The power of a bad example

A field experiment in household garbage disposal

Robert Dur
Erasmus University Rotterdam, CESIfo, IZA
Ben Vollaard
Tilburg University

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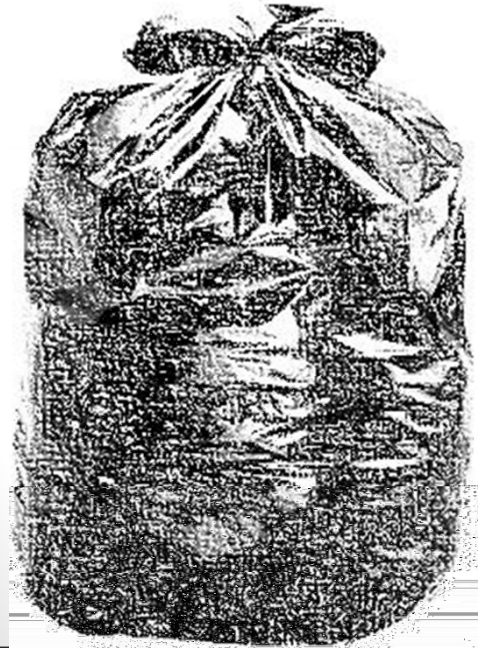


Disorder breeds disorder: *additional* negative externality from illegal behavior

Cialdini et al. (1990) *J of Personality & Soc Psychology*

- People tend to litter more in littered environment

Keizer et al. (2008) *Science*

- Signs of disorderly behavior trigger more and different types of disorder

Ramons and Torgler (2010) working paper

- Messy departmental coffee room tripples littering

Relevant for a range of behaviors

Why should disorder breed disorder? Potential mechanisms

- Copy-cat behavior ("If most people do it, it must be the sensible thing to do")
- Public good dilemma: conditional cooperation ("I only keep it clean if my neighbors do so as well")
- Signal of social norm or enforcement policy
- Marginal cost of disorder decreases in disorder ("If it's already dirty, who cares about more dirt")

Policy response: ‘fixing broken windows’

- If signs of disorderly behavior are quickly removed then…
  - People do not have a bad example to copy
  - People may infer that ‘we care’
  - The marginal cost of disorder goes up

‘Fixing broken windows’ may be naive

- Behavioral response may be different in repeated setting: *policy may invite* ***free riding***
- Behavioral response may be different in people’s **own habitat**

Our contribution to debate about fixing broken windows

- Test in a natural setting
- How do people react to *less cleaning* over a period of 3 months and in their own habitat?

Setting: illegally disposed garbage next to shared container

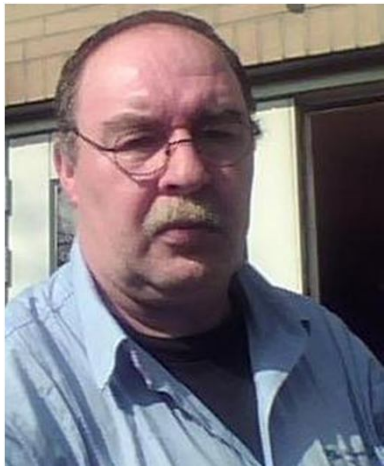
The policy response: frequent clean-up

The experiment

- Does frequent clean-up yield ‘double dividend’ or invite free-riding behavior?
- **Control**: cleaning of all garbage around container at least once a day
- **Treatment**: cleaning 2 to 3 times a week (abandon daily ‘cleaning train’)
- **Three-months experimental period**: Dec 2010 – Feb 2011

Data collection

- Record waste next to container early morning (8-9.30am) & early afternoon (1-2.30pm)
- Bags, abandoned household items
- 6 months in total

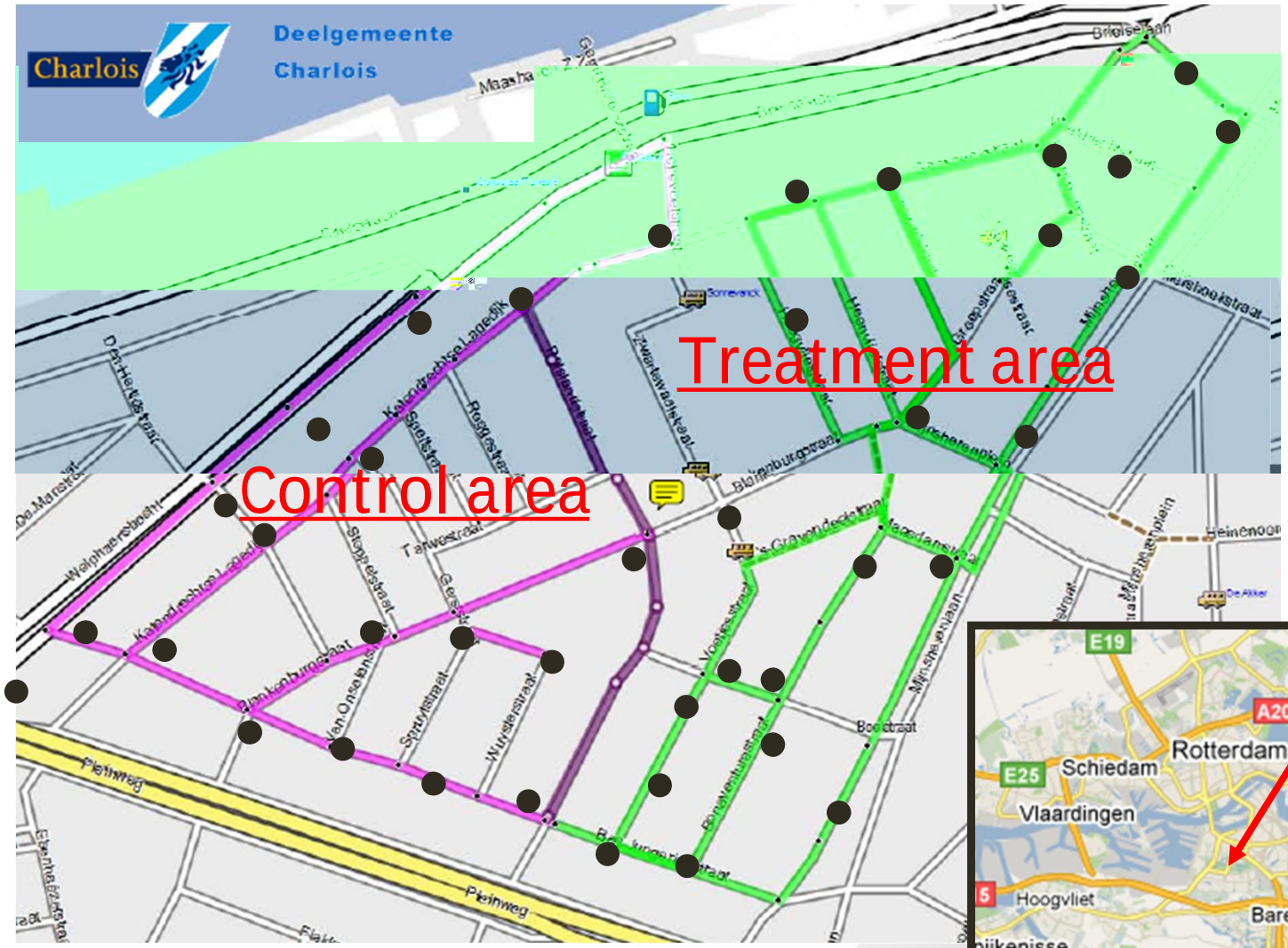


Herman Coomans

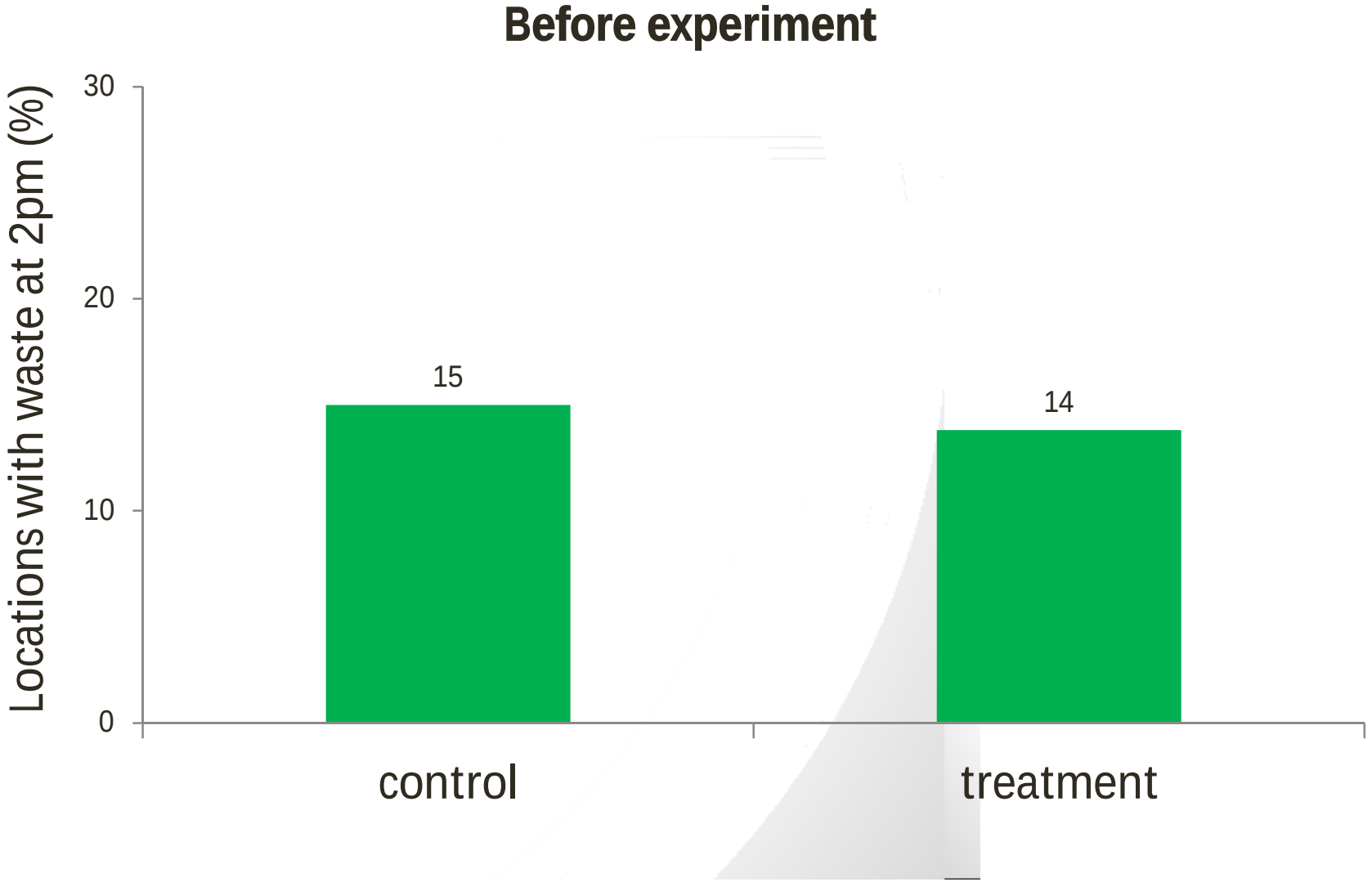
Randomization over 41 garbage container locations

- Ideally: randomization at the container level
- Logistical constraint: the 20 or 21 treatment locations needed to be co-located ► area could be cut up in a few ways
- Method: choose the cut for which the two groups are most similar, then coin toss which group receives treatment
- (*results are robust to collapsing data to 2 groups*)

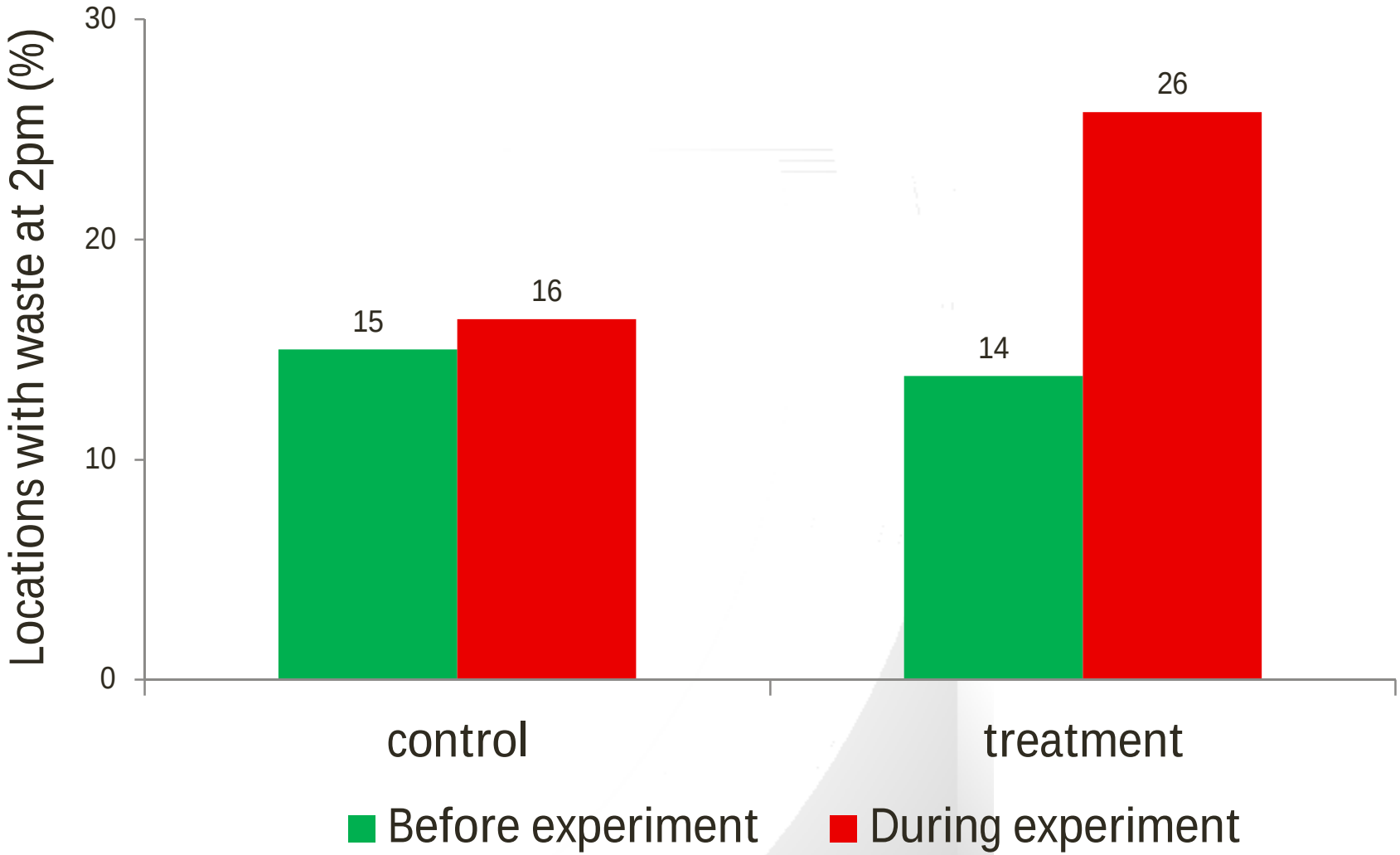
Charlois, City of Rotterdam, Netherlands



Randomization check: locations with waste at 2pm before experiment



Check on treatment (less cleaning a.m.): locations with waste at 2 p.m.

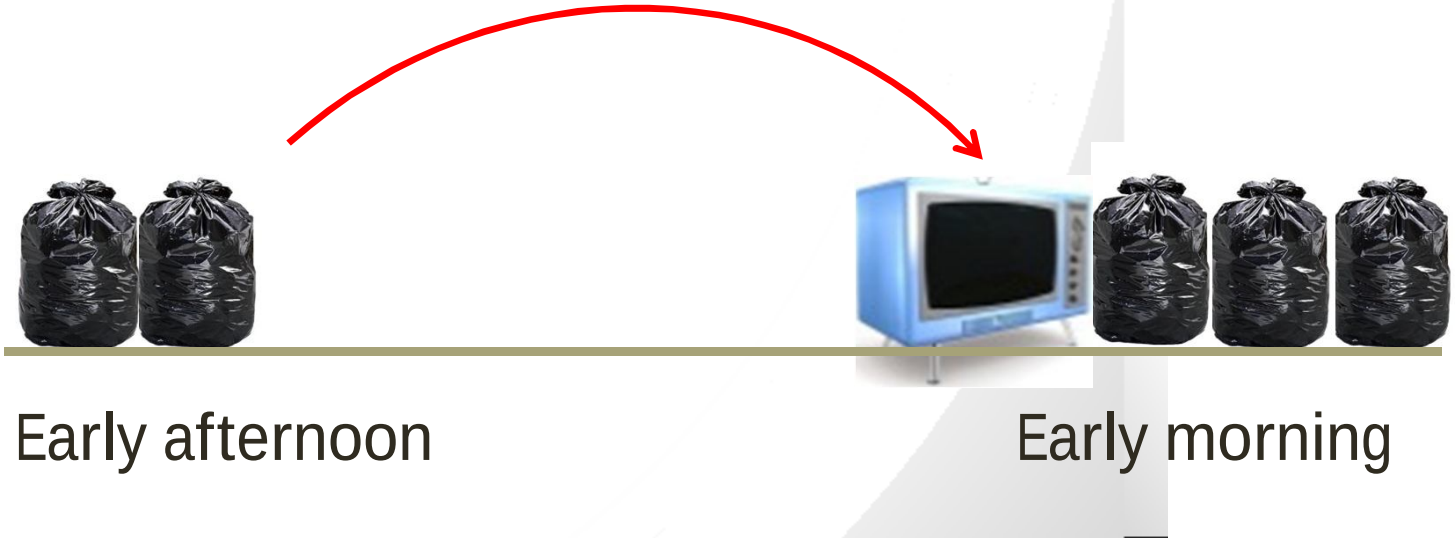


What happens between 2pm and 9am? Two competing hypotheses

- **‘Disorder breeds disorder’-effect**
  - Greater build-up afternoon to morning

- **‘Learn-to-clean-up-after-yourself’-effect**
  - Smaller build-up over time

More frequent illegal disposal of garbage in response to treatment?



Linear Probability Model

$$I(buildup>0)_{i,t} = \alpha\ Treatment_{i,t} + \eta_t + \lambda_i + \varepsilon_{i,t}$$

$I(buildup>0)_{i,t}$ = 1 if build-up of waste between early afternoon and early morning; 0 otherwise

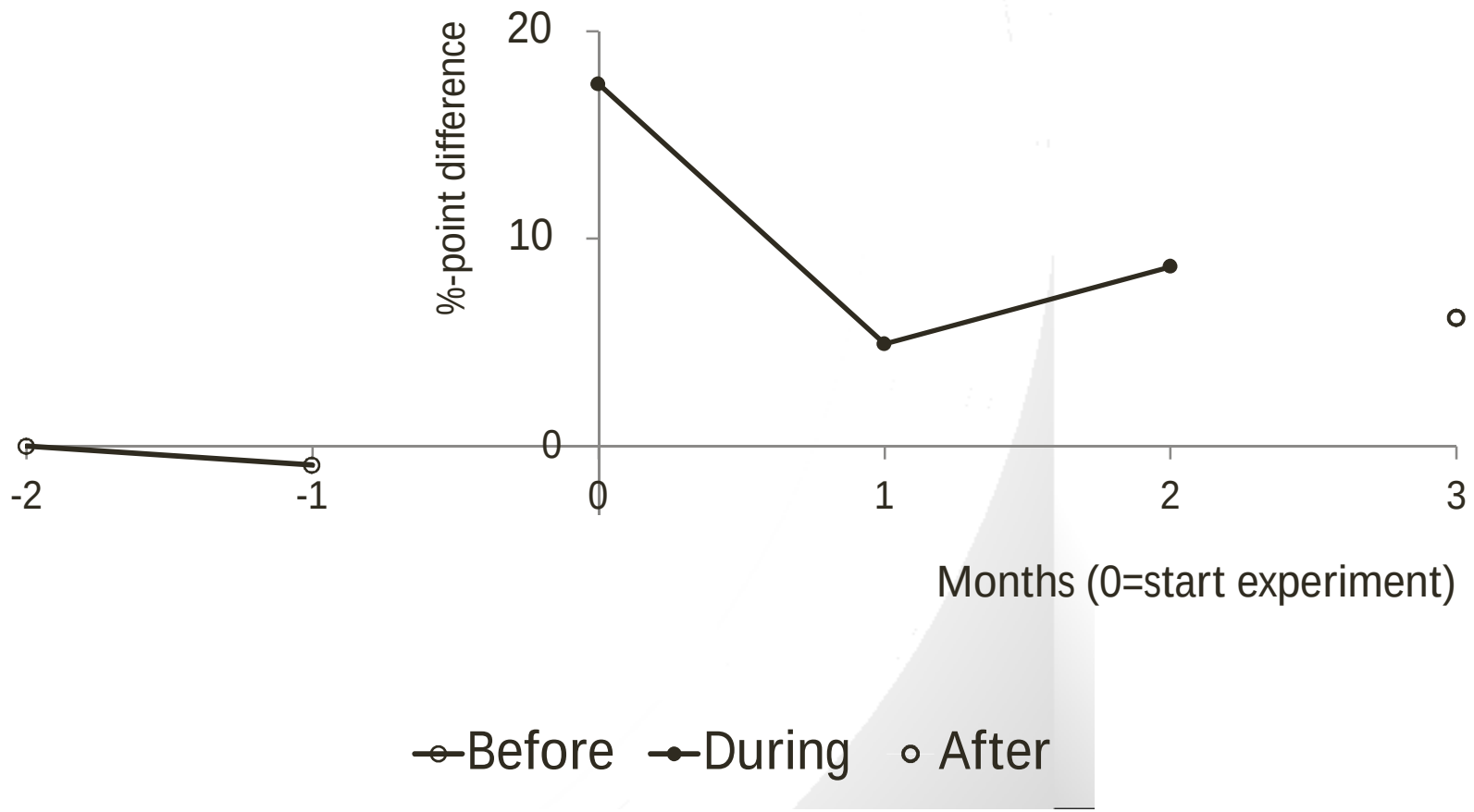
$Treatment_{i,t}$ = 1 in treatment area during treatment period; 0 otherwise

η_t ; λ_i = day and location FE

Observations by container location (i) and by day (t)

Share of locations with build-up of garbage goes up substantially

%-point difference in build-up of garbage treatment vs. control, by month



Average effect of less frequent cleaning on build-up of garbage

$$I(buildup>0)_{i,t} = \alpha\ Treatment_{i,t} + \eta_t + \lambda_i + \varepsilon_{i,t}$$

```
Fixed-effects (within) regression               Number of obs      =      1625
Group variable: locatie_id                      Number of groups   =        41

R-sq:  within  = 0.0749                         Obs per group: min =        26
       between = 0.0076                                        avg =      39.6
       overall = 0.0608                                        max =        48

                                                F(40,40)           =         .
corr(u_i, Xb)  = -0.0606                        Prob > F           =         .

                                    (Std. Err. adjusted for 41 clusters in locatie_id)
```

build-up	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
treatment	.0987682	.0433231	2.28	0.028	.011209	.1863274

(not showing coefficients of location-FE and day-FE)

Coefficient implies 10%-point higher build-up

No clear indication for 'learning to clean up after yourself' during experiment

$$I(buildup>0)_{i,t} = \alpha\, T'mnt_{i,t} + \alpha^{1}\, T'mnt_{i,t} * dummy(2^{nd}\ half\ period) + \eta_t + \lambda_i + \varepsilon_{i,t}$$

Fixed-effects (within) regression — Number of obs = 1625
Group variable: locatie_id — Number of groups = 41

R-sq: within = 0.0753
between = 0.0074
overall = 0.0612

Obs per group: min = 26
avg = 39.6
max = 48

F(40,40) = .
corr(u_i, Xb) = -0.0602 — Prob > F = .

(Std. Err. adjusted for 41 clusters in locatie_id)

build-up	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
treatment	.1232143	.0485891	2.54	0.015	.0250122	.2214165
t'mnt*period_2	-.0420135	.0461507	-0.91	0.368	-.1352876	.0512606

(not showing coefficients of location-FE and day-FE)

Interaction term for 2nd half experimental period insignificant

No clear evidence for persistency

$$I(buildup>0)_{i,t} = \alpha\, T'mnt_{i,t} + \alpha^{1}\, dummy(exp.\ area)_{i,t} * dummy(t\ after\ exp.) + \eta_t + \lambda_i + \varepsilon_{i,t}$$

Fixed-effects (within) regression — Number of obs = 194
Group variable: locatie_id — Number of groups = 41

R-sq: within = 0.0691
between = 0.0061
overall = 0.0563

Obs per group: min = 3
avg = 47.
max = 5

F(40,40) = .
corr(u_i, Xb) = -0.0603 — Prob > F = .

(Std. Err. adjusted for 41 clusters in locatie_id)

build-up	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
treatment	.0979786	.0433749	2.26	0.029	.0103147	.1856426
t'mnt*after	.0559032	.0603162	0.93	0.360	-.0660003	.1778068

(not showing coefficients of location-FE and day-FE)

Term for period after treatment insignificant

Sensitivity tests

- Robust to including indicator of garbage container being stuck at 2pm or 9am
- Similar effect when controlling for number of fines in control and treatment area

Same result when collapsing data to two areas (diff-in-diff)

$$I(buildup>0)_{i,t} = \alpha\ Treatment_{i,t} + \eta_t + \lambda_i + \varepsilon_{i,t}$$

Linear regression

Number of obs =	126
F(61, 57) =	.
Prob > F =	.
R-squared =	0.7106
Root MSE =	.12058

build-up	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
treatment	.1032665	.0432449	2.39	0.020	.0166702	.1898629

(not showing coefficients of area-FE and day-FE)

Conclusions

We find strong evidence that people litter more in more littered environment

No clear evidence that people learn to clean up after themselves (even though experiment lasted 3 months and took place in people's own habitat)

No clear evidence for persistency either

Ongoing field experiments

- More visible enforcement: bright yellow stickers on garbage next to container
- ‘Foot in the door’: creating commitment, overcoming collective action problem
- ‘Adopt a garbage container’: private space
- ‘In the spotlight’: motion sensing light to increase sense of being watched by neighbors