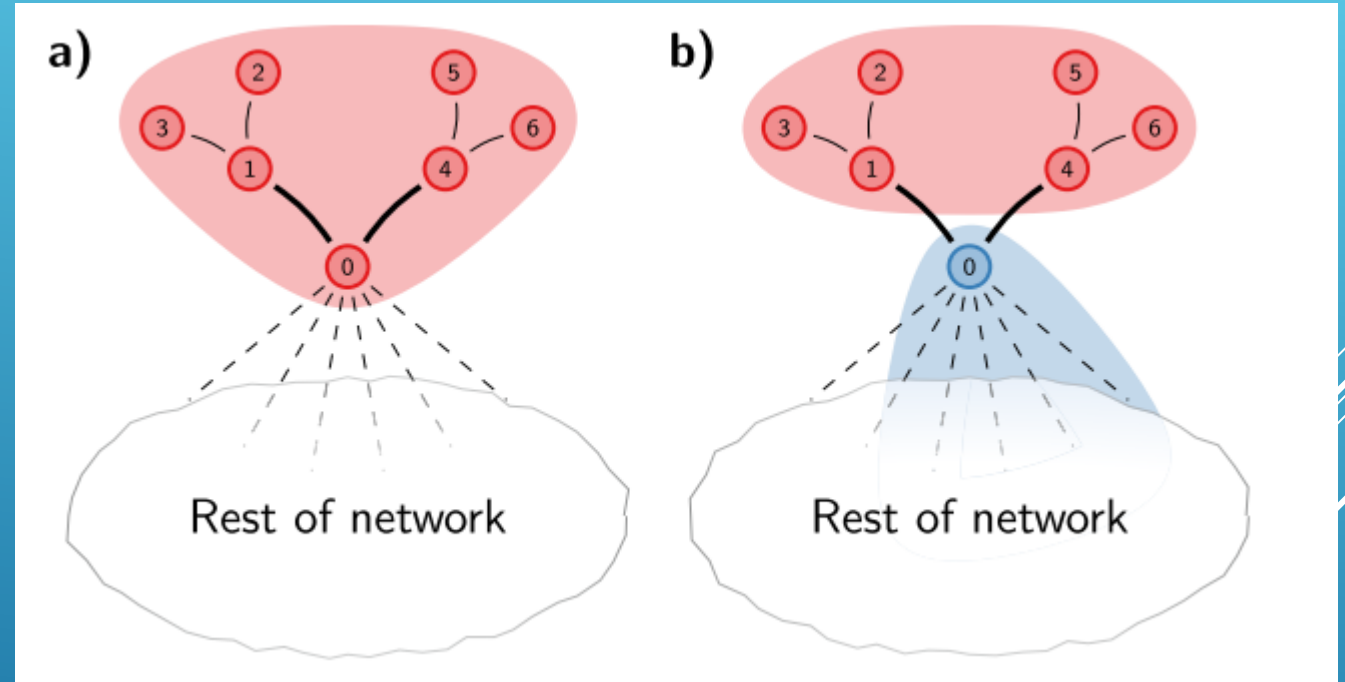# CLUSTERING 2 ALTERNATIVES AND IMPROVEMENTS TO MODULARITY

Analysis of Large Scale Social Networks

Bart Thijs

New Problem is described:

The linkage procedure of the Louvain method can lead to badly connected communities

MODULARITY BASED APPROACHES

The Leiden algorithm provides new linkage scheme:

a) *Individual nodes are moved to find a partition*

b) *Partition is refined (nodes within community are clustered again)*

c) *Network is aggregated using the refined partition*

d) *Partitioning of aggregated network is assumed based on initial portioning (step a)*

e) *Individual (aggregated) nodes are moved to optimize partition*

MODULARITY BASED APPROACHES

The refinement phase in the Leiden algorithm:

a) *Only within each community of initial partition*

b) *Each node in the community start as its own partition*

c) *Merges are performed*

1. *increase of quality function*

2. *sufficiently connected,*

3. *not greedy (not highest increase but probability relative to increase)*

MODULARITY BASED APPROACHES

Optimization of local moving in the Leiden algorithm:

a) *Only nodes whose neighbourhood has changed is visited.*

b) *Each node is in queue (random order)*

c) *Node is taken, processed and if changed, neighbourhood is added to the queue.*

MODULARITY BASED APPROACHES