Required increase in training set to keep accuracy of genomic selection constant across generations

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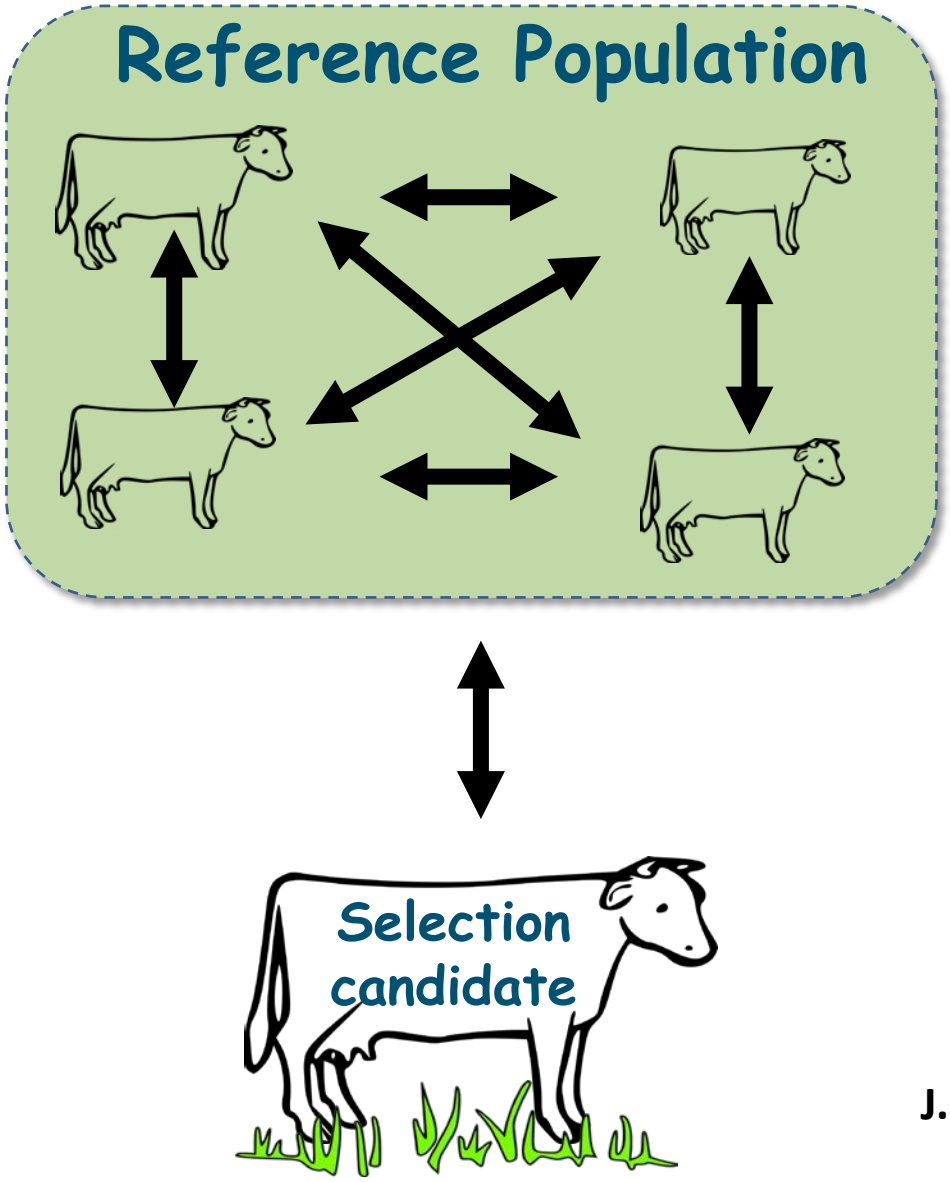
Acknowledgments

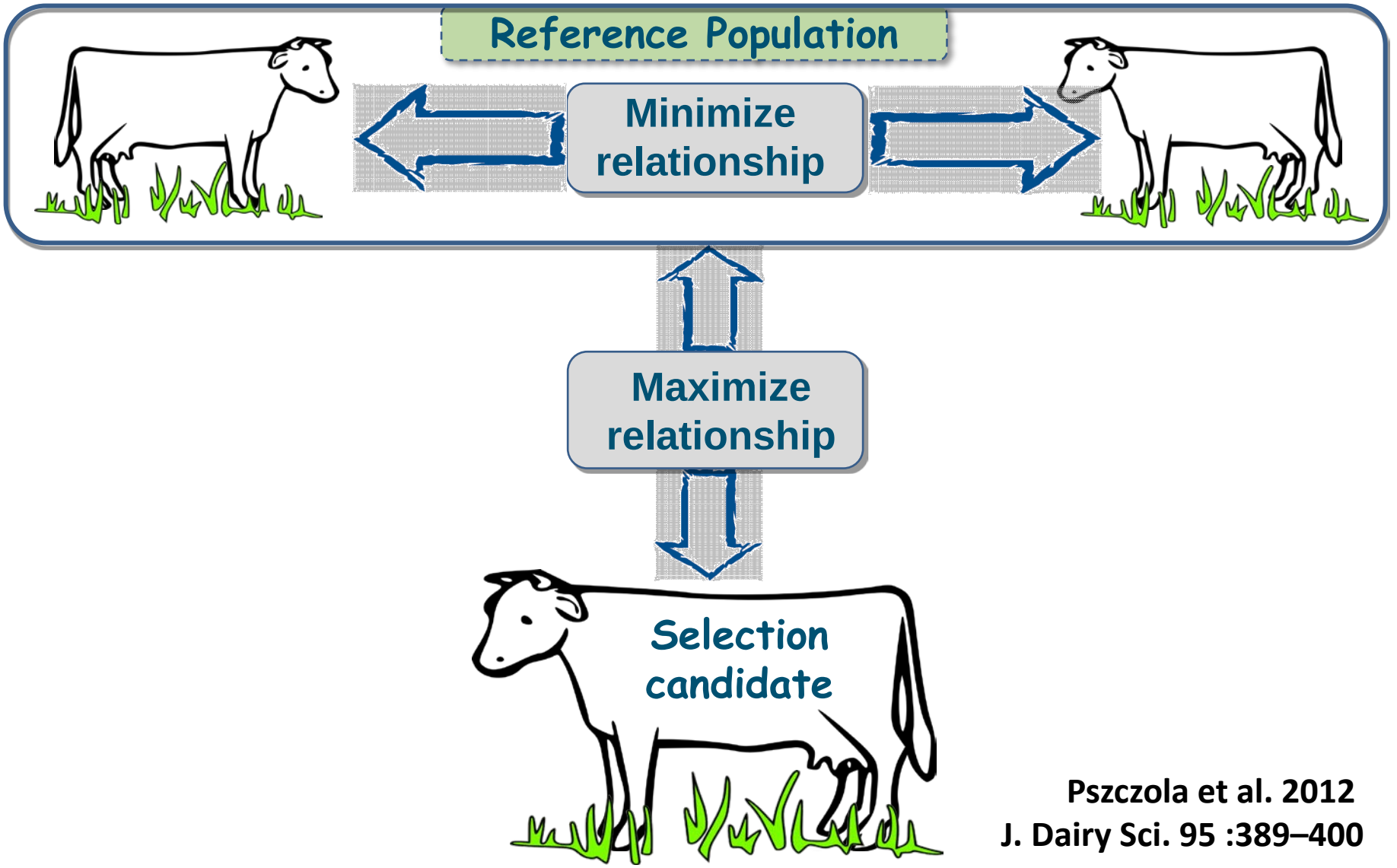
The GreenHouseMilk is financially supported by the European Commission under the Seventh Research Framework Programme, Grant Agreement KBBE-238562. This publication represents the views of the authors, not the European Commission, and the Commission is not liable for any use that may be made of the information.

Relationships are important in genomic selection

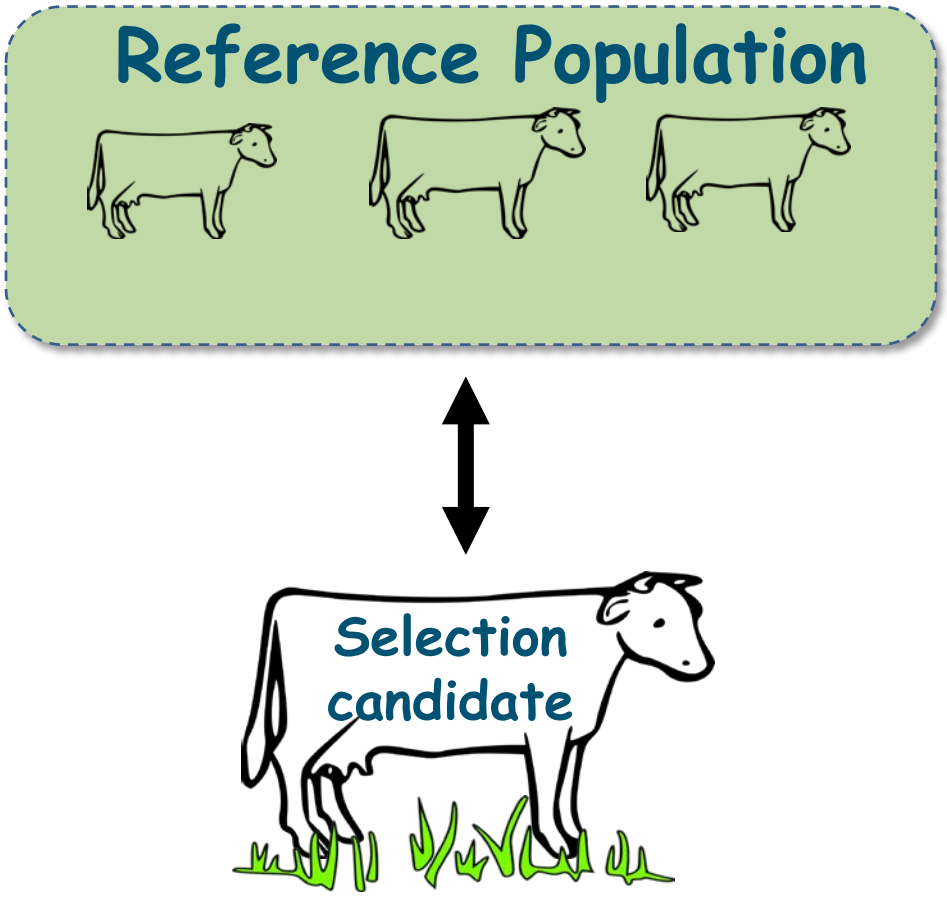


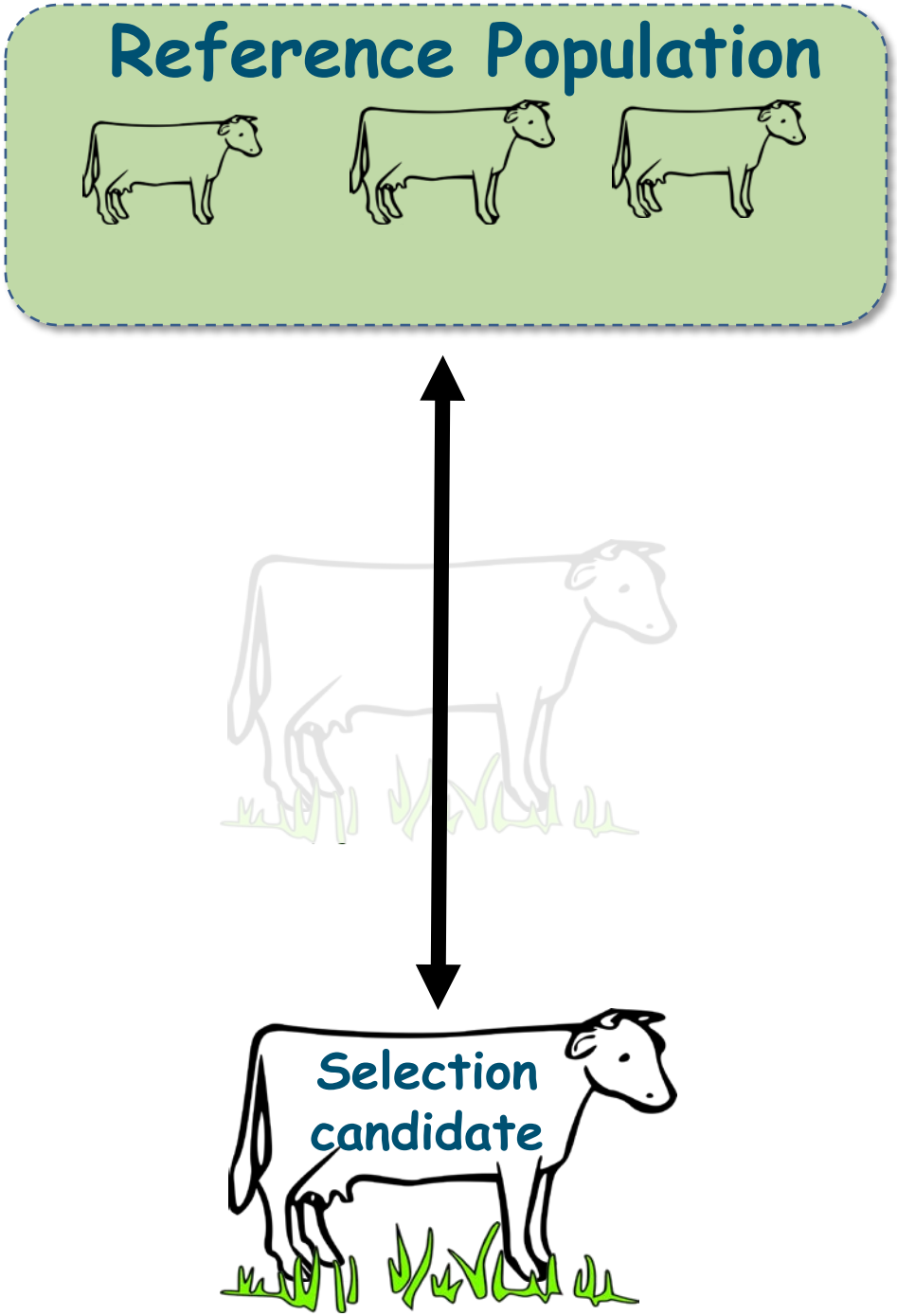
Pszczola et al. 2012
J. Dairy Sci. 95 :389–400

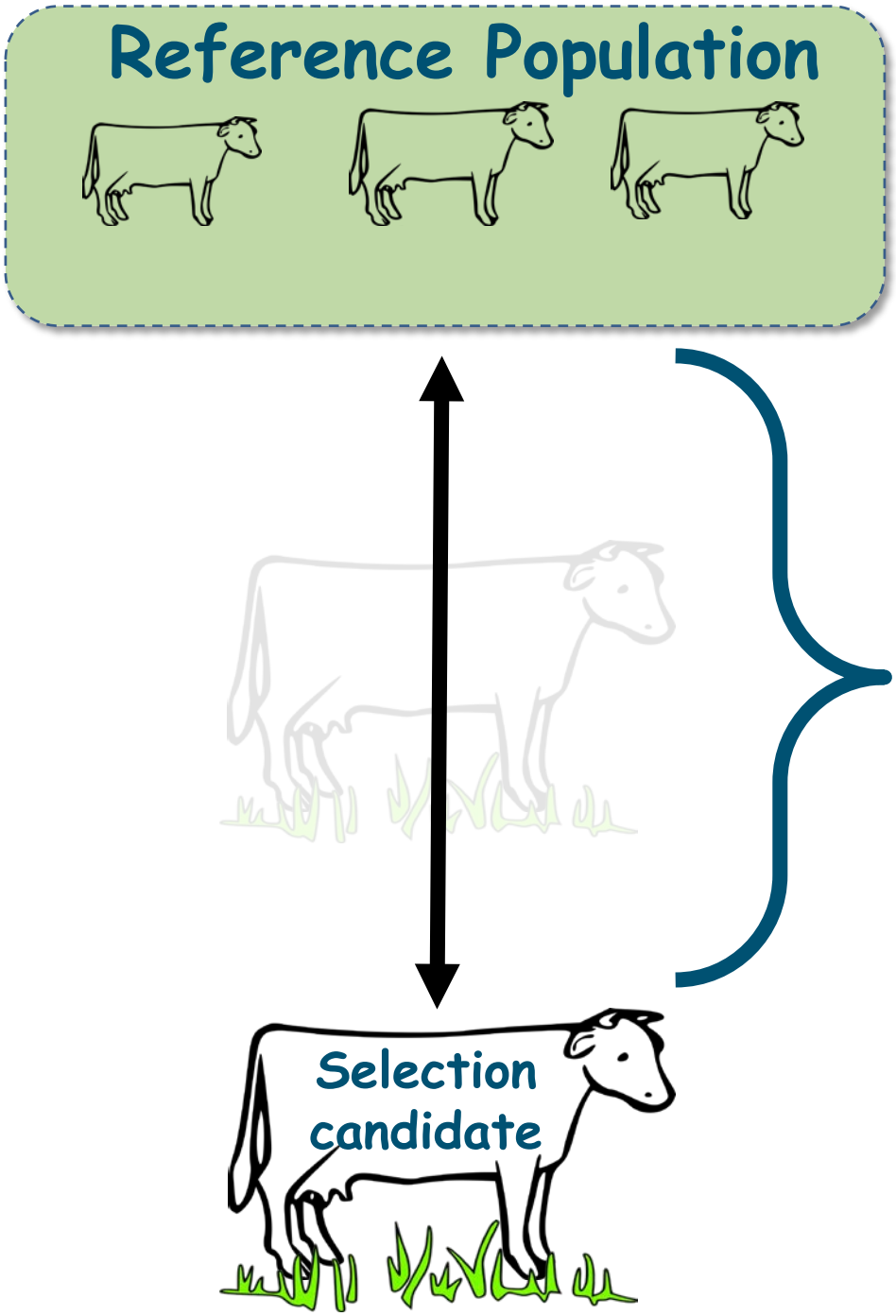
Optimal design of the reference population



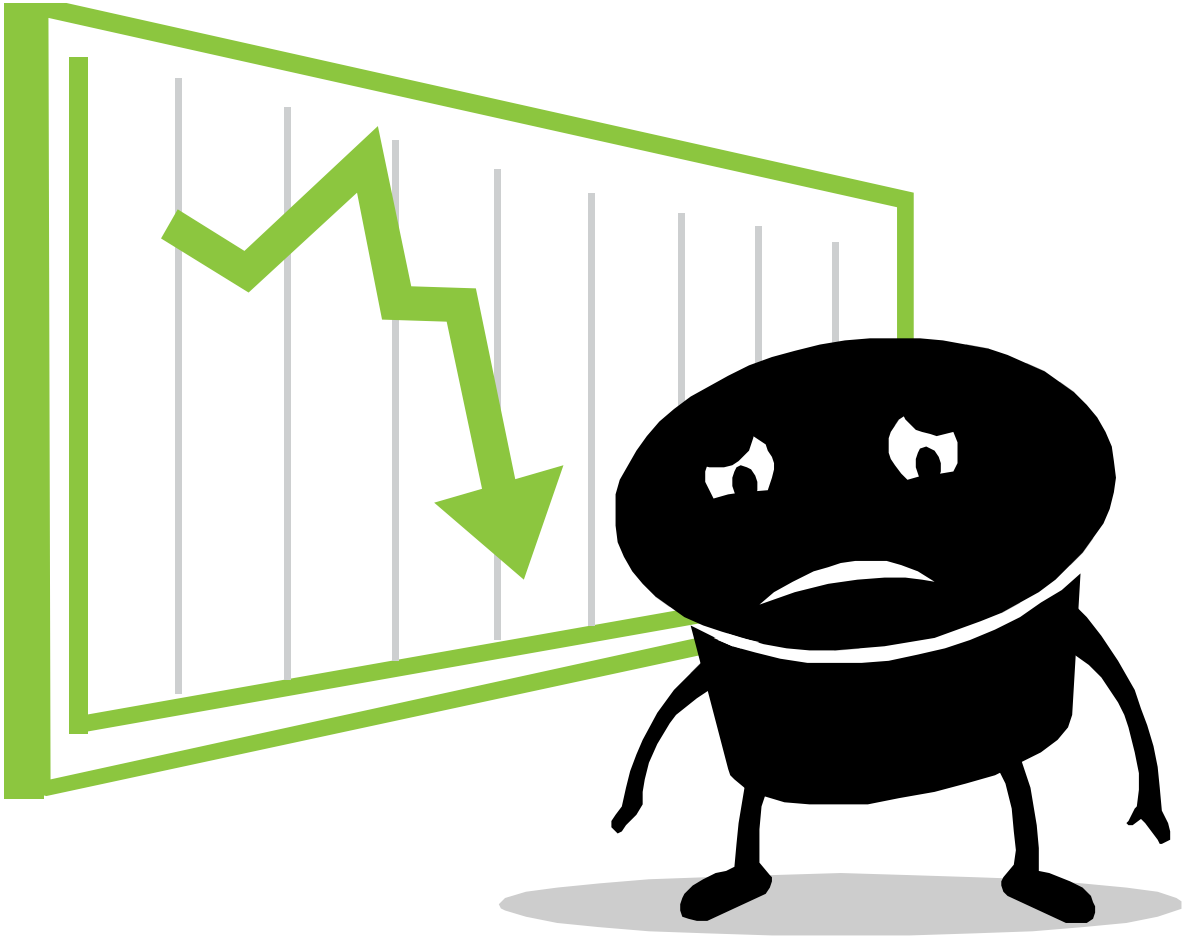
Pszczola et al. 2012
J. Dairy Sci. 95 :389–400


Reference Population
Selection candidate

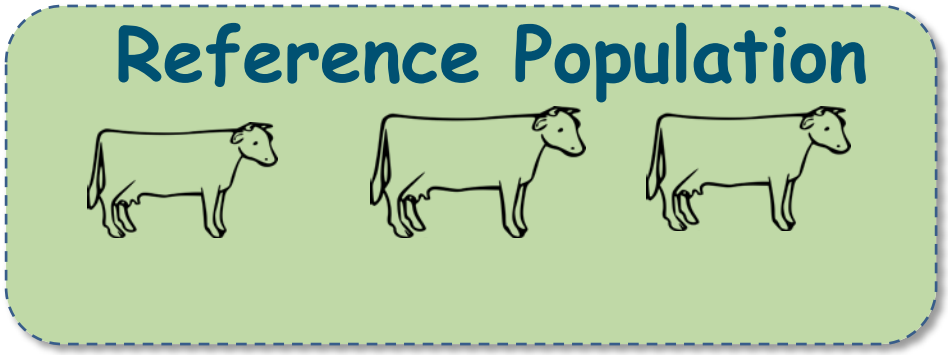

Reference Population
Selection candidate


Reference Population
Selection candidate
½Relationship

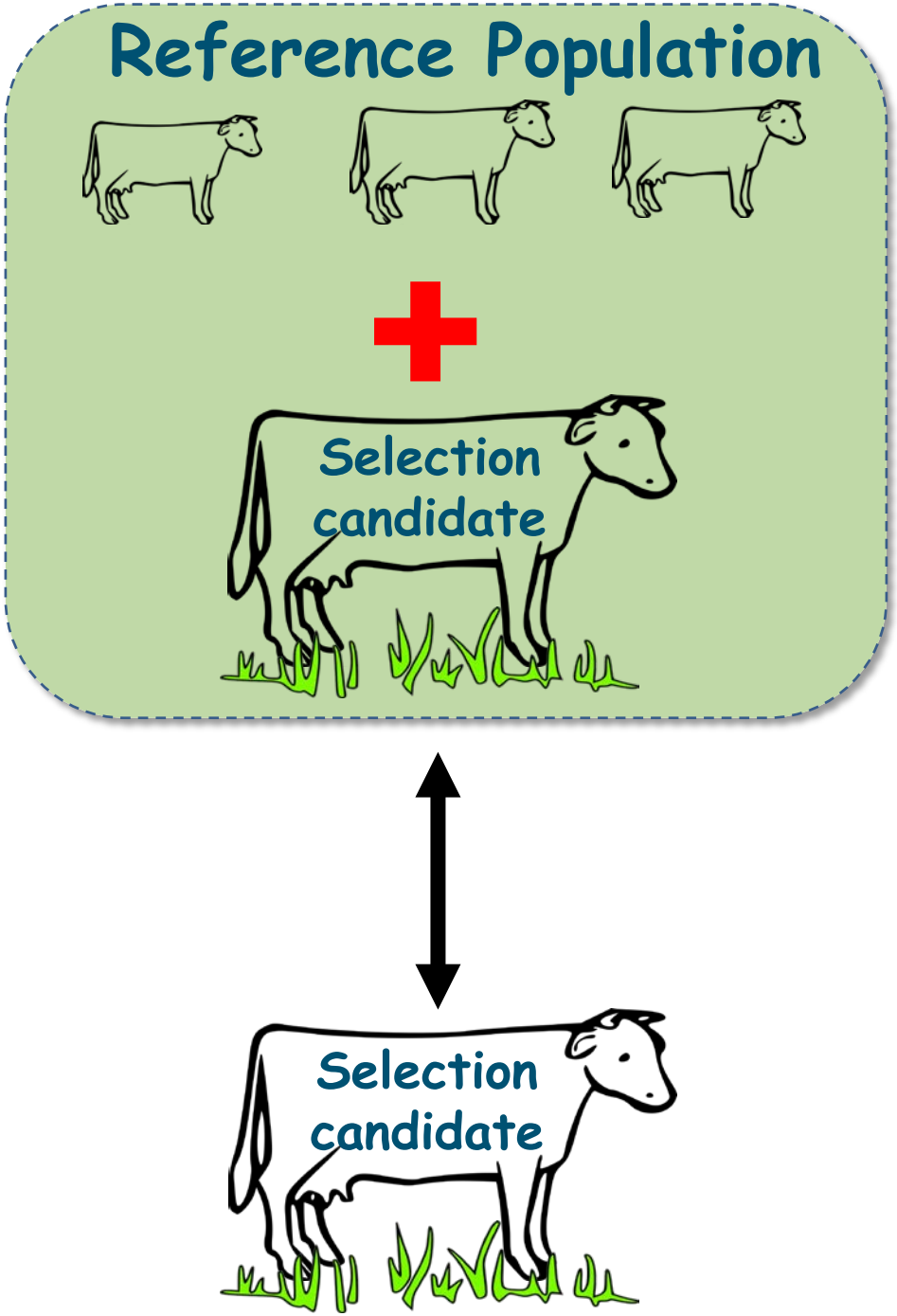
GS Accuracy with NO UPDATE of reference population



How to update?

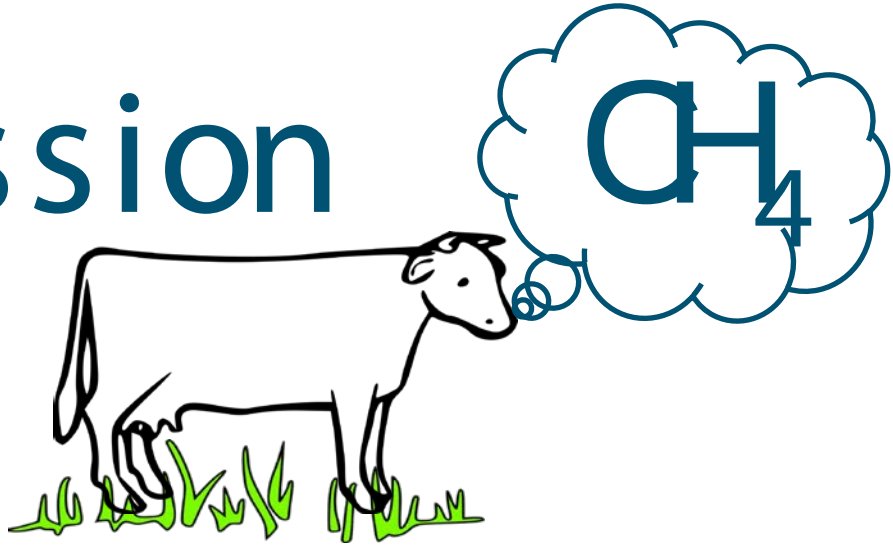


To maintain initial GS accuracy


Reference Population
Selection candidate
Selection candidate

Expensive traits

Methane emission

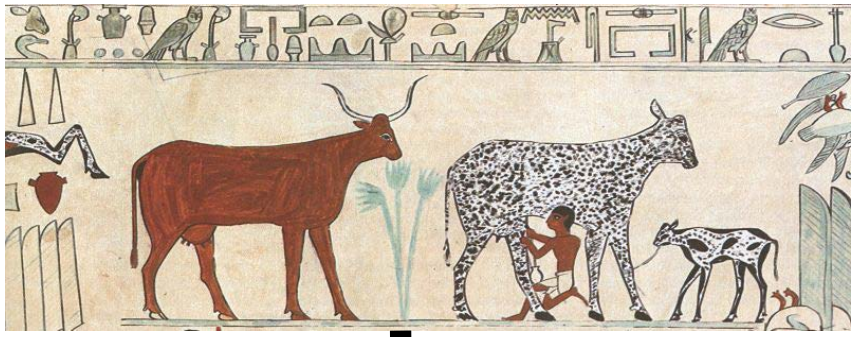


Expensive traits

=

Limited RP update


Data
Simulation



$h^2 = 0.3$

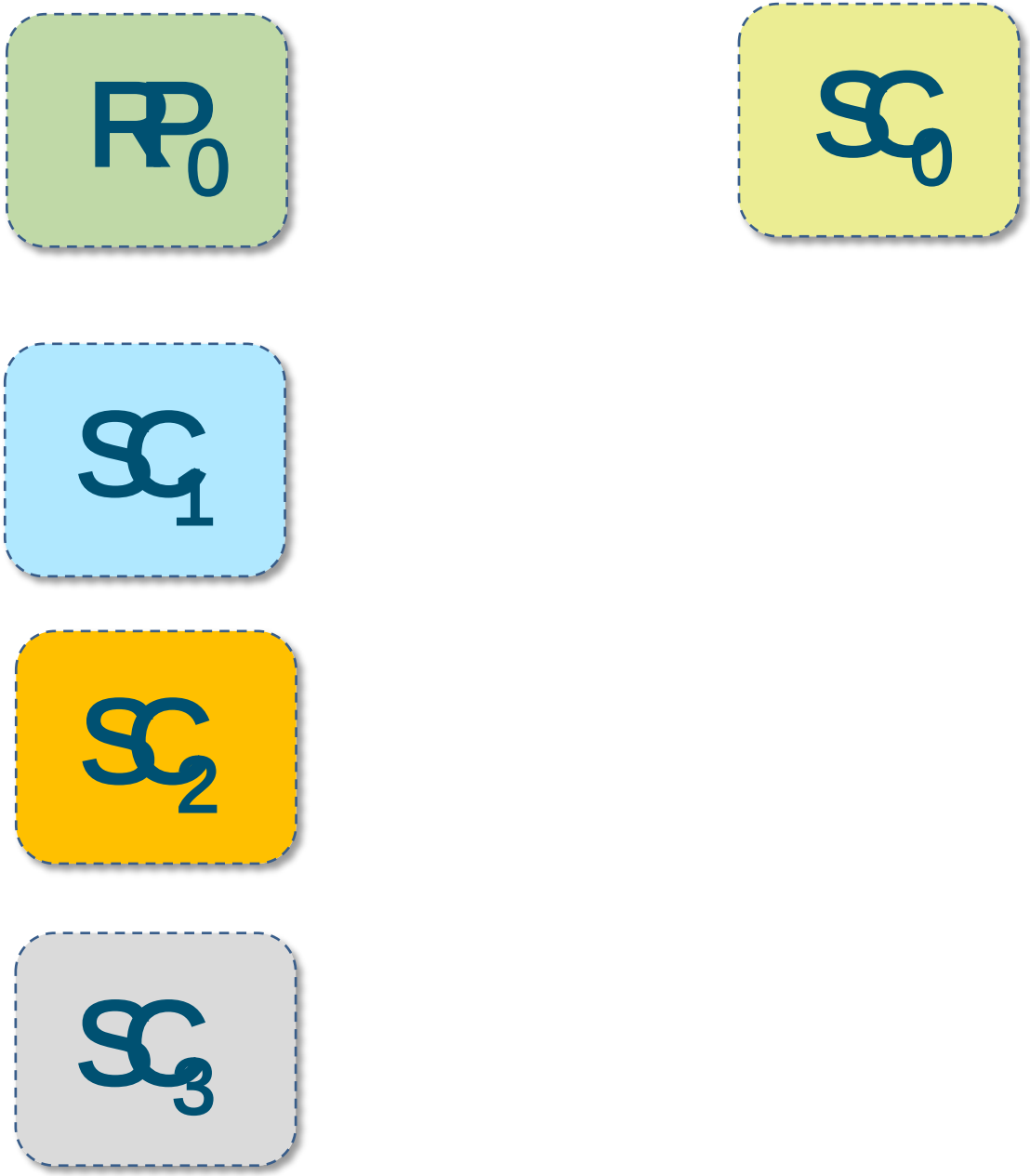
Reference Population

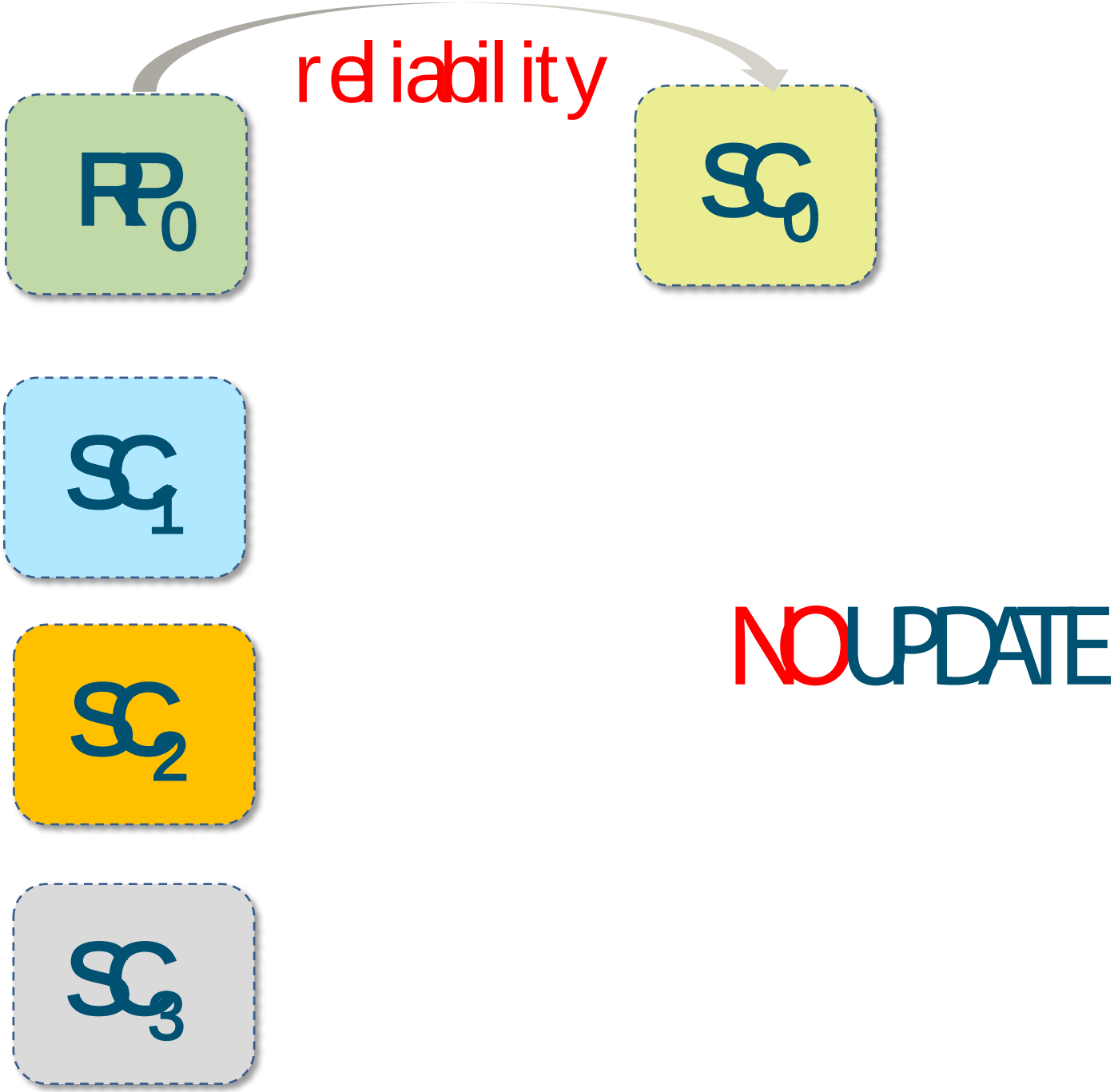
n=2,000

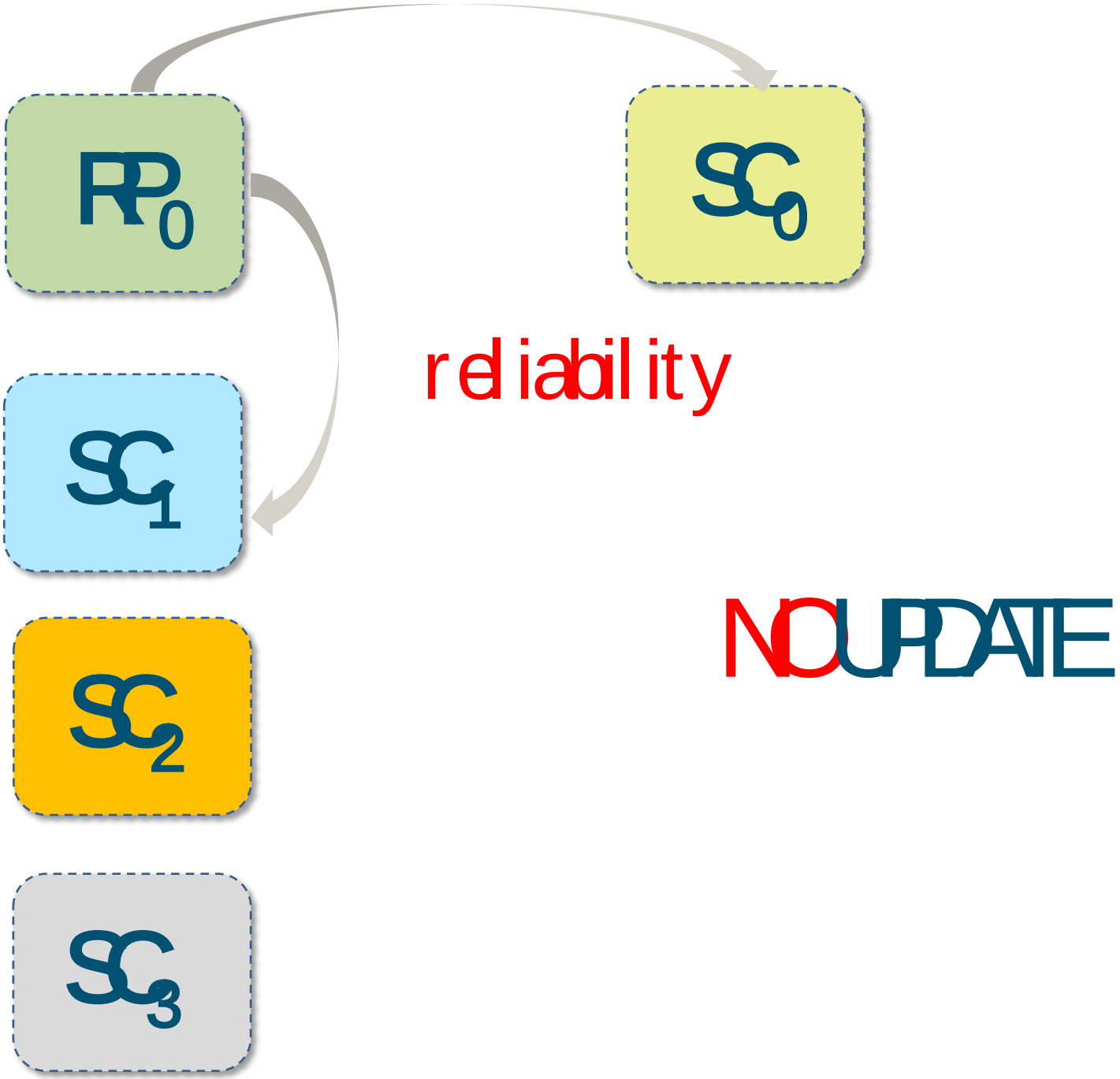
Selection candidates

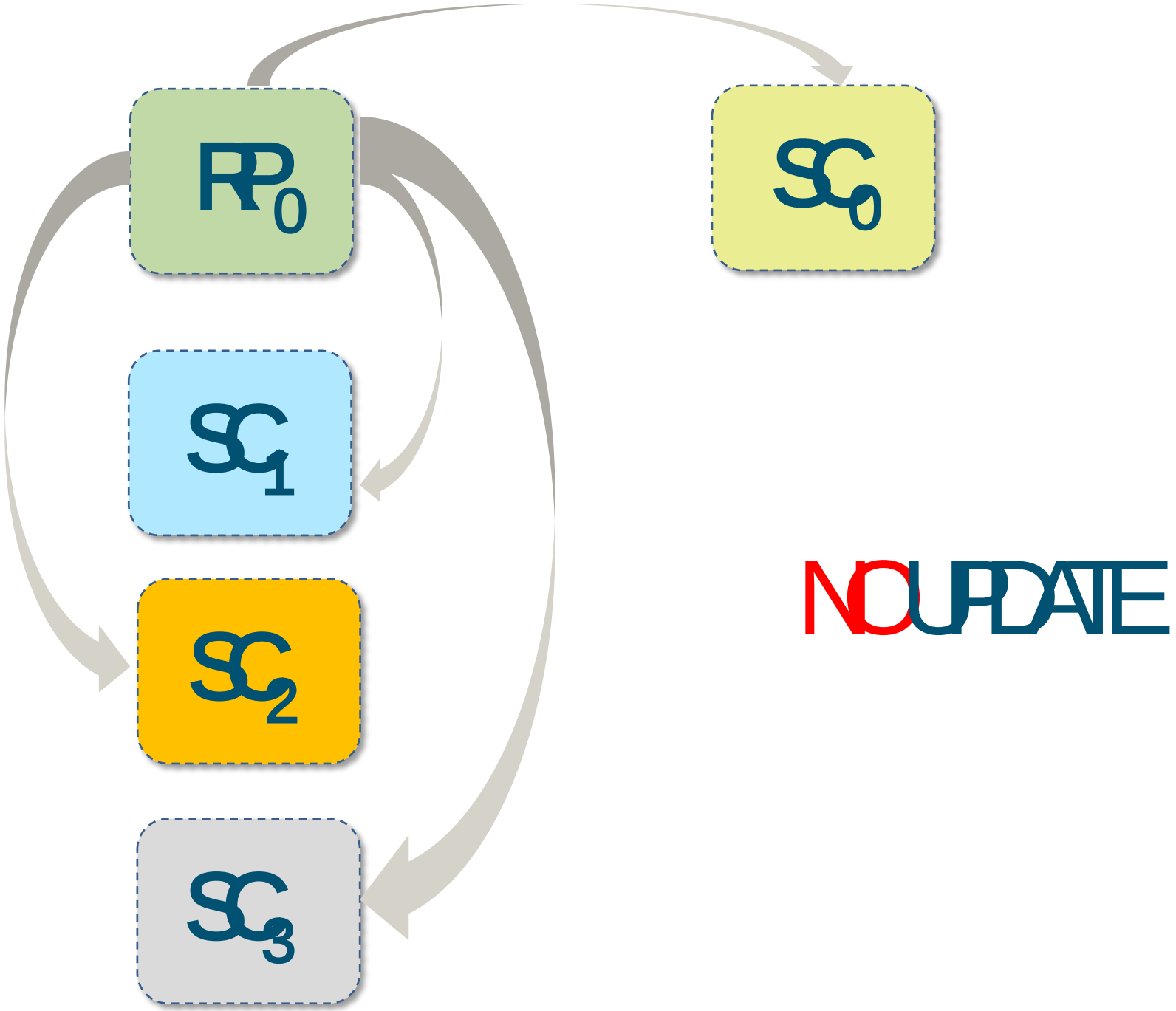
n=1,000

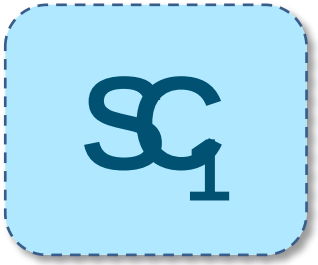
Scenarios


RP0
SC0
SC1
SC2
SC3


reliability
RP0
SC0
SC1
SC2
SC3
NO UPDATE

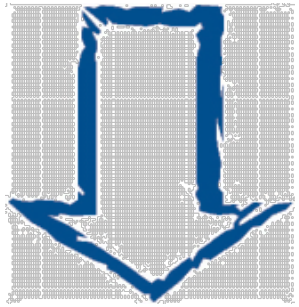

RP0
SC0
reliability
SC1
NOUPDATE
SC2
SC3


RP0
SC0
SC1
SC2
SC3
NOUPDATE

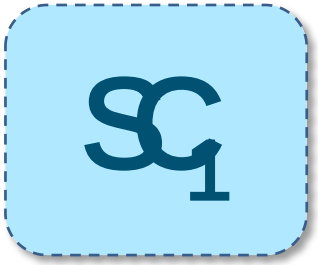


UPDATE

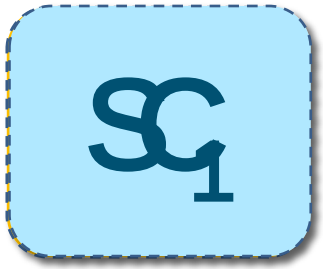
reliability

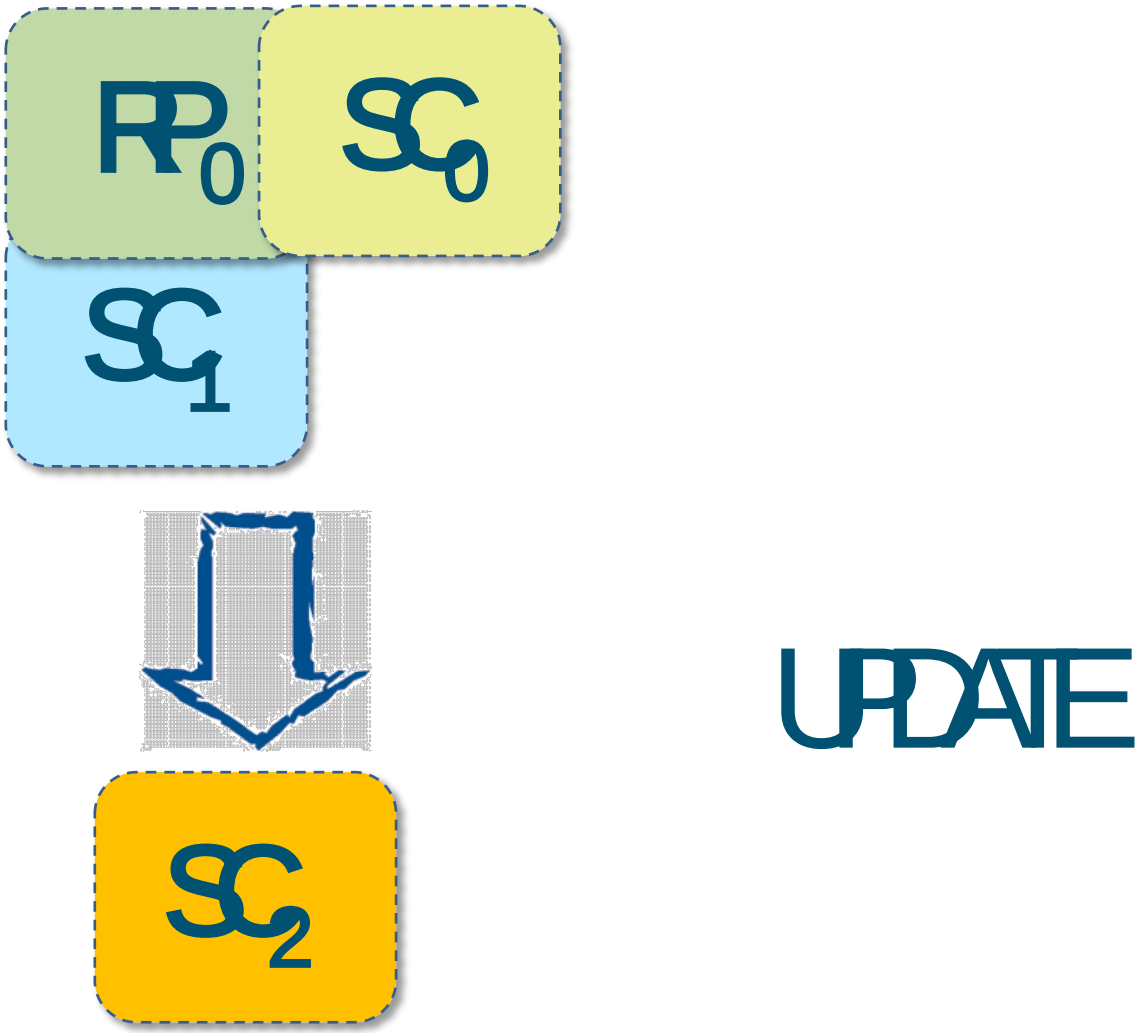


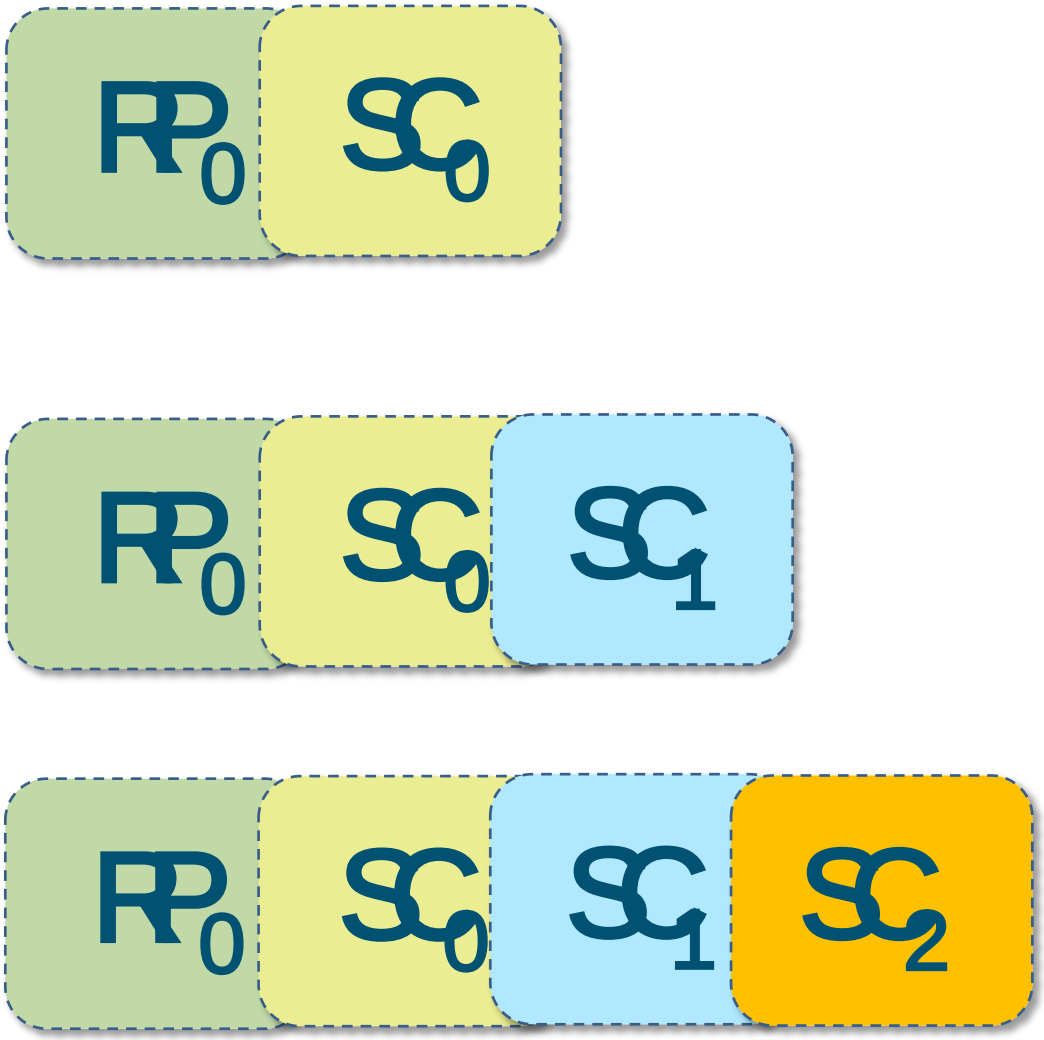
UPDATE



UPDATE



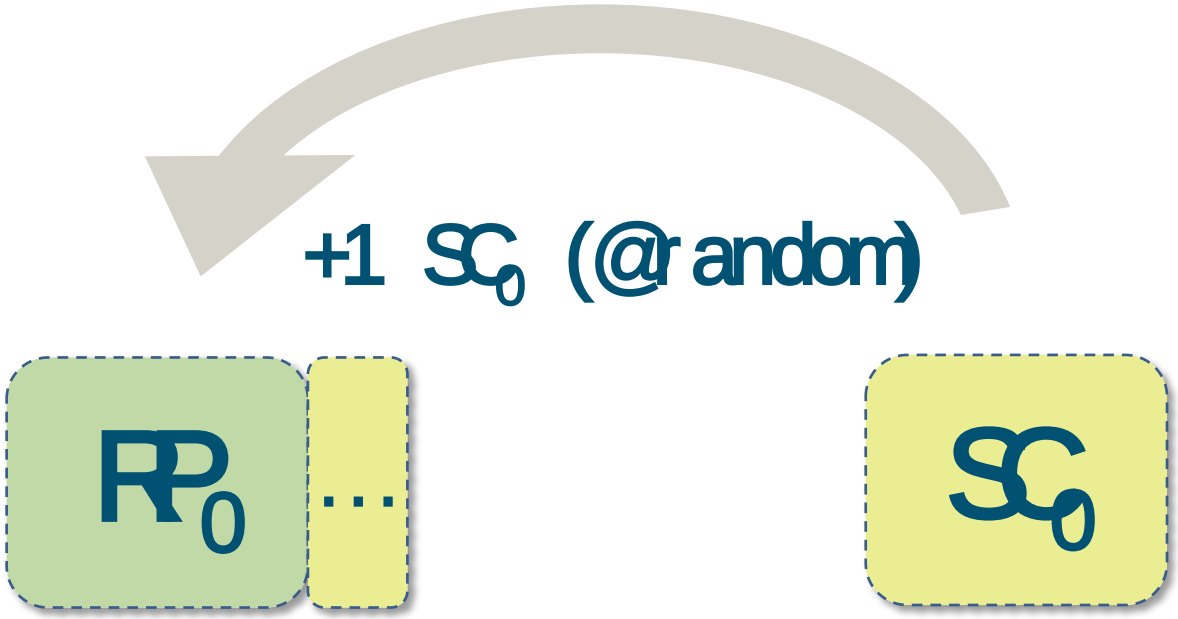

RP0
SC0
SC1
reliability
SC2
UPDATE

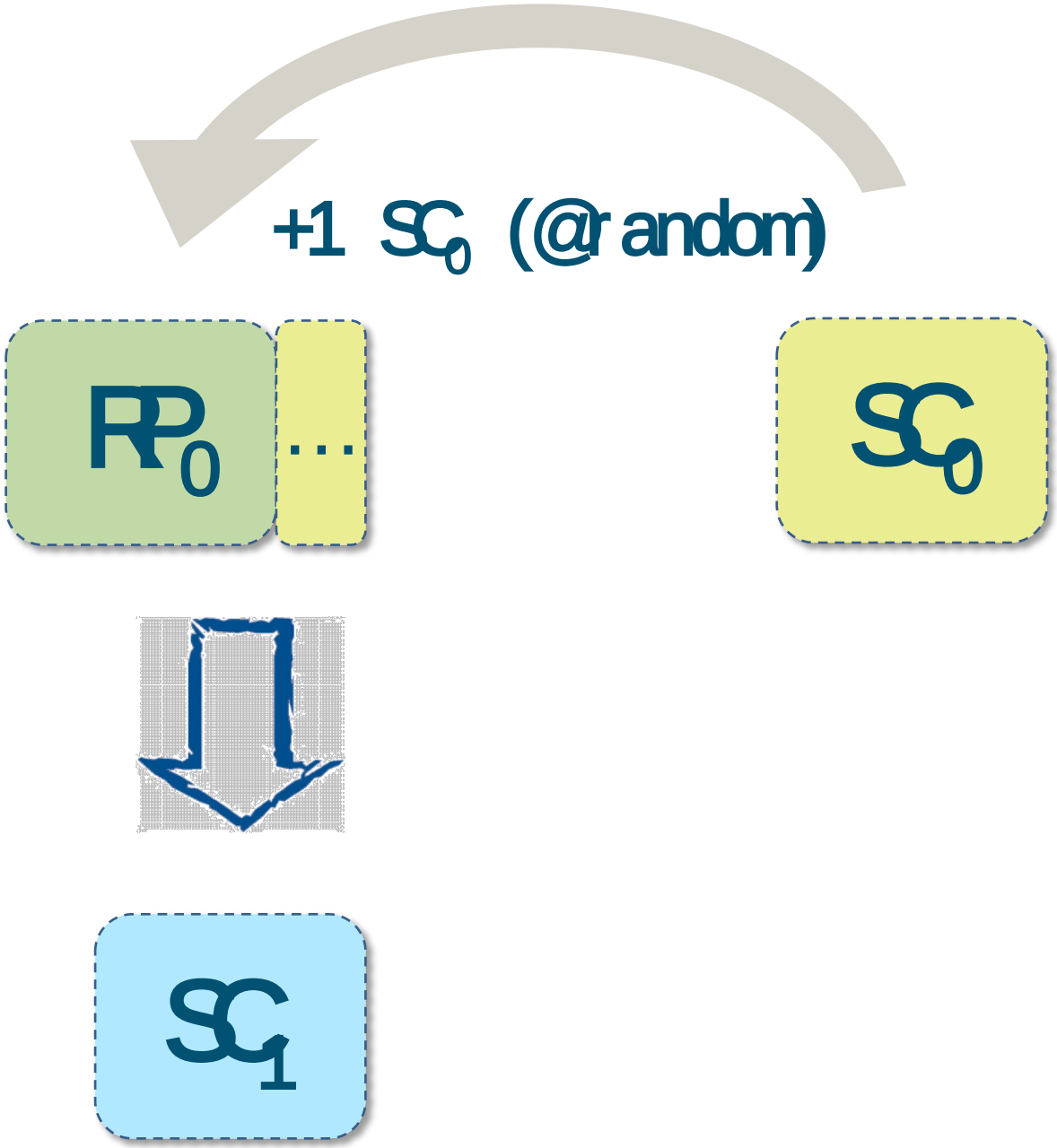

RP0
SC0
UPDATE 0
RP0
SC0
SC1
UPDATE 1
RP0
SC0
SC1
SC2
UPDATE 2

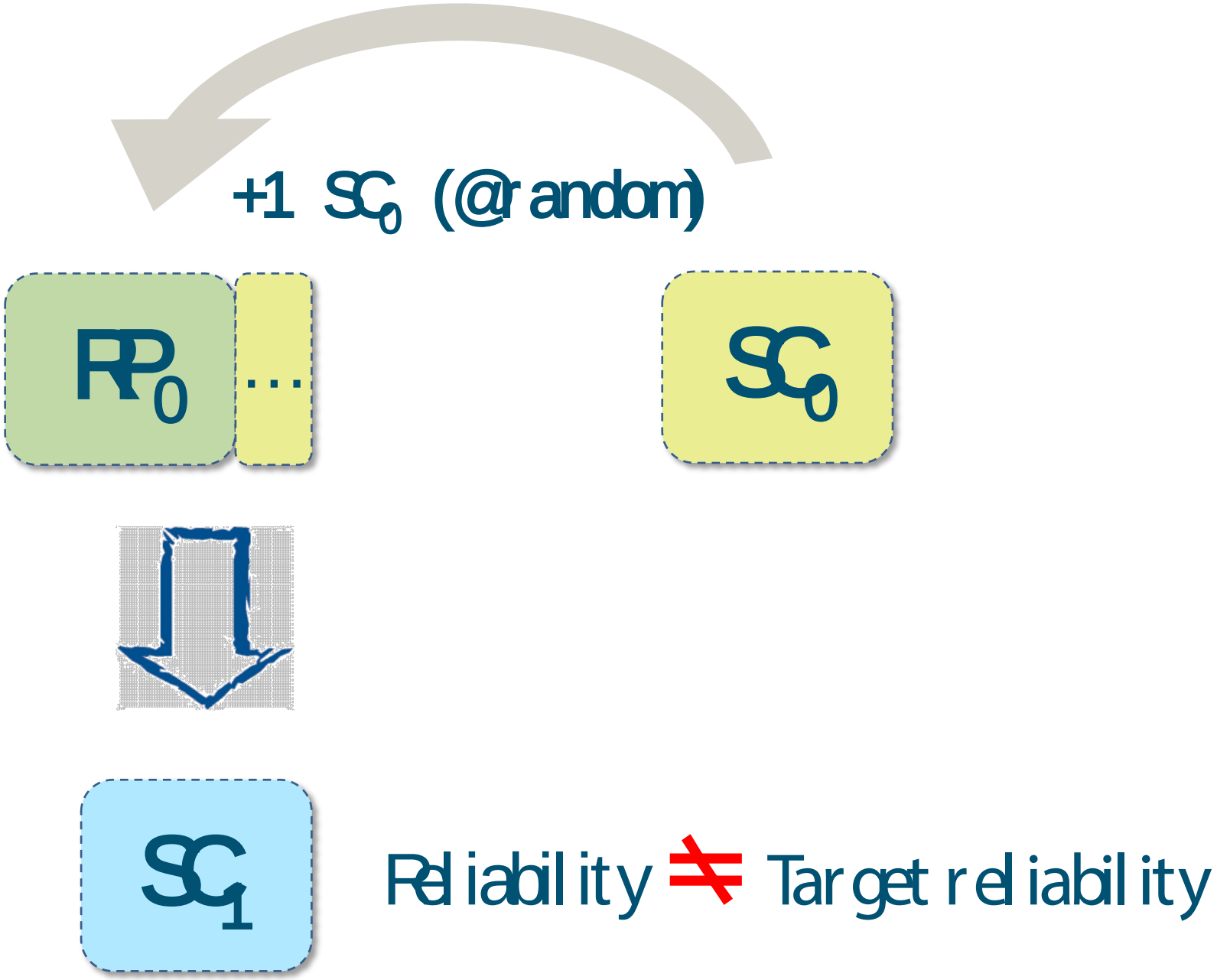
How many need to be added?

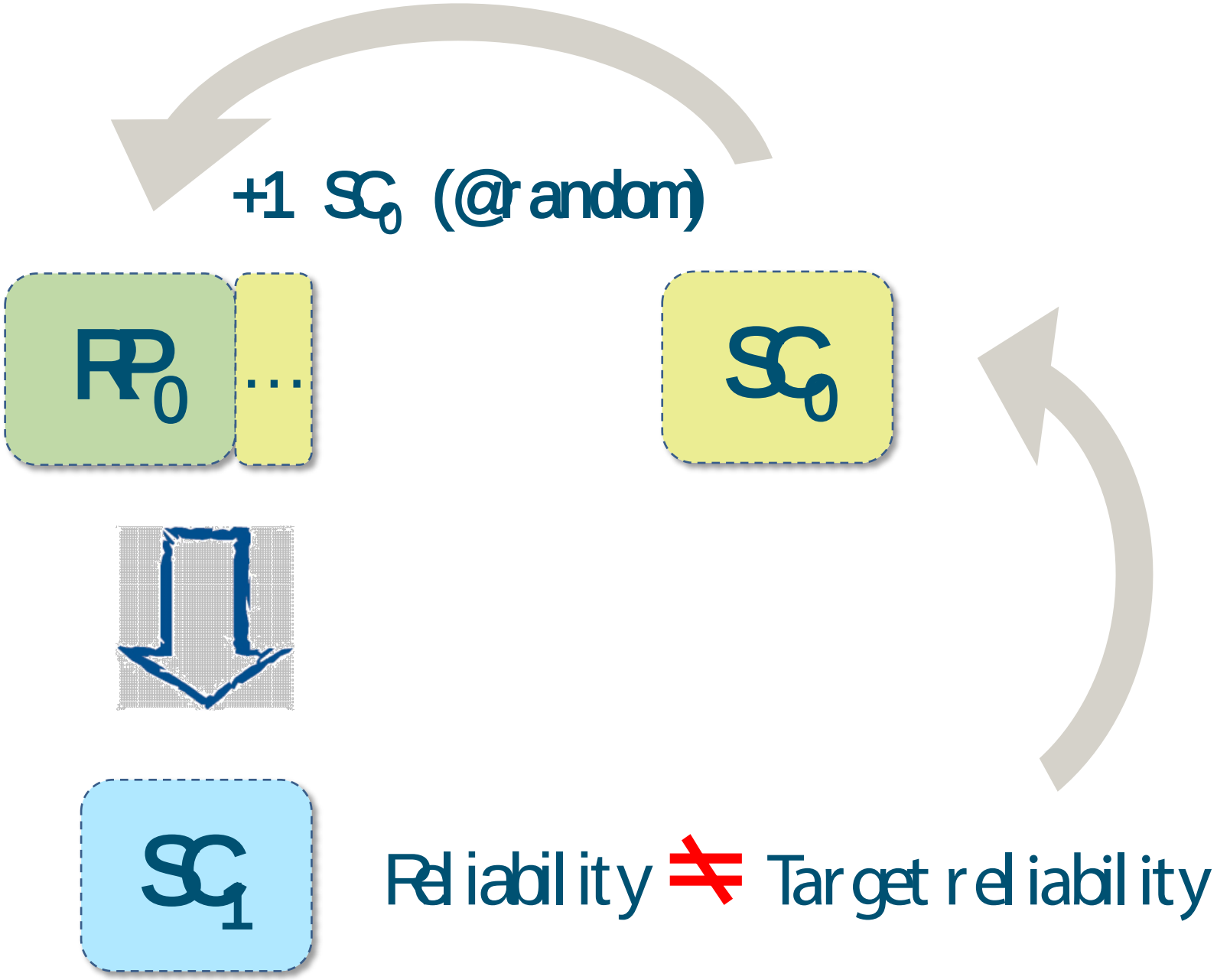
(To maintain initial GSD accuracy)

=INITIAL(Target) reliability


+1 SC0 (@random)
RP0
...
SC0

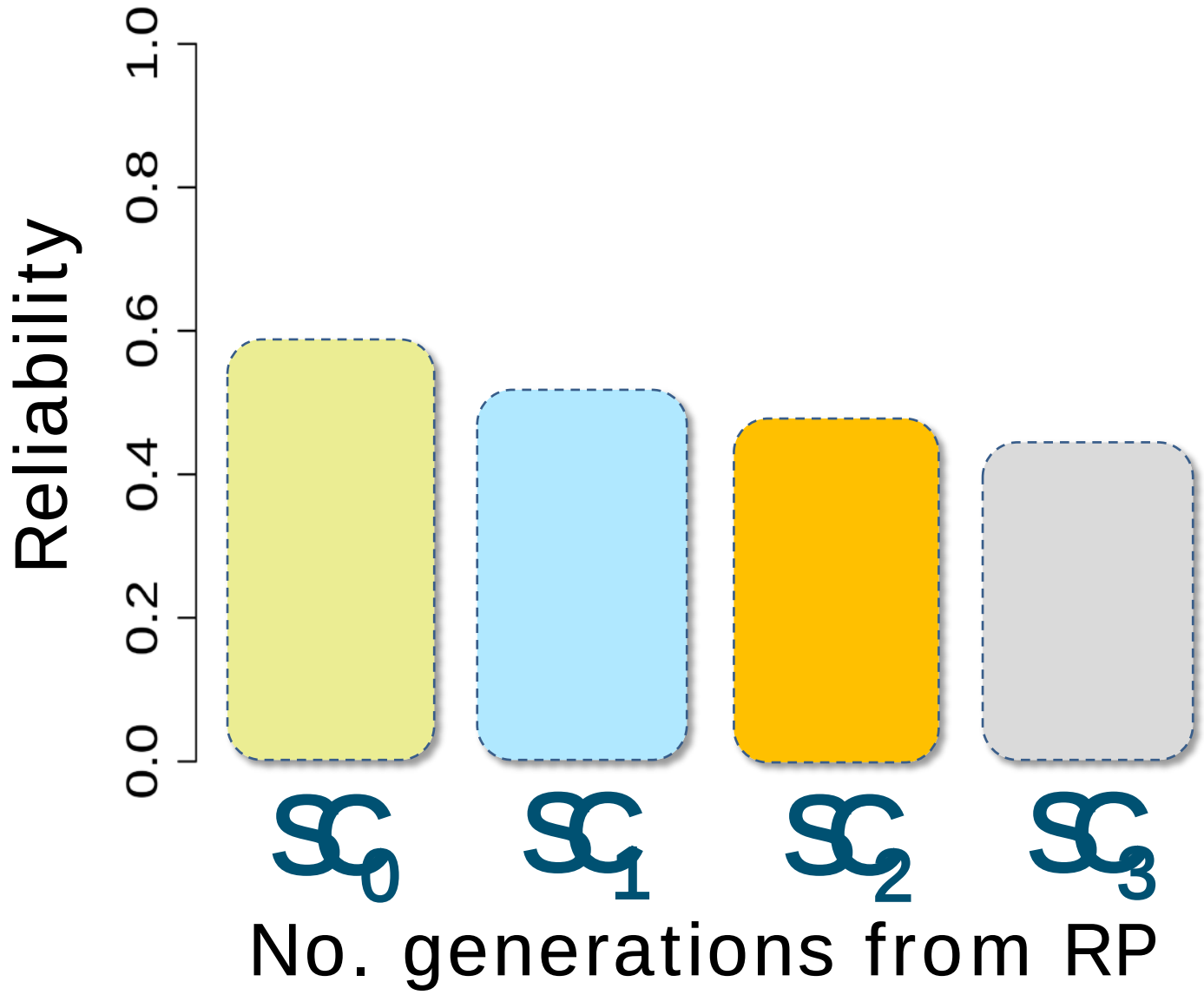

+1 SC0 (@random)
RP0 …
SC0
SC1


+1 SC_0 (@random)
RP_0 …
SC_0
SC_1
Reliability ≠ Target reliability

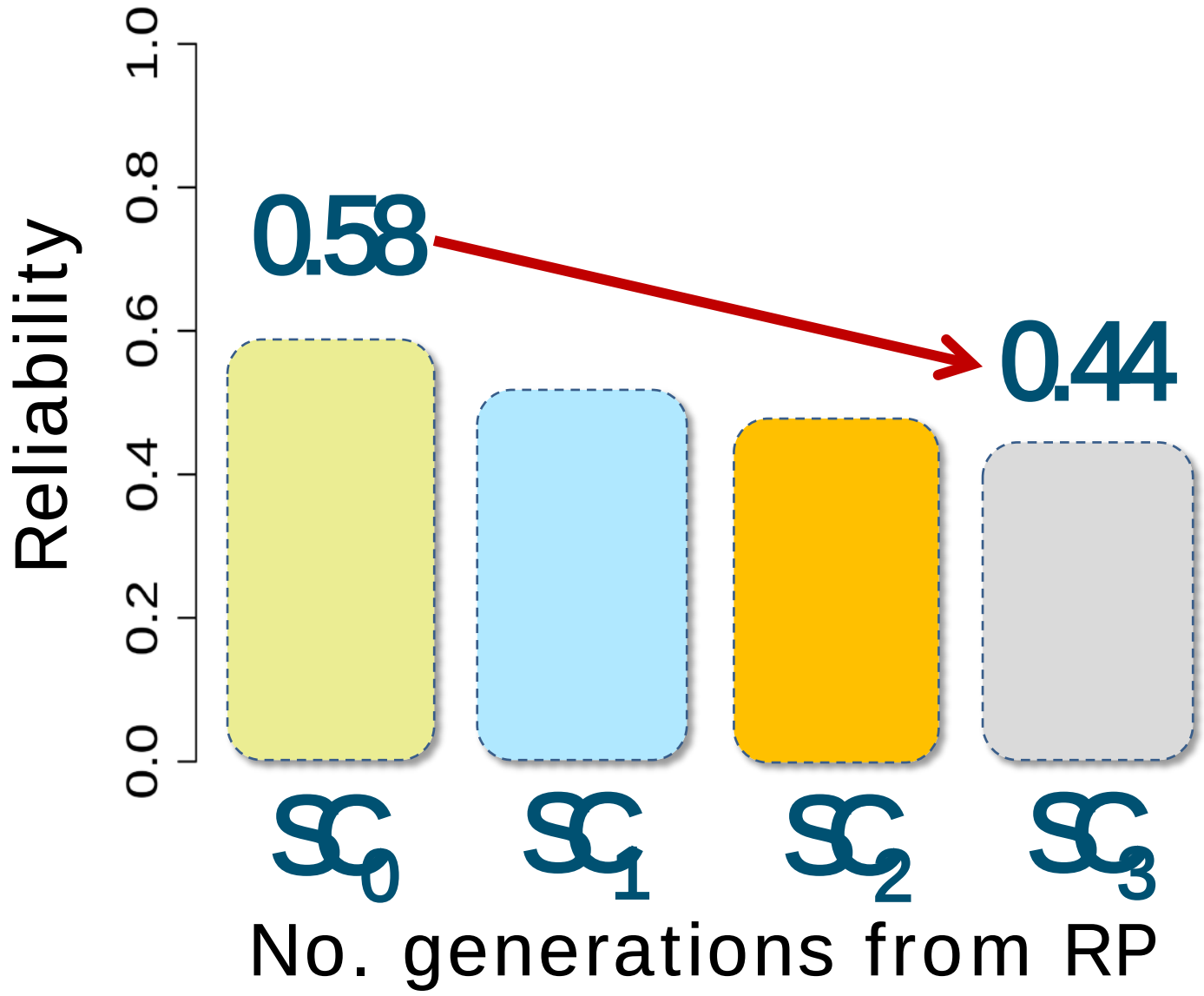

+1 SC0 (@random)
RP0 …
SC0
SC1
Reliability ≠ Target reliability

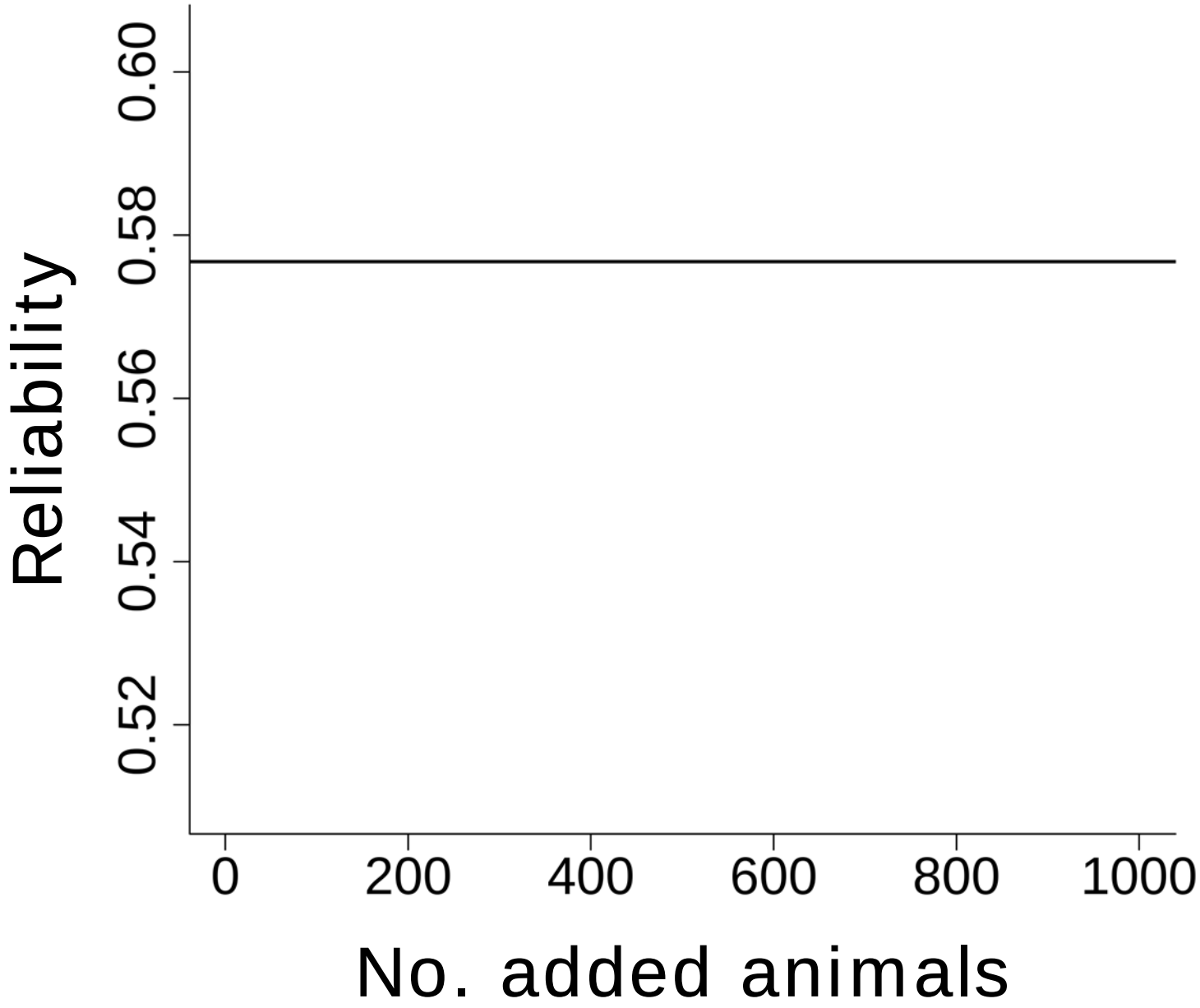
RESULTS

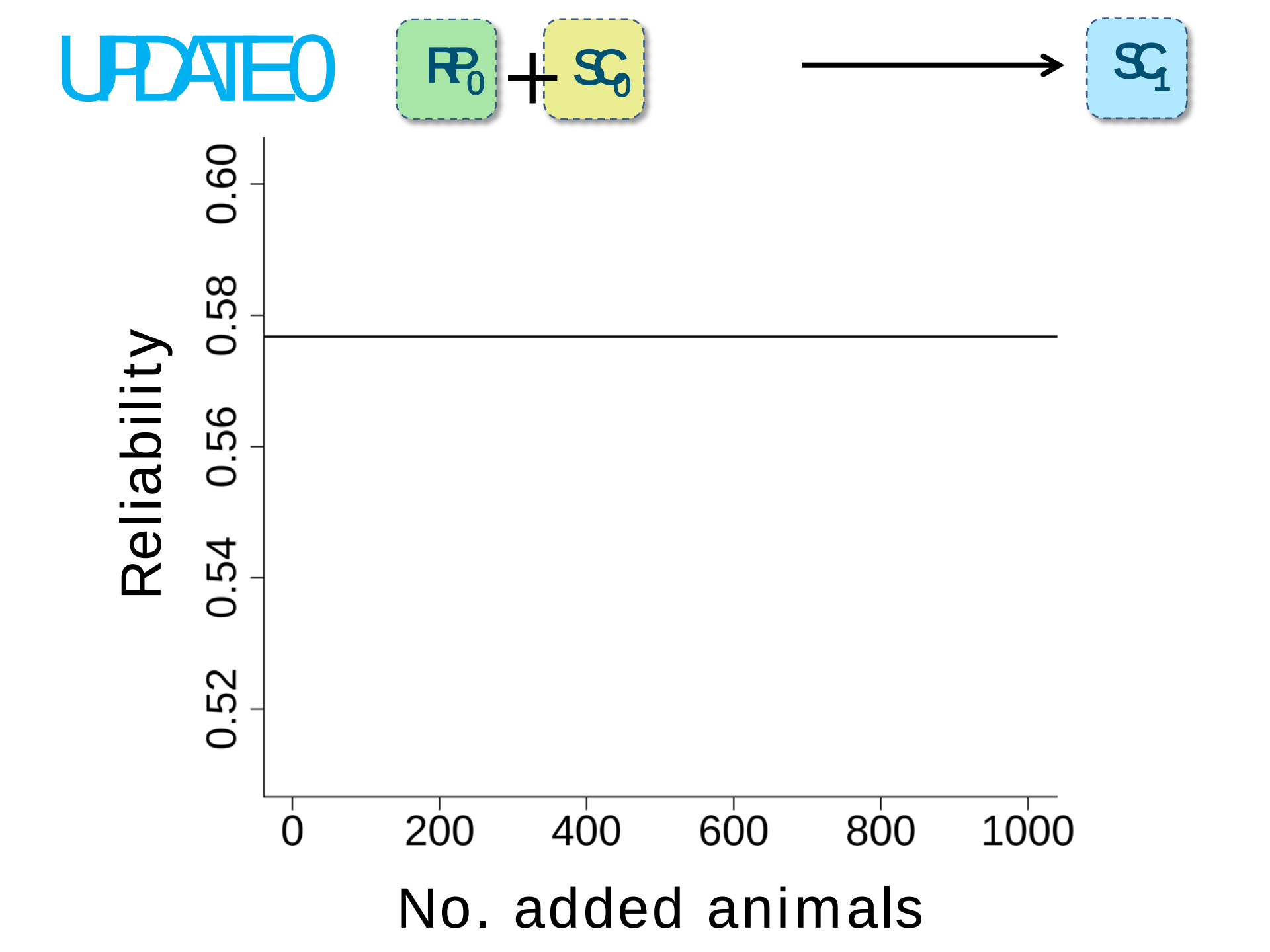
NO UPDATE

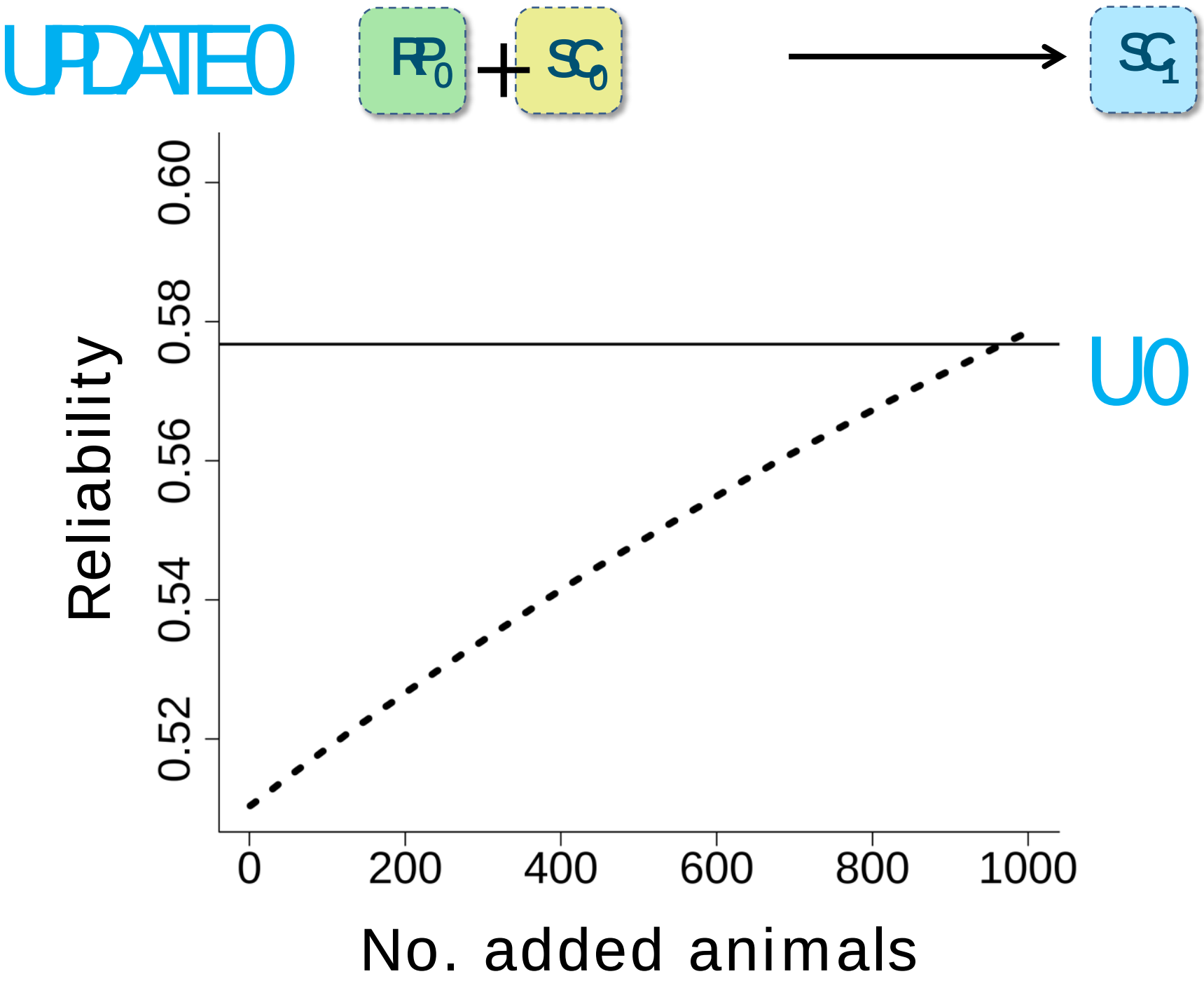

Reliability
0.0
0.2
0.4
0.6
0.8
1.0
SC0
SC1
SC2
SC3
No. generations from RP

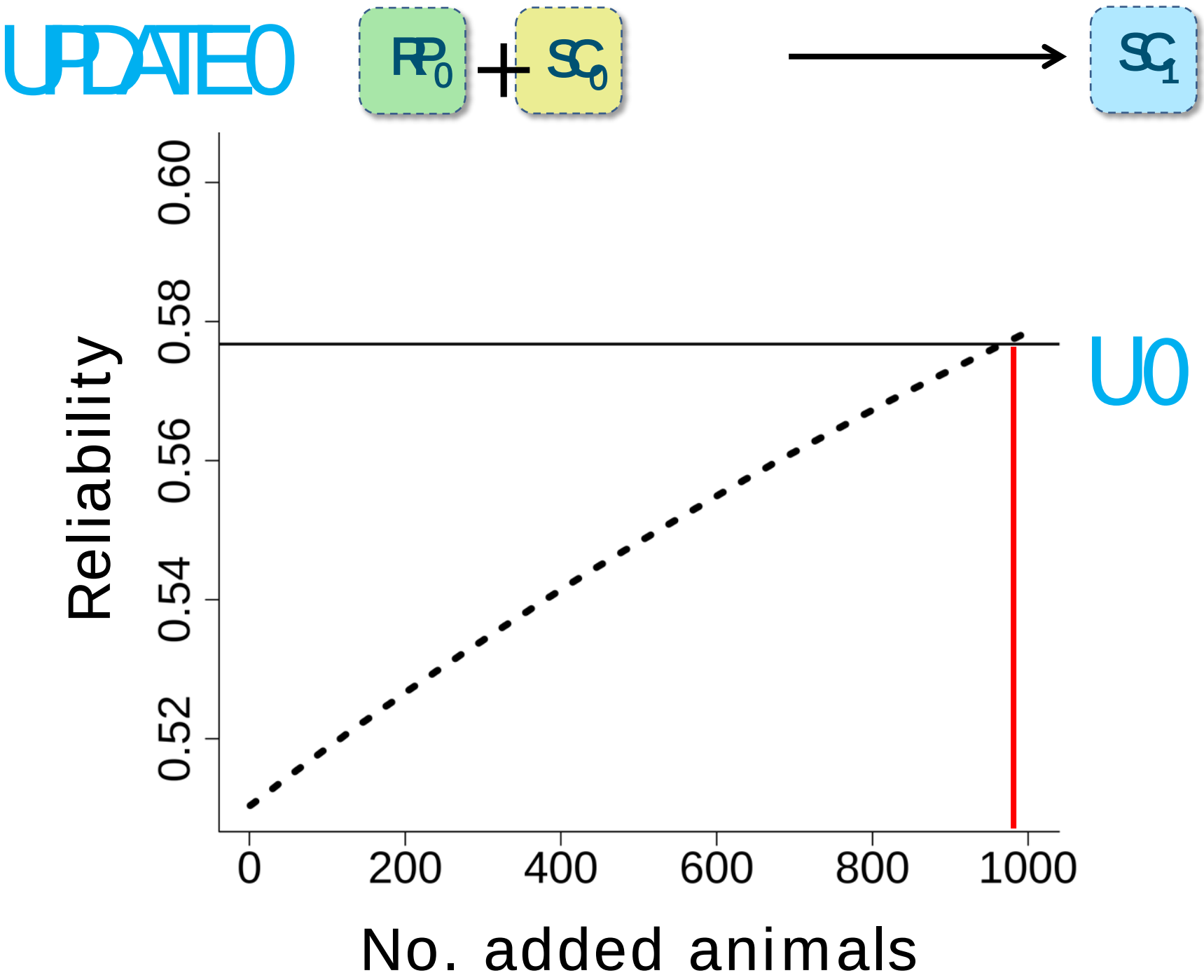
NO UPDATE


Reliability
0.0
0.2
0.4
0.6
0.8
1.0
0.58
0.44
SC0
SC1
SC2
SC3
No. generations from RP

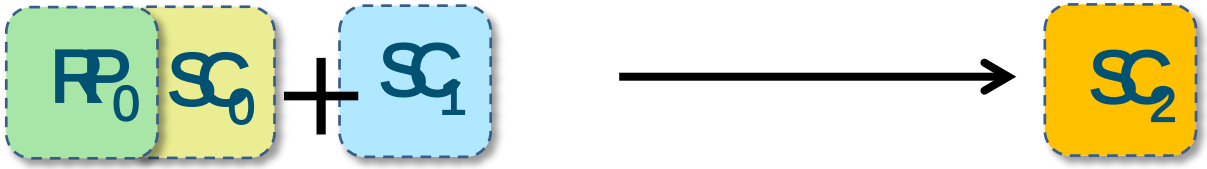

Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals

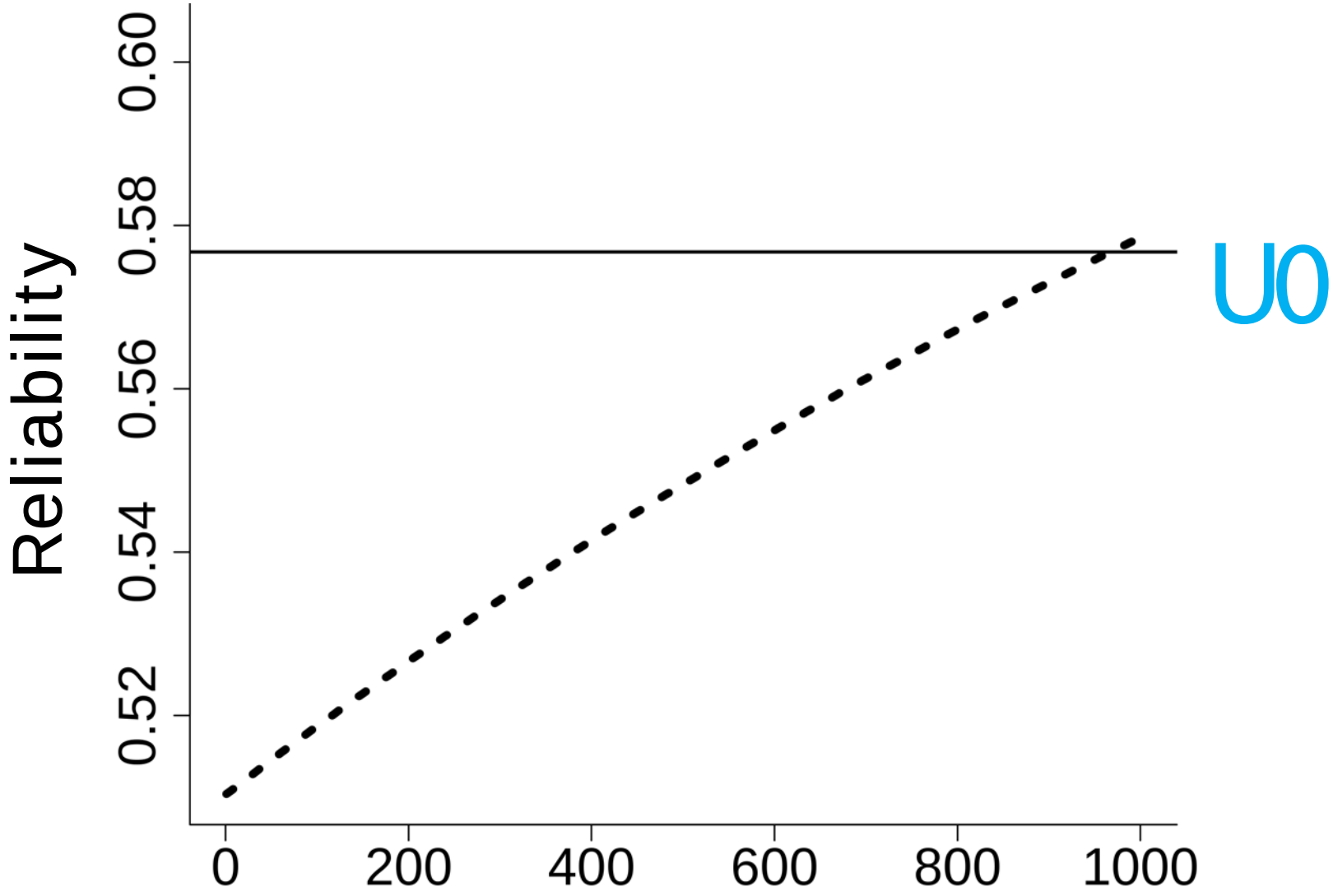

UPDATE0
RP0
+
SG0
SG1
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals


UPDATE0
RP0
+
SG0
SG1
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U0

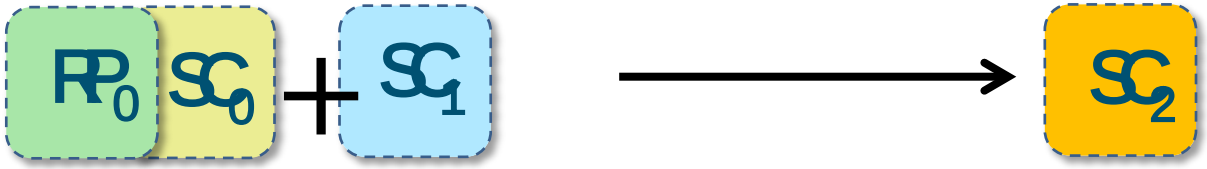

UPDATE0
RP0
+
SG0
SG1
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U0

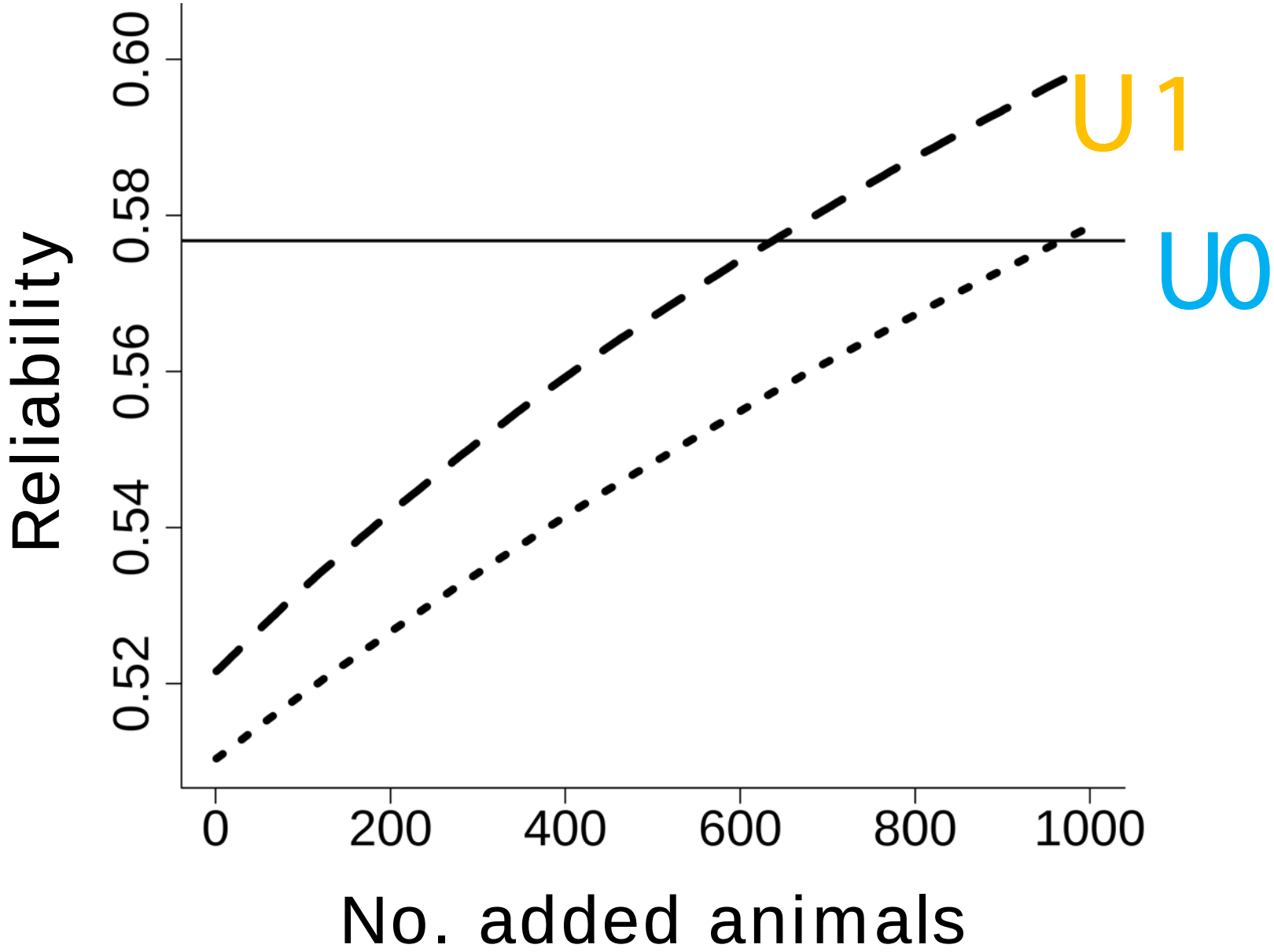
UPDATE1


RP0 SC0
+
SC1
SC2

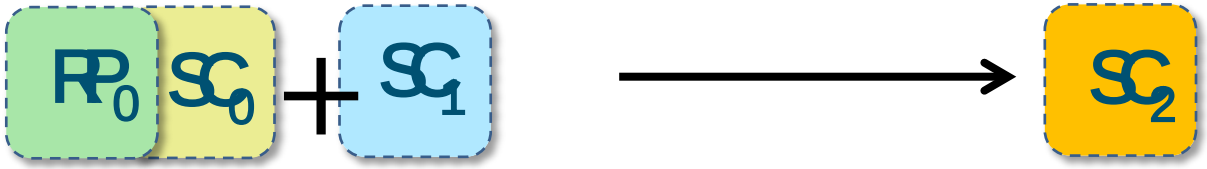

Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U0

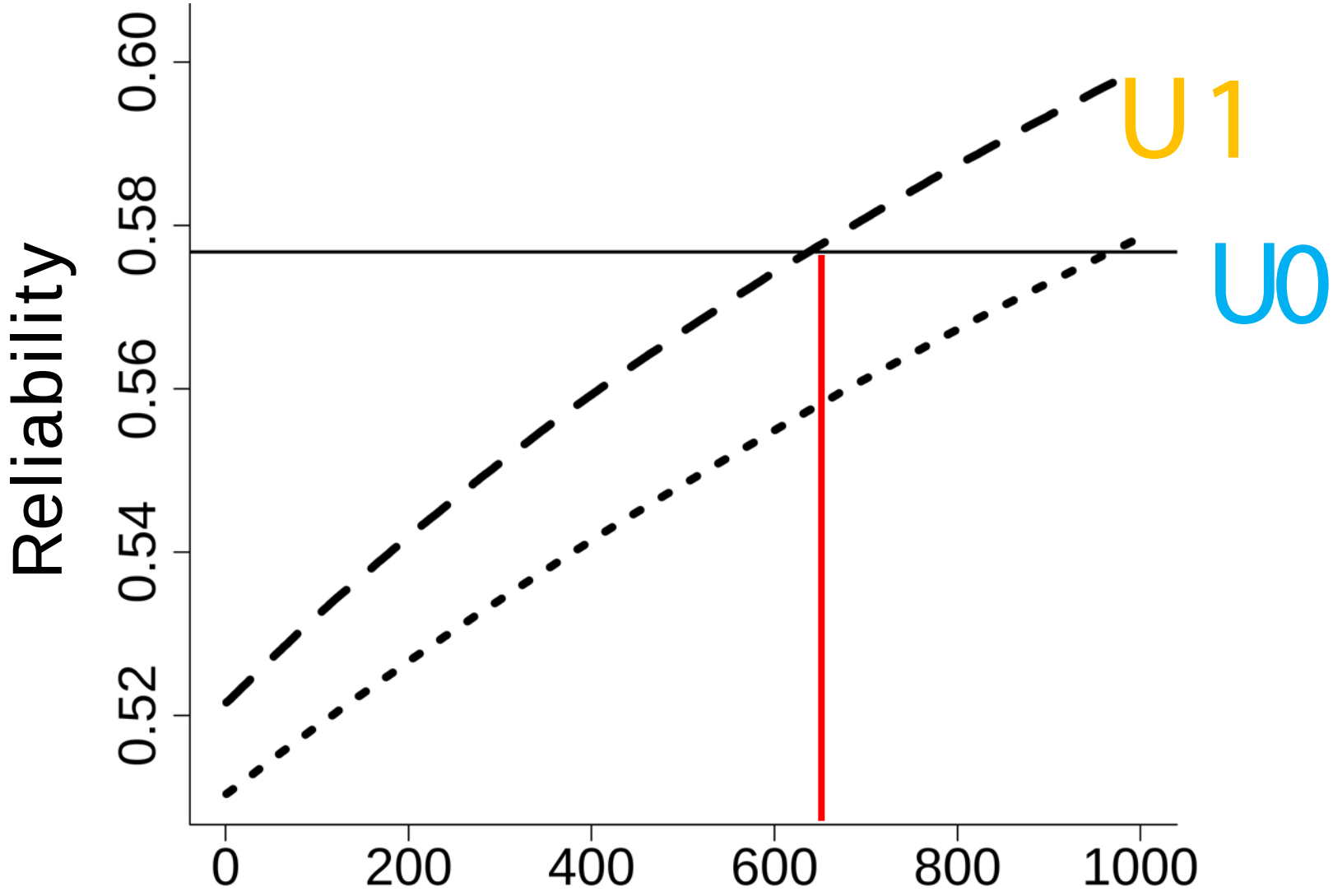
UPDATE1


RP0 SC0
+
SC1
SC2


Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U1
U0

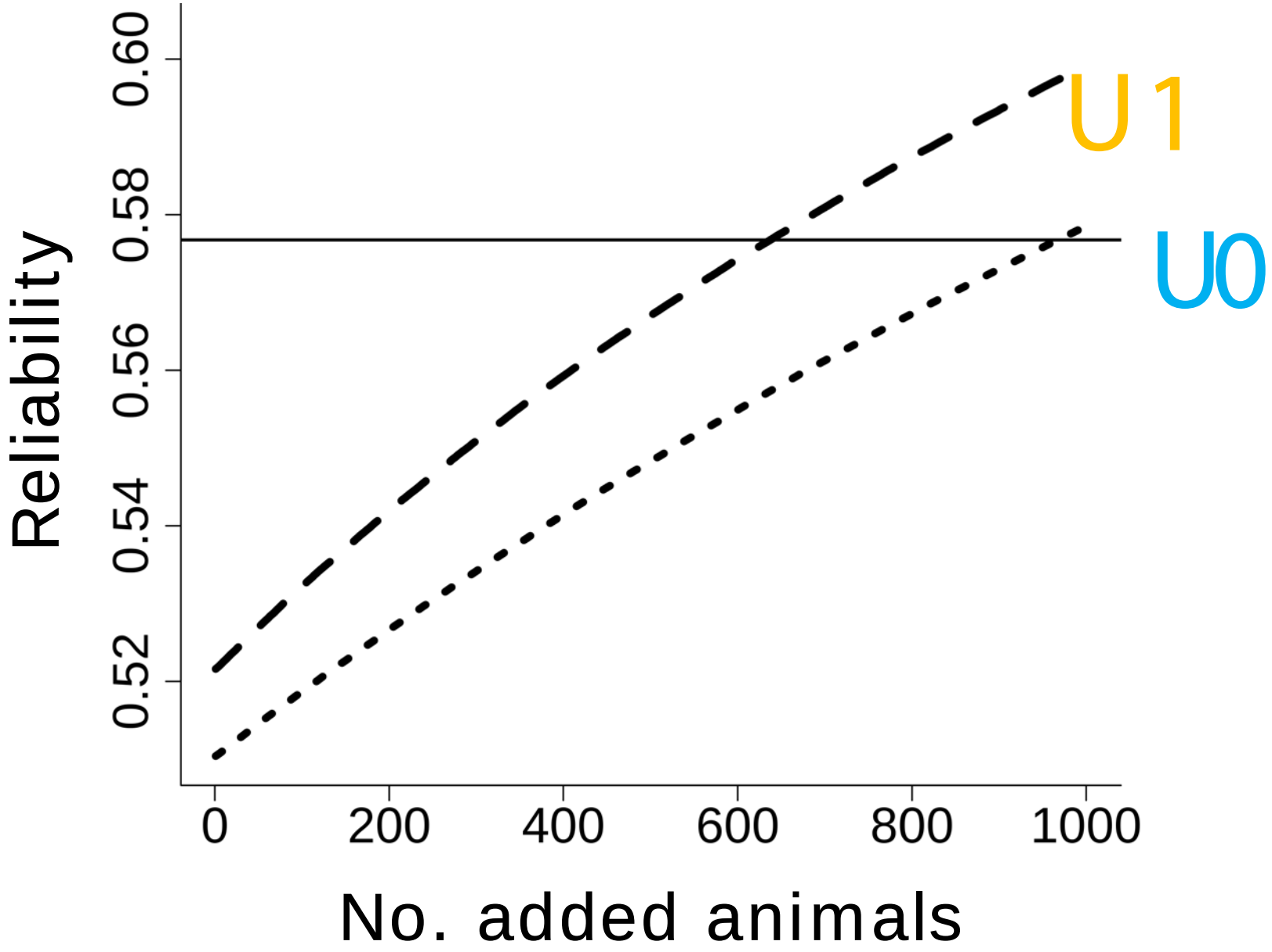
UPDATE1


PP0
SC0
+
SC1
SC2


Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U1
U0

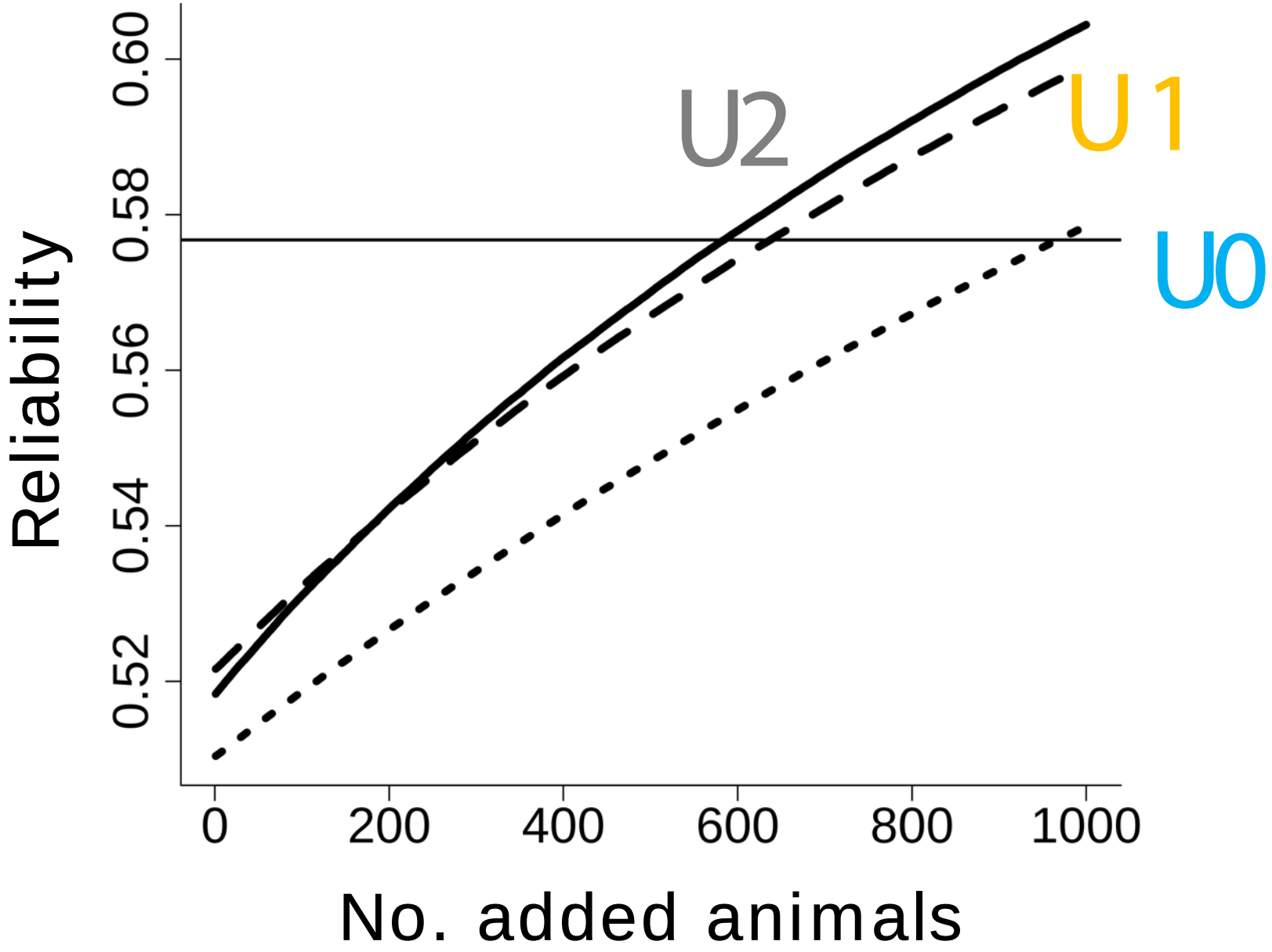
UPDATE2


RP0
SC0
SC1
SC2
SC3


Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals
U1
U0

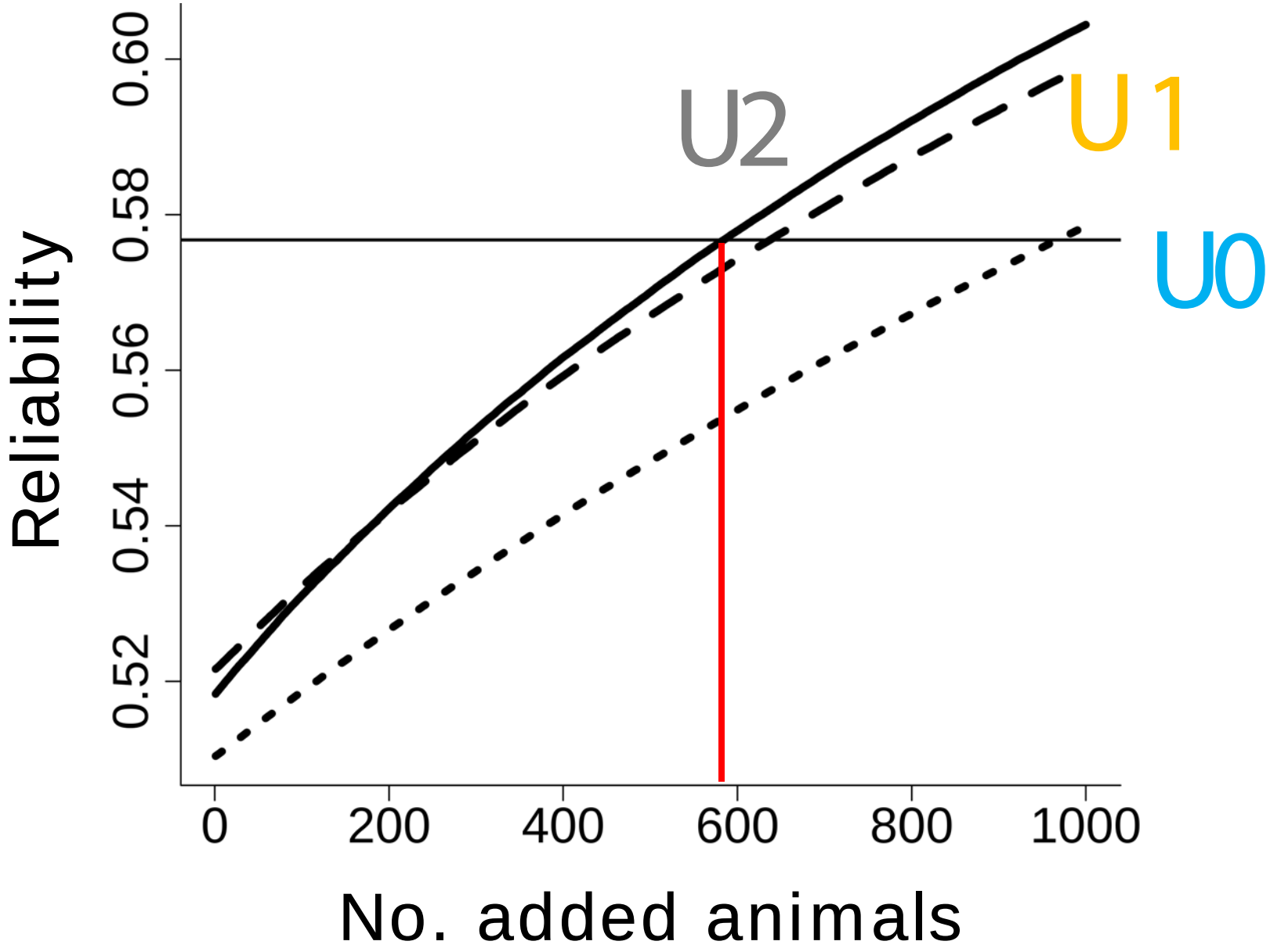
UPDATE2


RP0
SC0
SC1
SC2
SC3


U2
U1
U0
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals

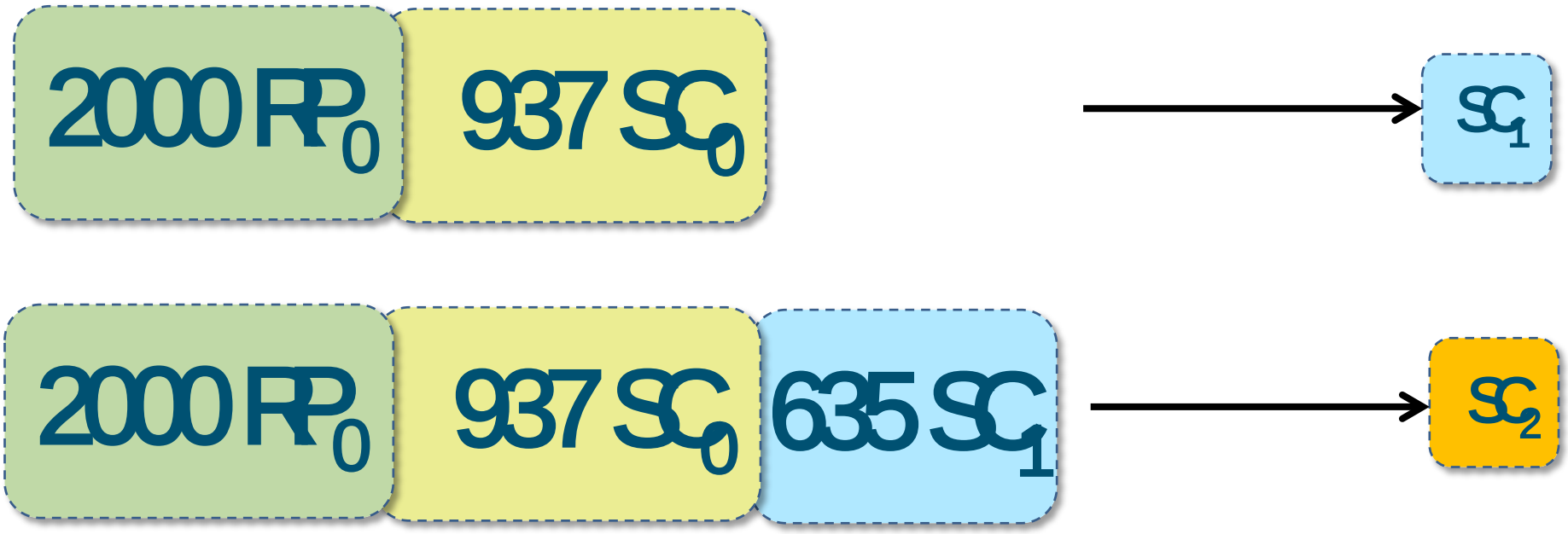
UPDATE2


RP0
SC0
SC1
SC2
SC3

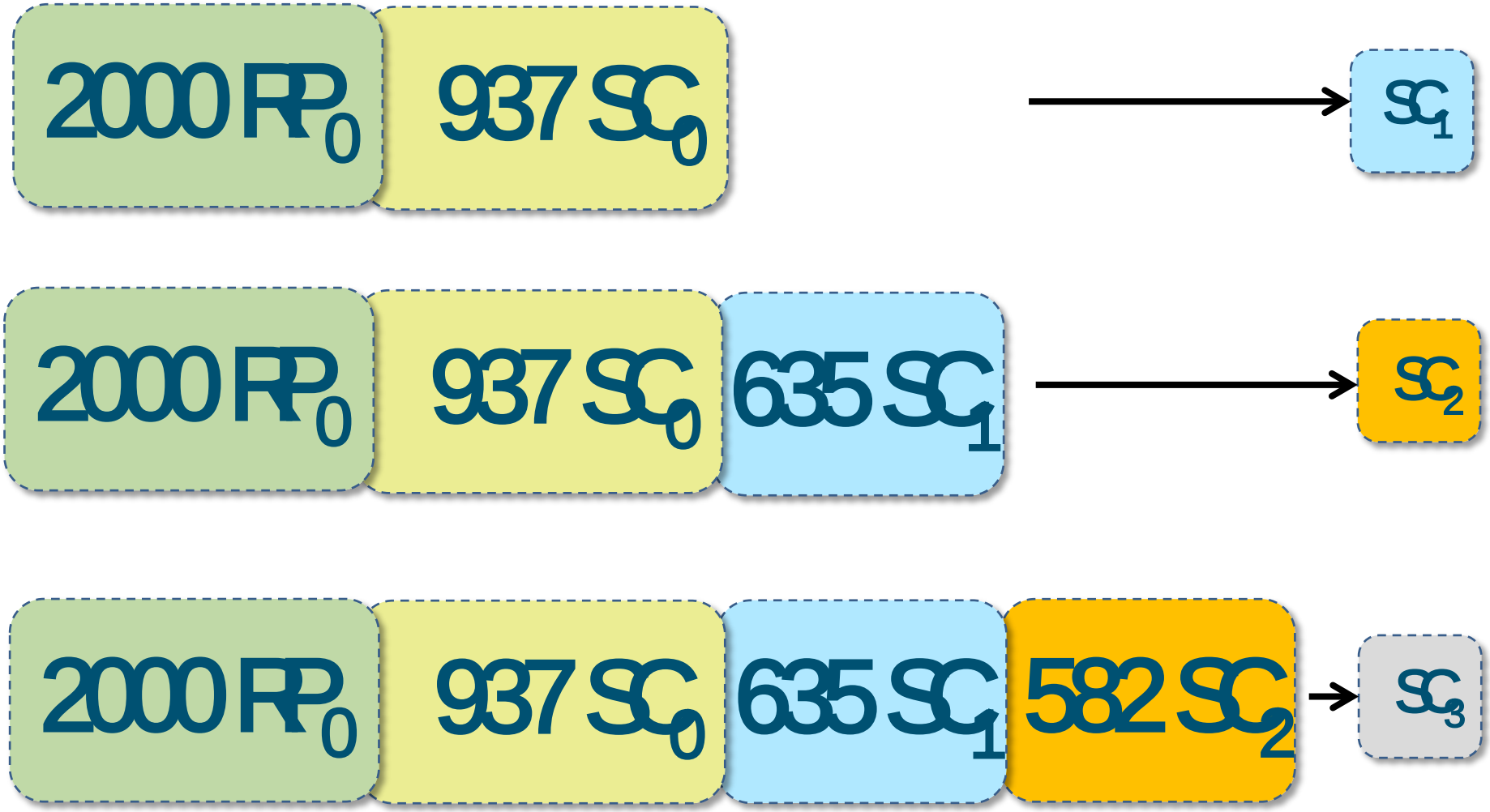

U2
U1
U0
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals

Requested update

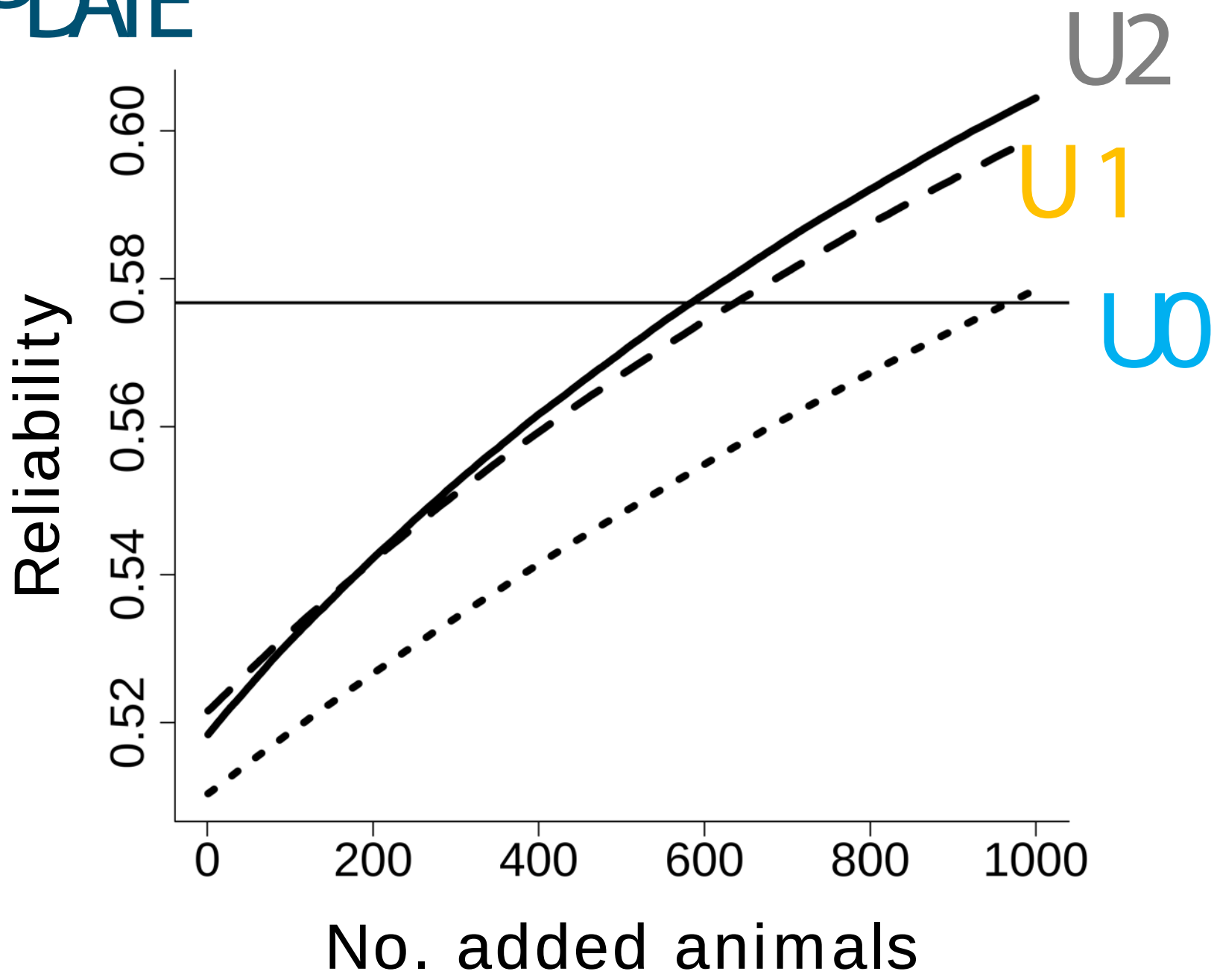
Requested update



Requested update

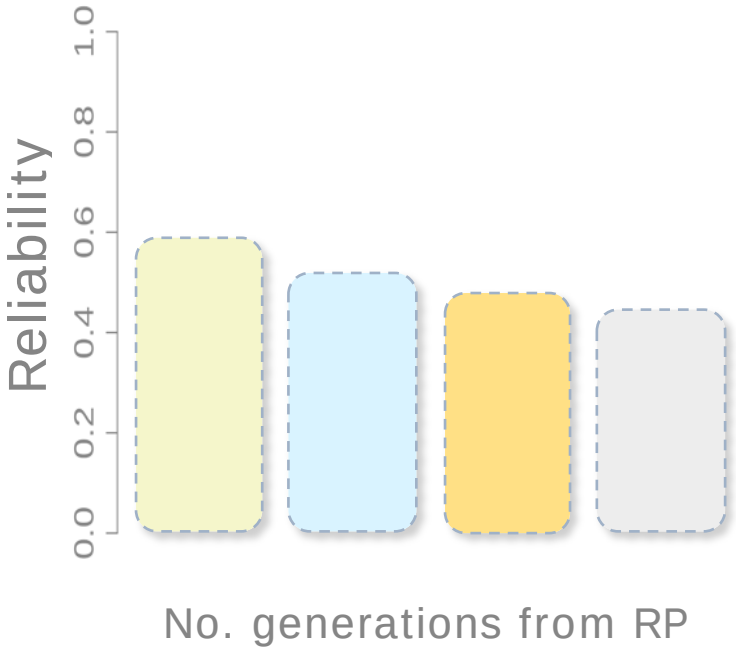


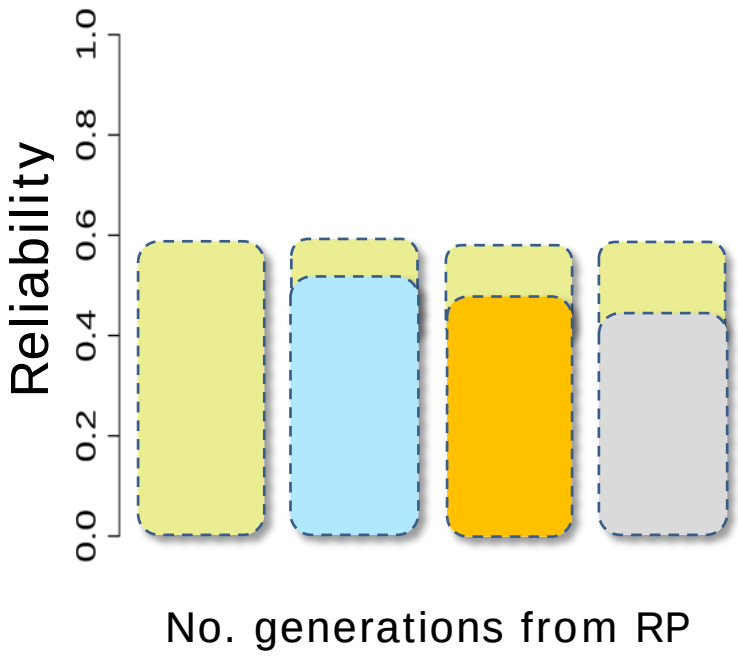
UPDATE


U2
U1
U0
Reliability
0.52
0.54
0.56
0.58
0.60
0
200
400
600
800
1000
No. added animals

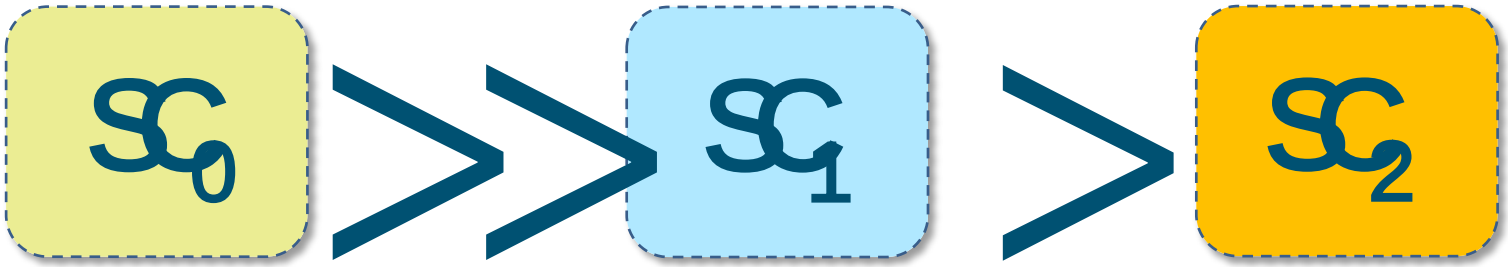
Conclusions

NO update Vs. Update <1000





#update



Thank you for your attention!

Optimal strategies to update the reference population are especially needed for novel traits

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