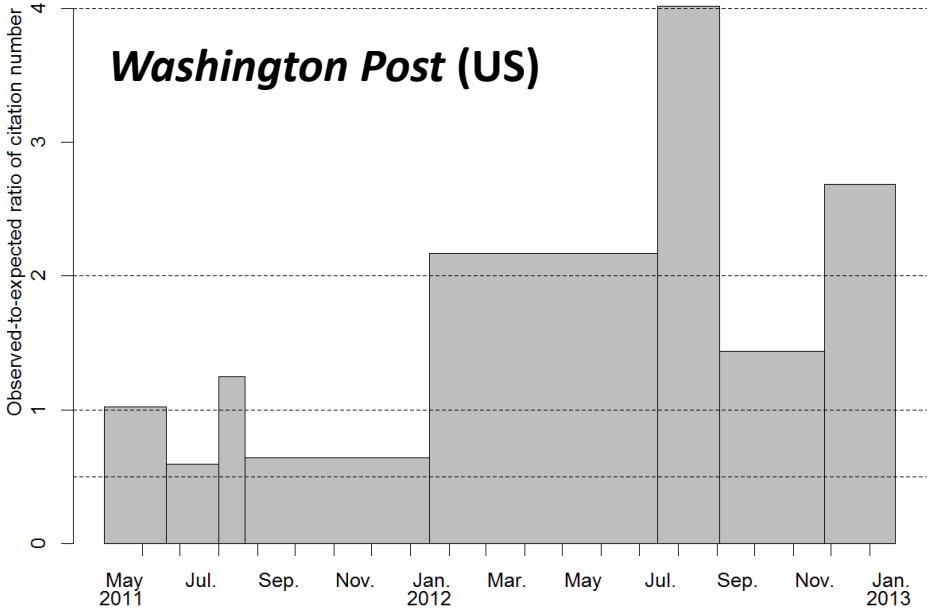
EXPERIMENTS

Comparison of Media Attention regarding Syria

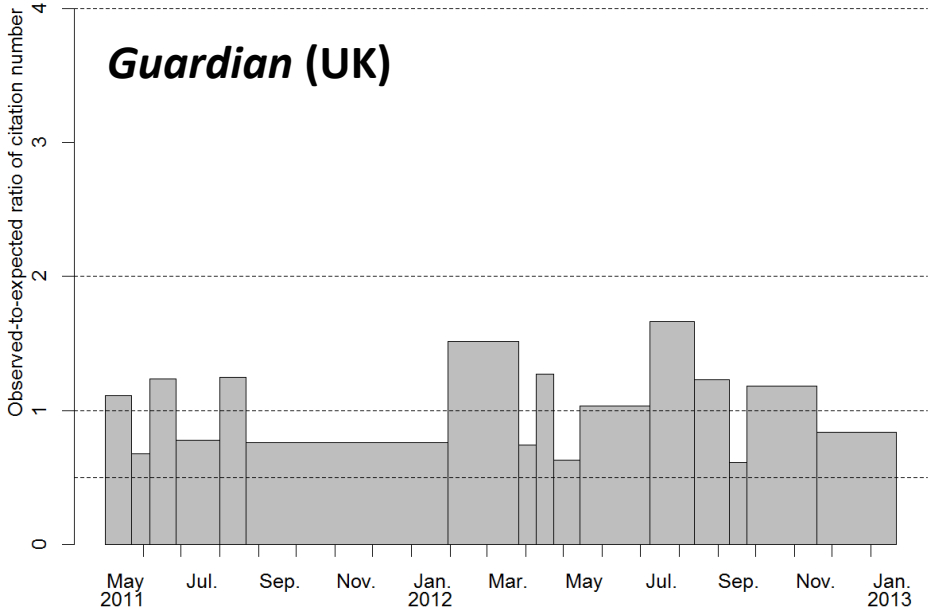


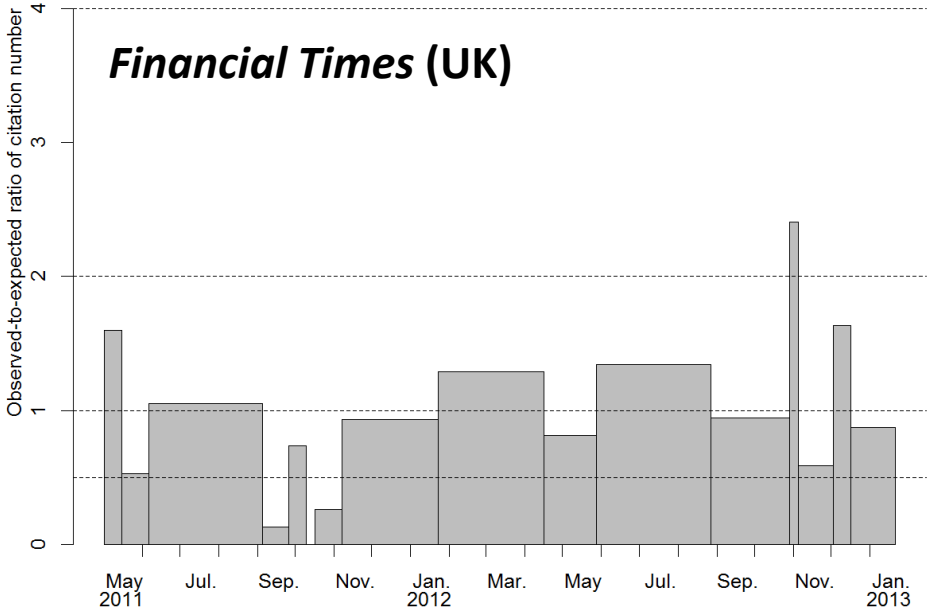


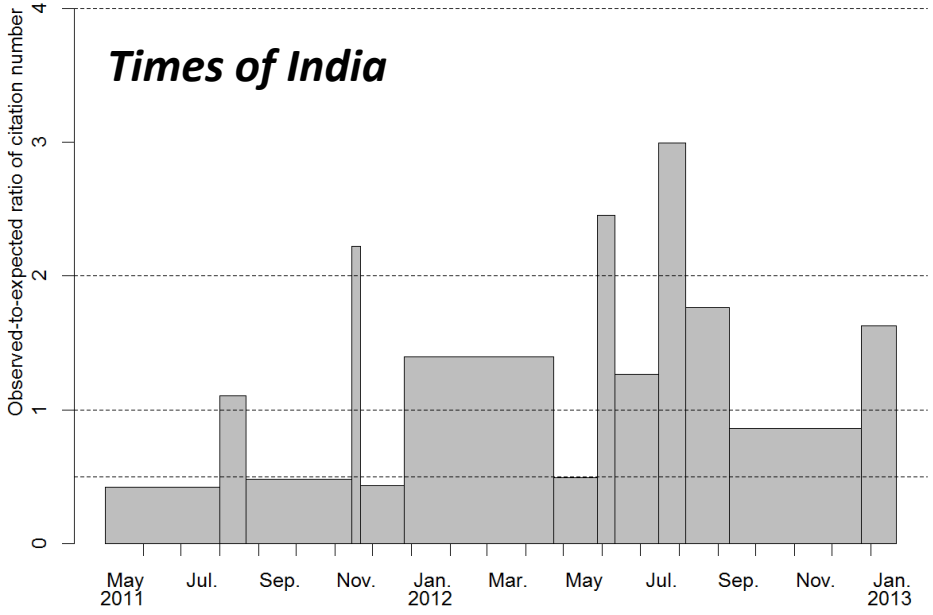




Comparison of Media Attention regarding Syria







CONCLUSION AND PERSPECTIVES REGARDING THE ALGORITHM

Complexity of the Algorithm

The space and time algorithmic complexities depend on the structure of the covering relation:

the more constraint, the less complex

Dimension	Number of parts	Number of partitions	Time complexity	Space complexity
Unconstrained	$\Theta(2^n)$	$\Theta\left(e^{n \log n}\right)$	$\Theta(3^n)$	$\Theta(2^n)$
Ordered	$\Theta(n^2)$	$\Theta(2^n)$	$\Theta(n^3)$	$\Theta(n^2)$
Hierarchical	$O(n)$	$O(1.23^n)$	$O(n)$	$O(n)$
Other topologies	?	?	?	?

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THANK YOU FOR YOUR ATTENTION

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