On Proportional Symbol Maps - An applied perspective

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Geometry Lab SS 2020

Overview - ToC

Introduction

Motivation

A few words on why. Picture of COVID-19 and similar data.

Proportional Symbol Maps

Backreference. Explanation of topic.

Maps and Glyphs

Introduce glyph types discussed and create transition into Algo section.

Algorithms

Prior

David's part. See Philip's list and or discussion.

Generalized

See Philip's list and or discussion.

Our approach

See Philip's list and or discussion.

Squares and Pies... and so on

See Philip's list and or discussion.

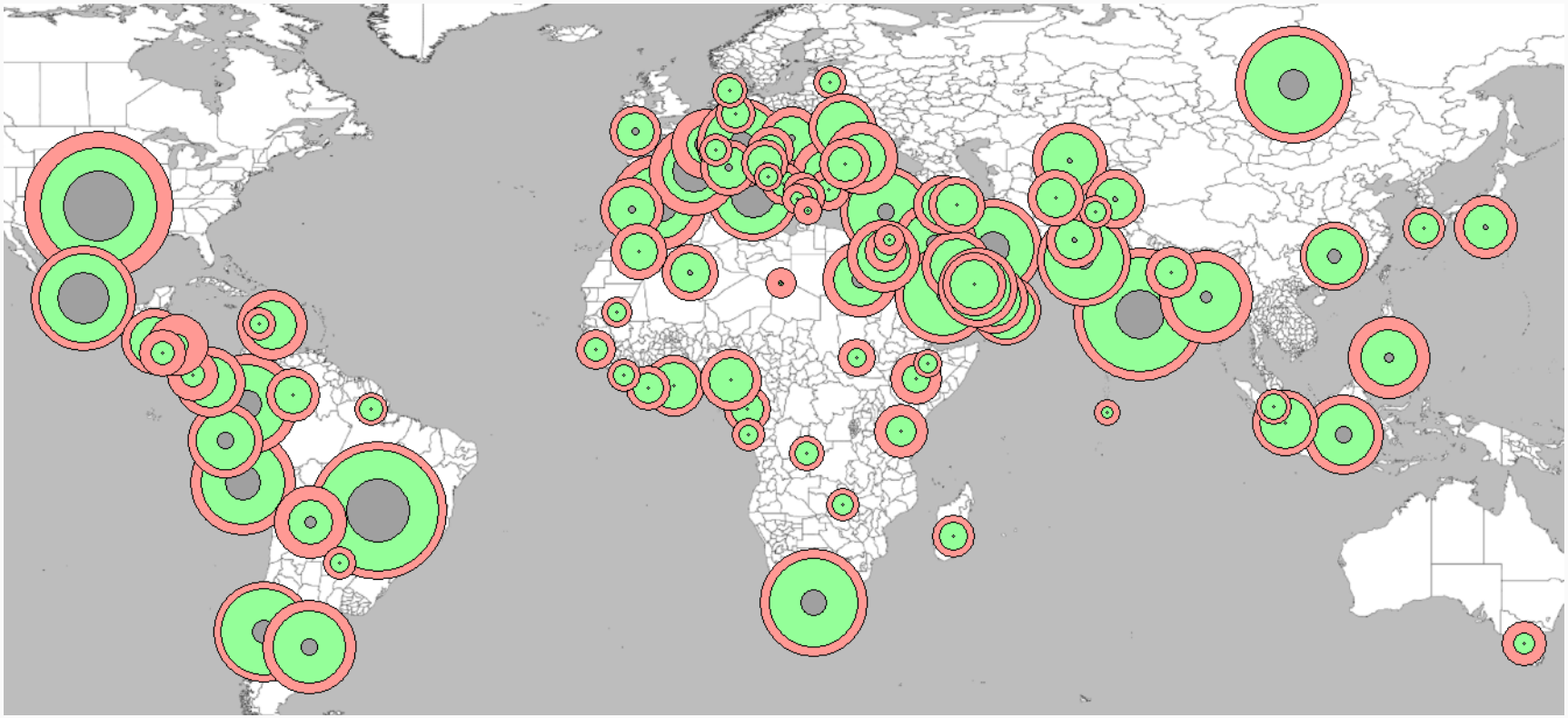
Experimental results

Experimental Setup

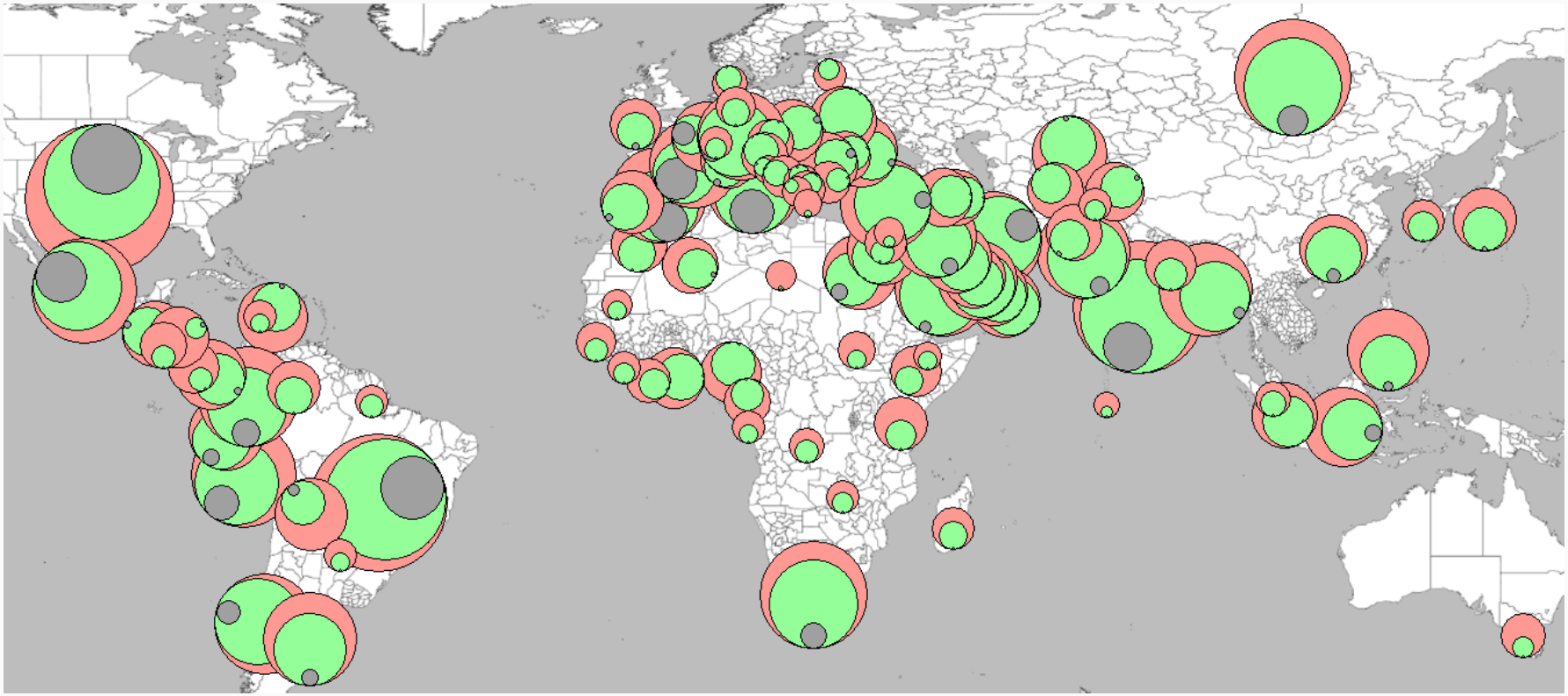
- We use the John Hopkins University Covid-19 data
- recovered cases are colored green, deceased cases are colored black and the infected are colored red
- logarithmic scaling dependent on two parameters:

$$r = M * \log\left(\frac{c_i S}{c_{max}}\right)$$

M is the maximum size of a glyph, S is a scaling factor and c_{max} is the maximum number of cases



algorithm	covered	minVis (rel)	minVis (abs)	min one glyph	average rel vis	absolute perc
random	44	0.071 (0)	0.995 (0)	0	0.658	0.677
LeftToRight	42	0.331 (0)	2.189 (0)	0	0.641	0.678
RightToLeft	43	0.324 (0)	0.995 (0)	0	0.656	0.693
Painter	16	0.408 (0)	6.283 (0)	34.991	0.761	0.718
MinMinStacking (abs)	16	0.473 (0)	2.189 (0)	44.467	0.757	0.724
MinMinStacking (rel)	18	0.691 (0)	2.189 (0)	37.327	0.748	0.725
MinSumStacking (abs)	18	0.702 (0)	3.974 (0)	44.467	0.75	0.721
MinSumStacking (rel)	18	0.702 (0)	2.189 (0)	37.327	0.744	0.723



algorithm	covered	minVis (rel)	minVis (abs)	min one Glyph	average rel vis	absolute perc
random	21	0.025 (0)	0.589 (0)	0	0.765	0.714
LeftToRight	12	0.948 (0)	2.743 (0)	0	0.775	0.725
RightToLeft	13	0.664 (0)	2.89 (0)	0	0.783	0.735
Painter	0	0.585	6.283	47.758	0.857	0.759
our Stacking	0	2.342	6.283	75.034	0.859	0.77

Table 2: date: 02.08.2020 , $M = 50$, $S = 500$ and MnC $= 5000$

algorithm	covered	minVis (rel)	minVis (abs)	min one glyph	average rel vis	absolute perc
random	44	0.071 (0)	0.995 (0)	0	0.658	0.677
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Table 3: centered disks

algorithm	covered	minVis (rel)	minVis (abs)	min one Glyph	average rel vis	absolute perc
random	21	0.025 (0)	0.589 (0)	0	0.765	0.714
LeftToRight	12	0.948 (0)	2.743 (0)	0	0.775	0.725
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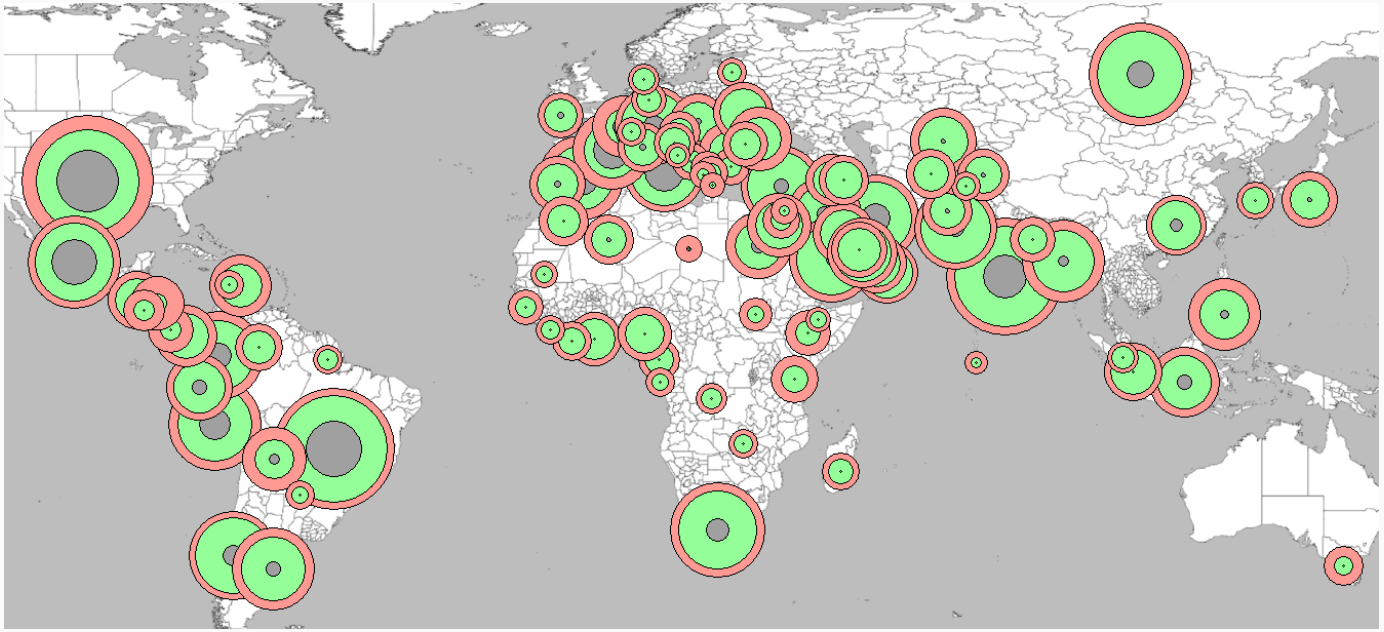
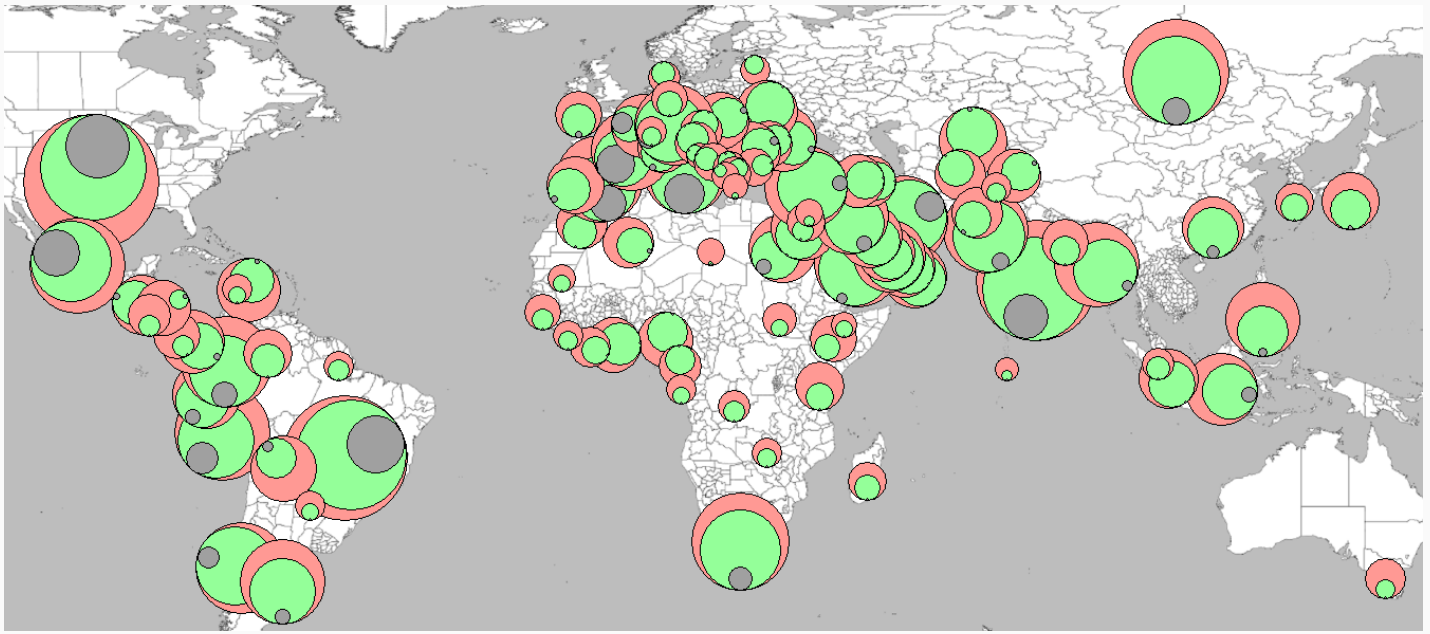
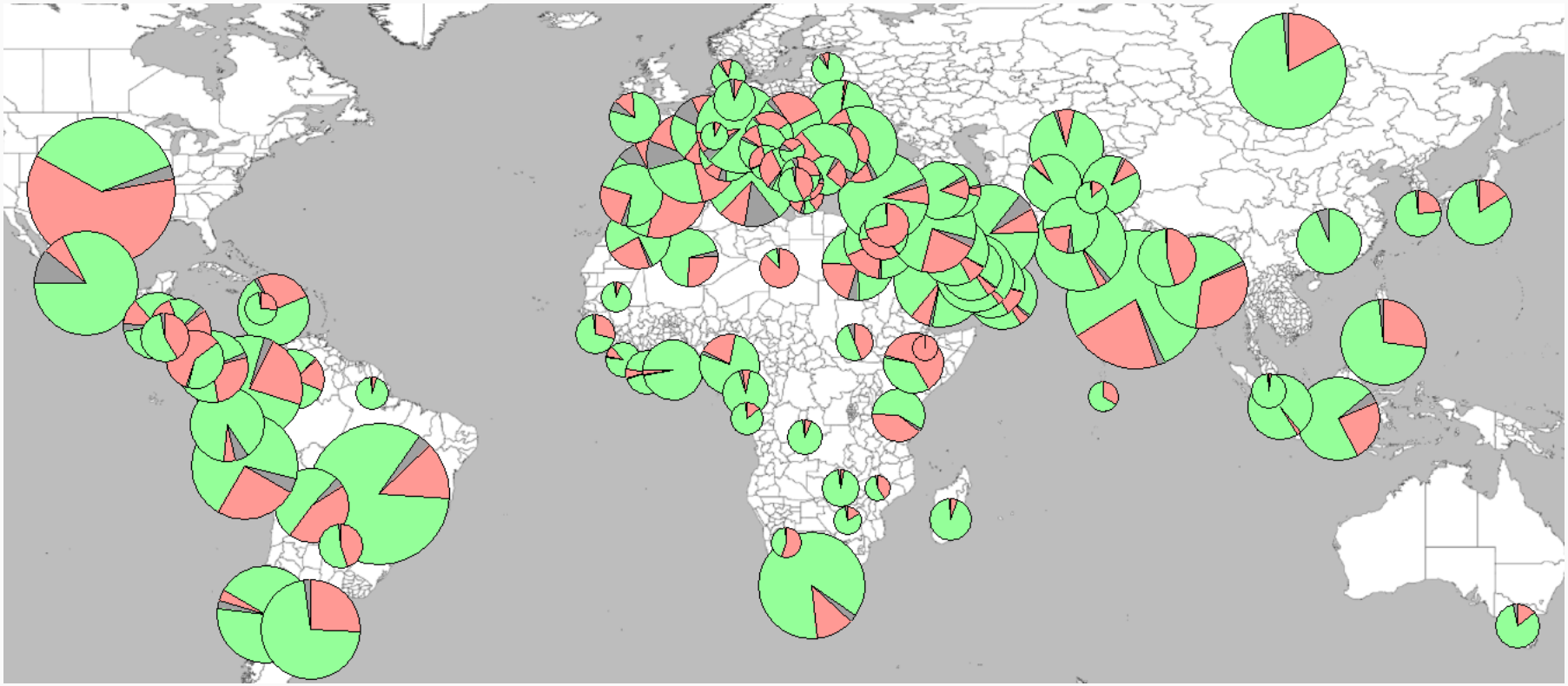
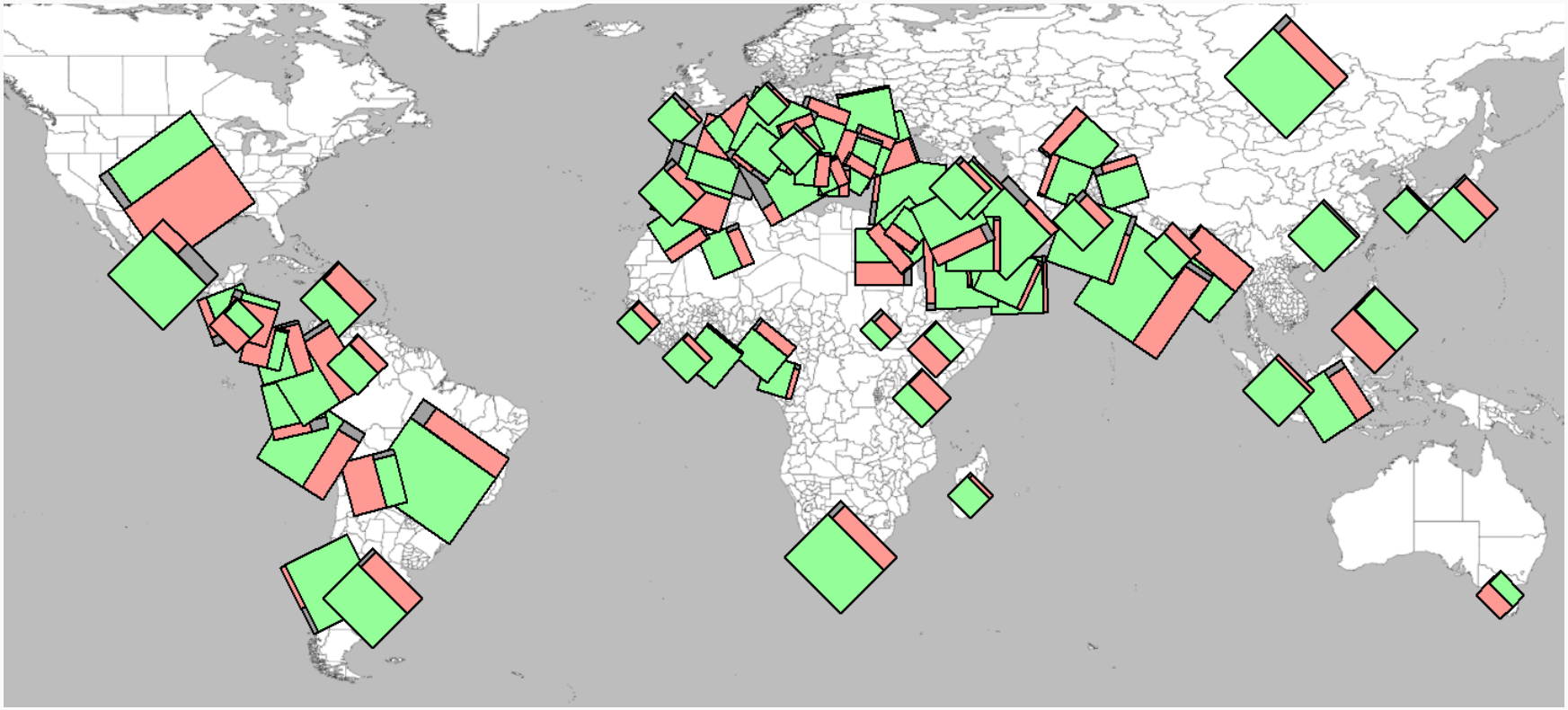






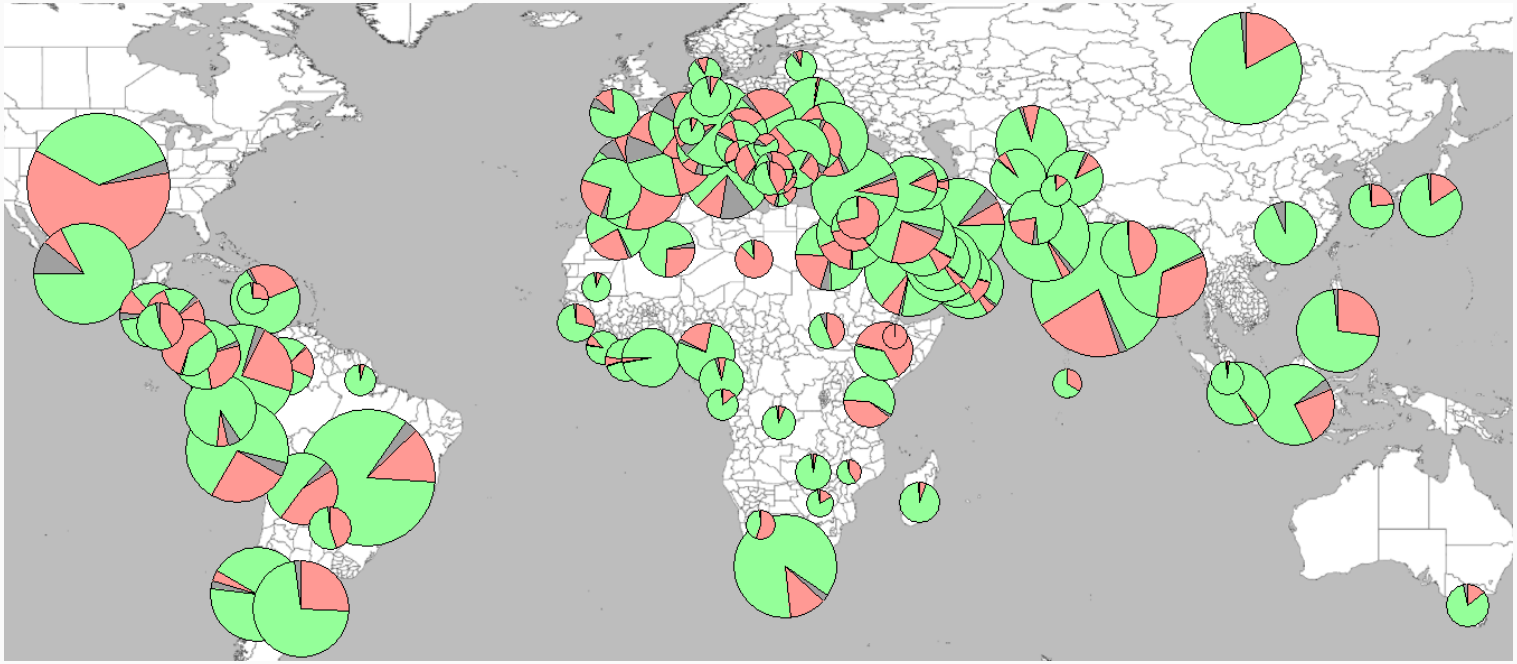
algorithm	covered	minDist	minDistAvg	maxDistAvg
Painter+random	60	0.002 (0)	1.211	4.035
random+heuristic	24	0.0 (0)	1.687	2.573
RightToLeft	18	0.017 (0)	1.719	2.685
Painter+ heuristic	6	0.022 (0)	1.733	2.648
our Stacking	0	0.271	1.765	2.838

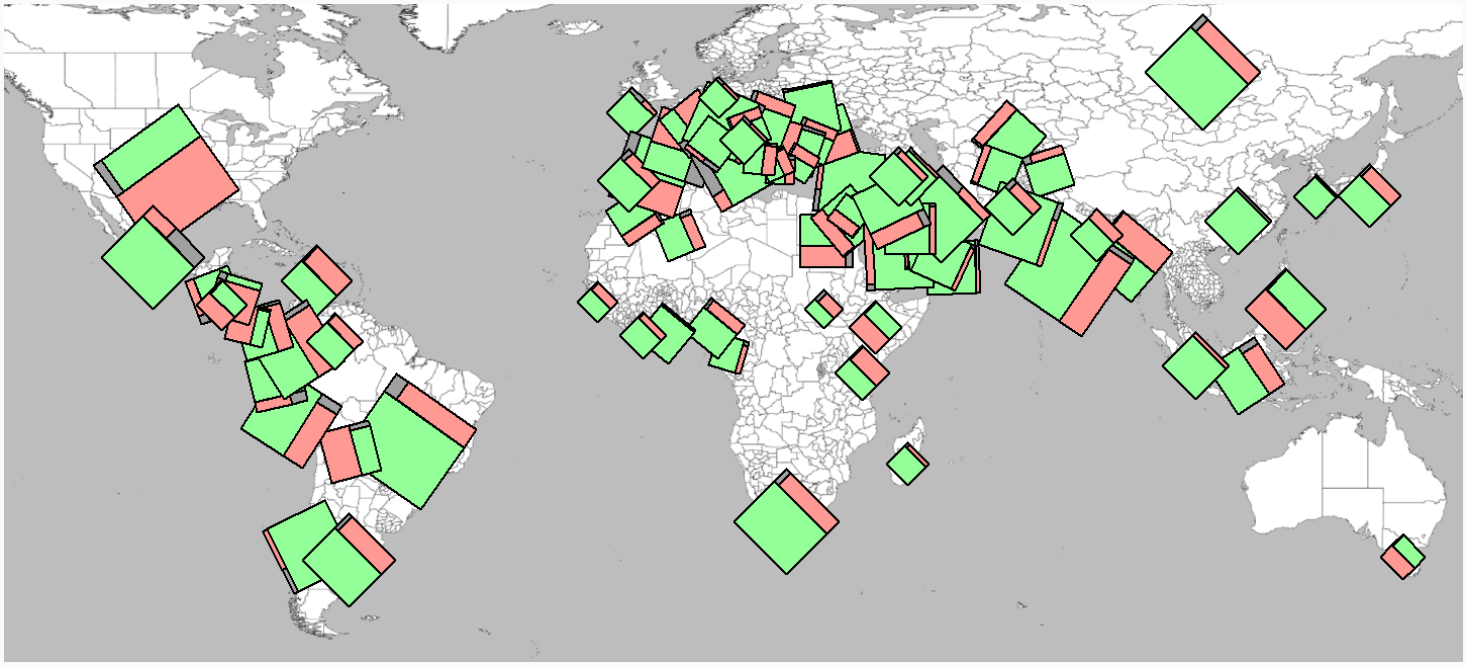
Table 5: date: 22.08.2020 , $M = 50$, $S = 500$ and MnC $= 5000$



algorithm	covered	minDist
random Stacking+random rotations	35	0.361 (0)
Painter+random rotations	17	0.251 (0)
random Stacking+heuristic rotations	26	0.038 (0)
Painter+heuristic	14	0.263 (0)
our Stacking	7	0.078 (0)

Table 6: date: 22.08.2020 , $M = 50$, $S = 500$ and MnC $= 5000$





Exploration in App

Exploration of the data

[Switch to app and play!]

Conclusion and Outlook

Summary

- Four glyphs were shown, with two new approaches.
- NP-hardness of new approaches was outlined.
- Heuristics and greedy approach usually are good choices.
- Square/pie approach can be interpreted as discrete version of the relative visibility.
- All of this was verified on the most recent COVID-19 data,
- and experimentally demonstrated.