Towards confirmatory data analysis? Deriving and analysing routing information from an origin-destination bike share dataset

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153
HDC 9
CYCLE HIRE
BARCLAYS
13536

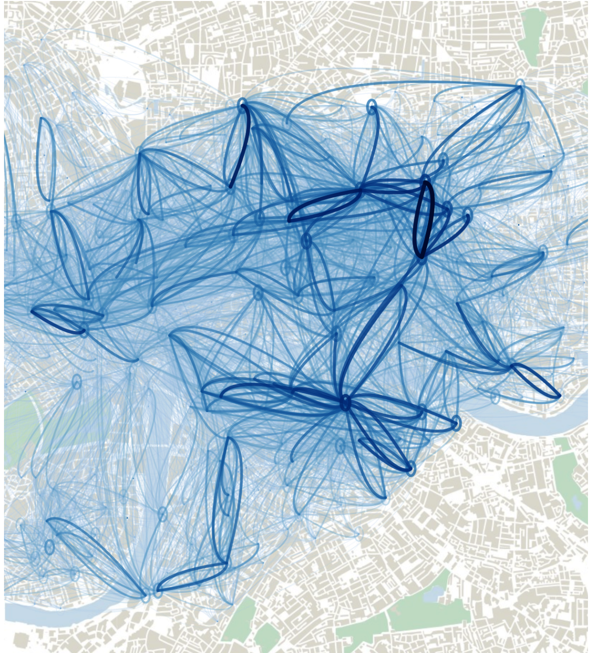
Usage dataset

Customers

memID	###82
gender	f
postcode	nw5 ###
distance	1.3km
oac	cl
imd	3
recency	3
frequency	4

Journeys

memID	oTime	dTime	oStation	dStation
###82	18:44:26	18:50:20	61	223
###82	11:06:24	11:15:04	62	223
###82	22:09:24	22:23:19	94	94
###82	20:30:36	20:46:26	94	194
###82	19:00:17	19:04:38	94	269
###82	14:30:38	14:34:17	94	269
###82	07:58:09	08:02:05	94	269



Men
High RF
<5km
Sep 2011-2012
10,700 members;
1.7m journeys

Female
High RF
<5km
Sep 2011-2012
3,200 members;
457,000 journeys

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Exploring gendered cycling behaviours within a large-scale behavioural data-set

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Analysing over 10 million journeys made by members of London's Cycle Hire Scheme, we find that female customers' usage characteristics are demonstrably different from those of male customers. Usage at weekends and within London's parks characterises women's journeys, whereas for men, a commuting function is more clearly identified. Some of these variations are explained by geo-demographic differences and by an atypical period of usage during the first three months after the scheme's launch. Controlling for each of these variables brings some convergence between men and women. However, many differences are preserved. Studying the spatio-temporal context under which journeys are made, we find that women's journeys are highly spatially structured. Even when making utilitarian cycle trips, routes that involve large, multi-lane roads are comparatively rare, and instead female cyclists preferentially select areas of the city associated with slower traffic streets and with cycle routes slightly offset from major roads.

Keywords: gender and cycling behaviour; bicycle share schemes; visual analytics; behavioural data-sets

1. Introduction

As access to public or shared transport systems becomes increasingly digitised, new data-sets have emerged offering opportunities to research travel behaviour in a continuous, large-scale and non-invasive way (Blythe and Bryan 2007; Froehlich, Neumann, and Oliver 2008; Kusakabe, Iryo, and Asakura 2010; Páez, Trépanier, and Morency 2011; Lathia, Ahmed, and Capra 2012). The data produced by urban bike share schemes can be regarded as a particular instance of these new data-sets. In most recent bike share schemes, data on usage are continually reported to central databases. Researchers working within data mining (Froehlich, Neumann, and Oliver 2008; Jensen et al. 2010; Borgnat et al. 2011; Lathia, Ahmed, and Capra 2012) and information visualisation (Wood, Slingsby, and Dykes 2011) have processed and then queried these data to identify patterns of usage at various spatial and temporal resolutions. Some of these works have been used by scheme operators to help overcome problems around fleet management, and by policy-makers for better understanding usage at particular docking stations. They have nevertheless been constrained by the level of detailed information made easily available (Wood, Slingsby, and Dykes 2011; Lathia, Ahmed, and Capra 2012). In many studies, data were harvested from the web, where local transport authorities publish in real-time the

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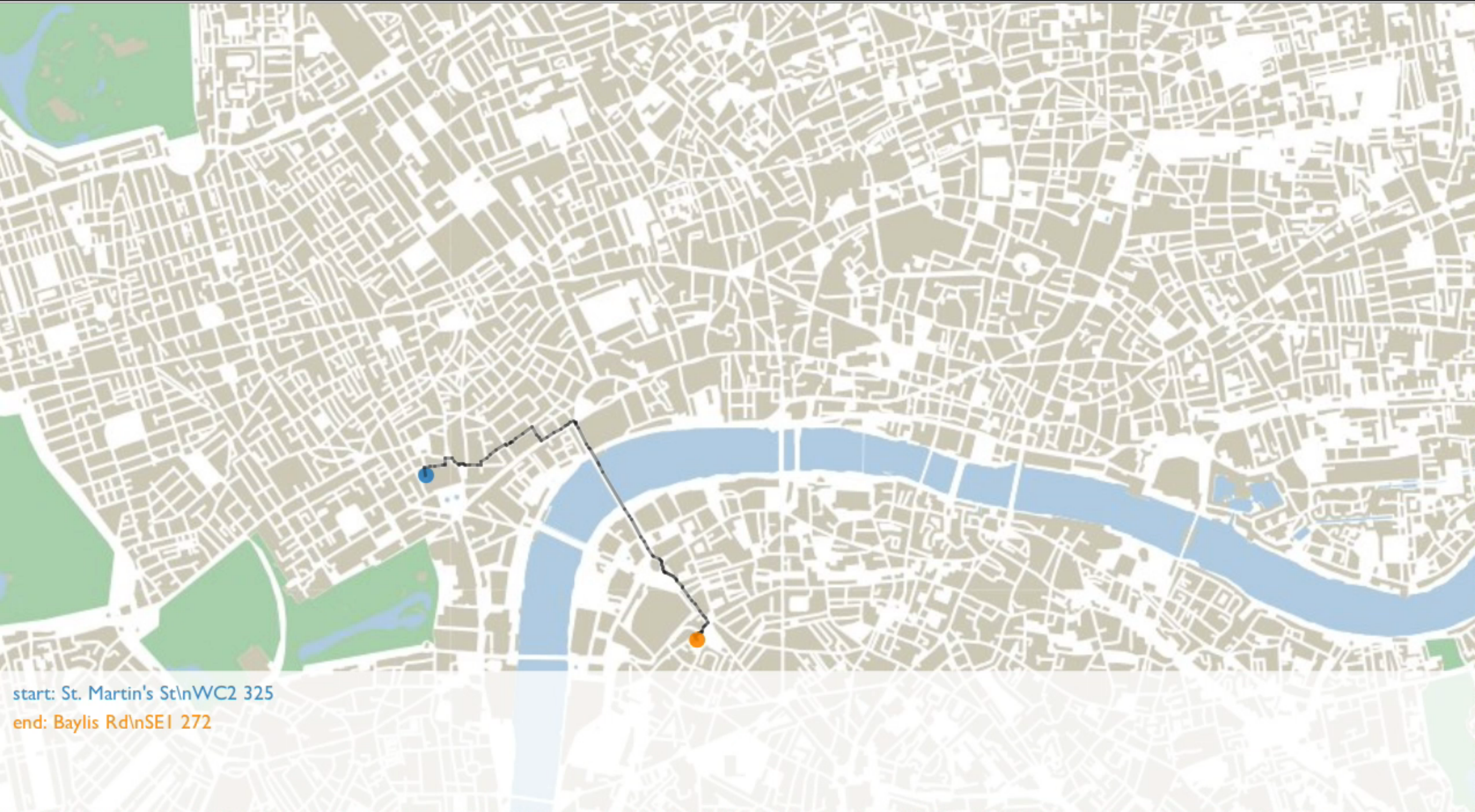
Motivation


start: St. Martin's St\nWC2 325
end: Baylis Rd\nSE1 272

Conflating actual with GIS routes?

Research questions

RQ1. Which bridges are most likely to be used by men and women?

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RQ2. To what extent are these bridges crossed equally in either direction (northbound and southbound)?

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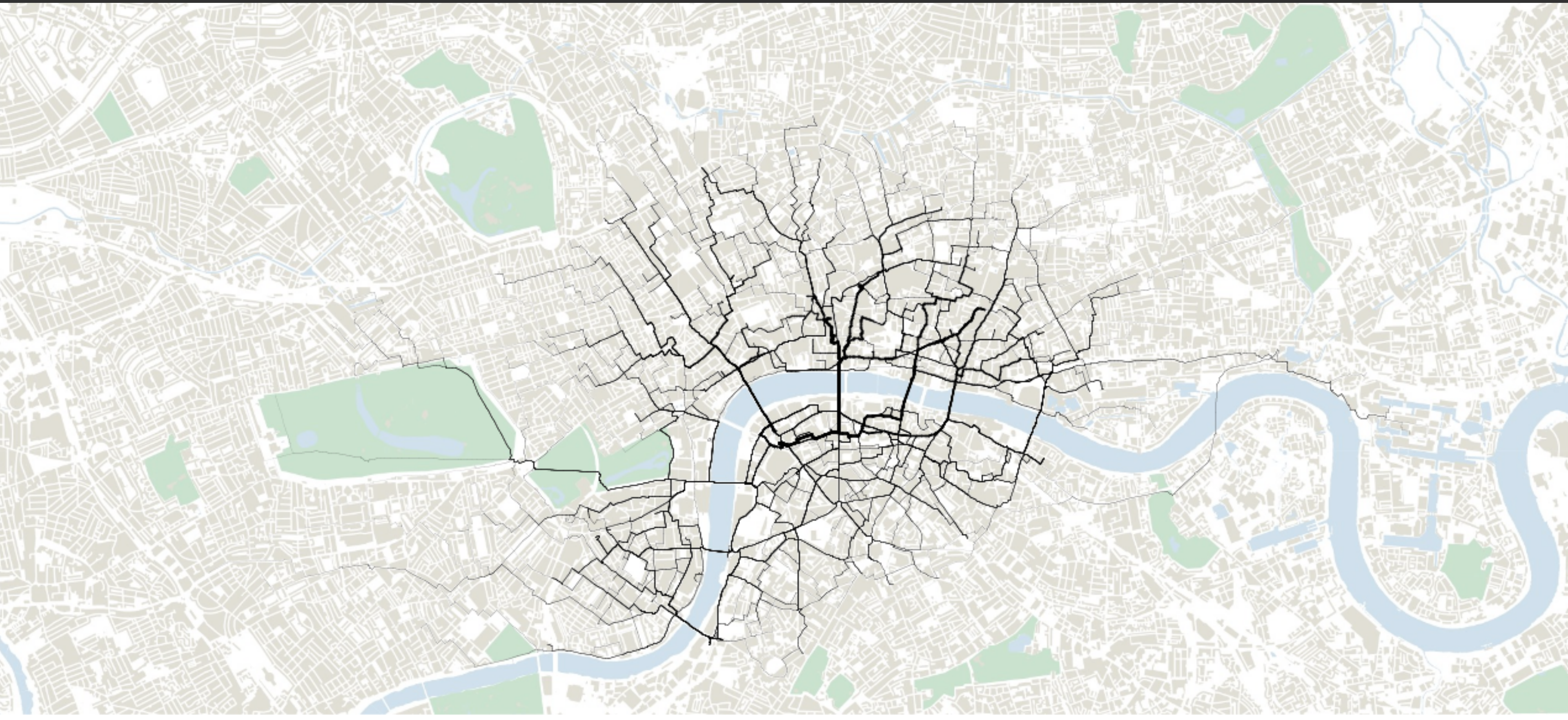
RQ2. To what extent are these bridges crossed equally in either direction (northbound and southbound)?

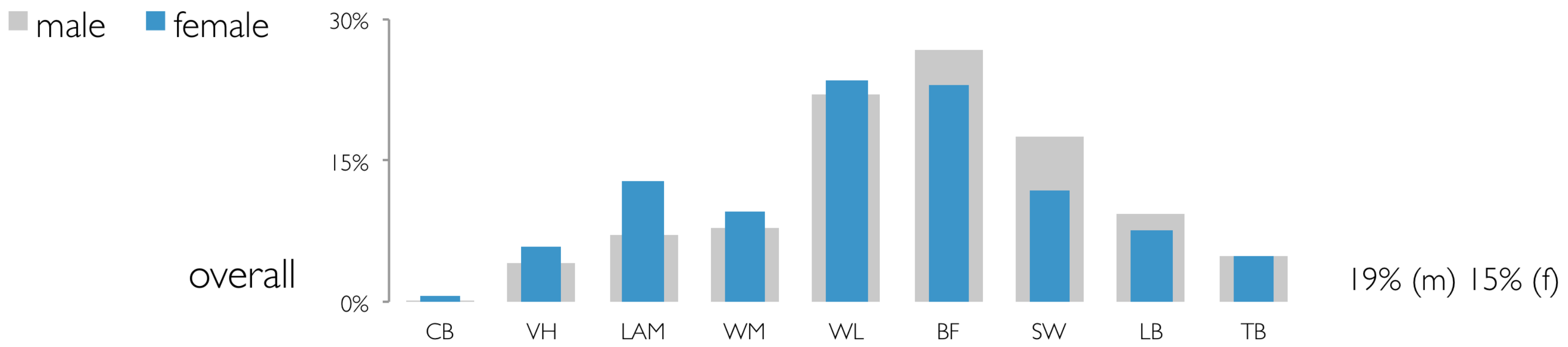
RQ3. Are journeys that involve a river crossing generally more demanding than other journeys made between LCHS docking stations?


Blackfriars Bridge
Waterloo Bridge
Southwark Bridge
Westminster Bridge
London Bridge
Vauxhall Bridge
Lambeth Bridge

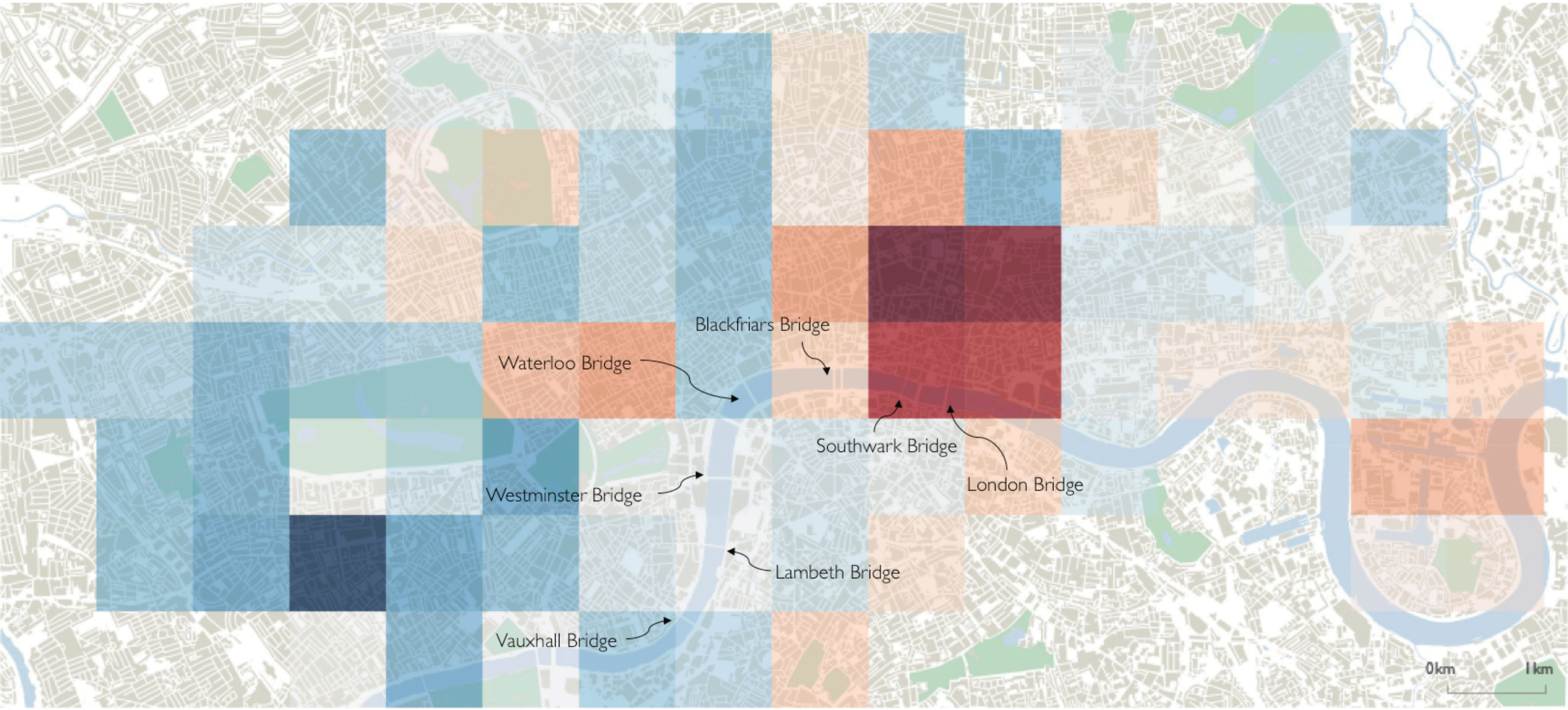


Counted journeys over ‘suggested’ bridges

Men's and women's usage of bridges



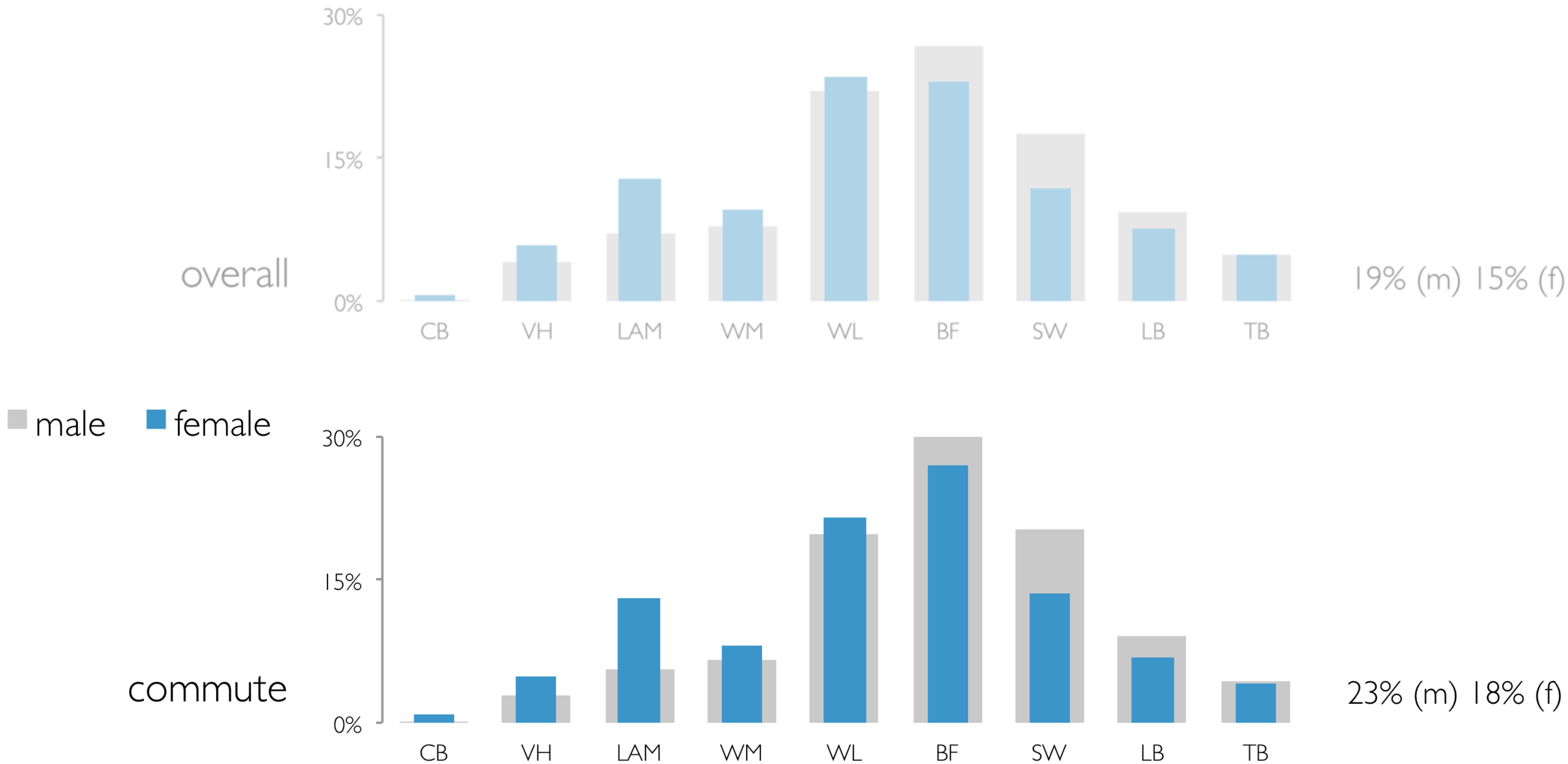
Geography of men's and women's workplaces



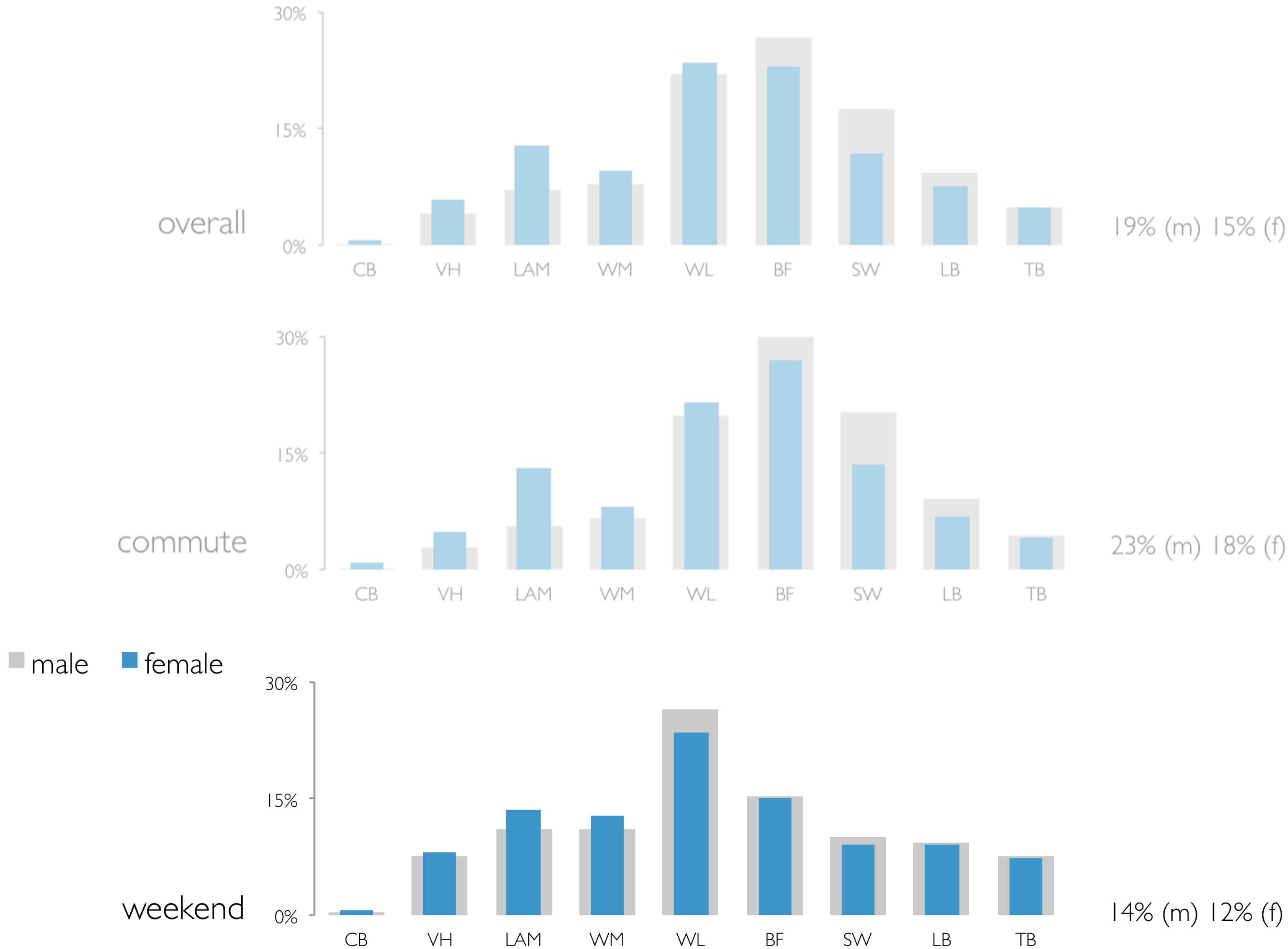
women

chi stat: 313 df: 112

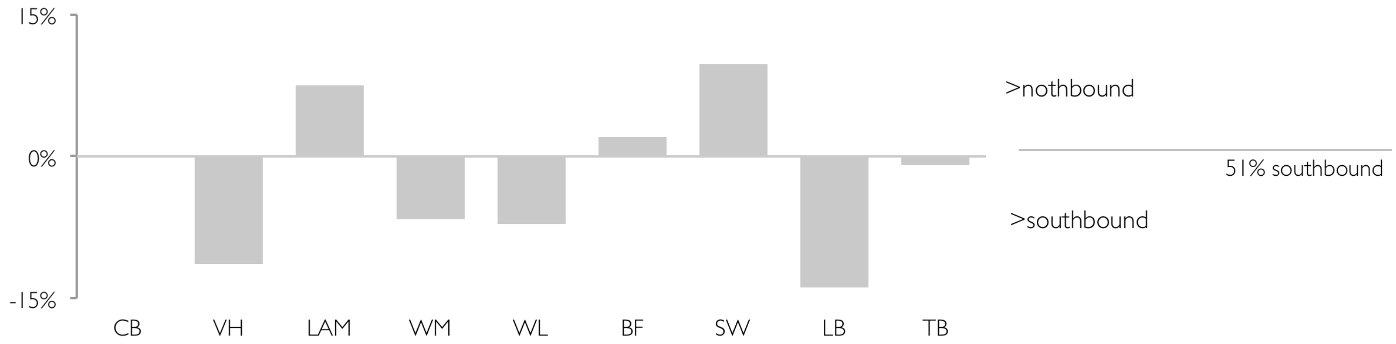
Men's and women's usage of bridges



Men’s and women’s usage of bridges



Are bridges crossed equally in both directions?



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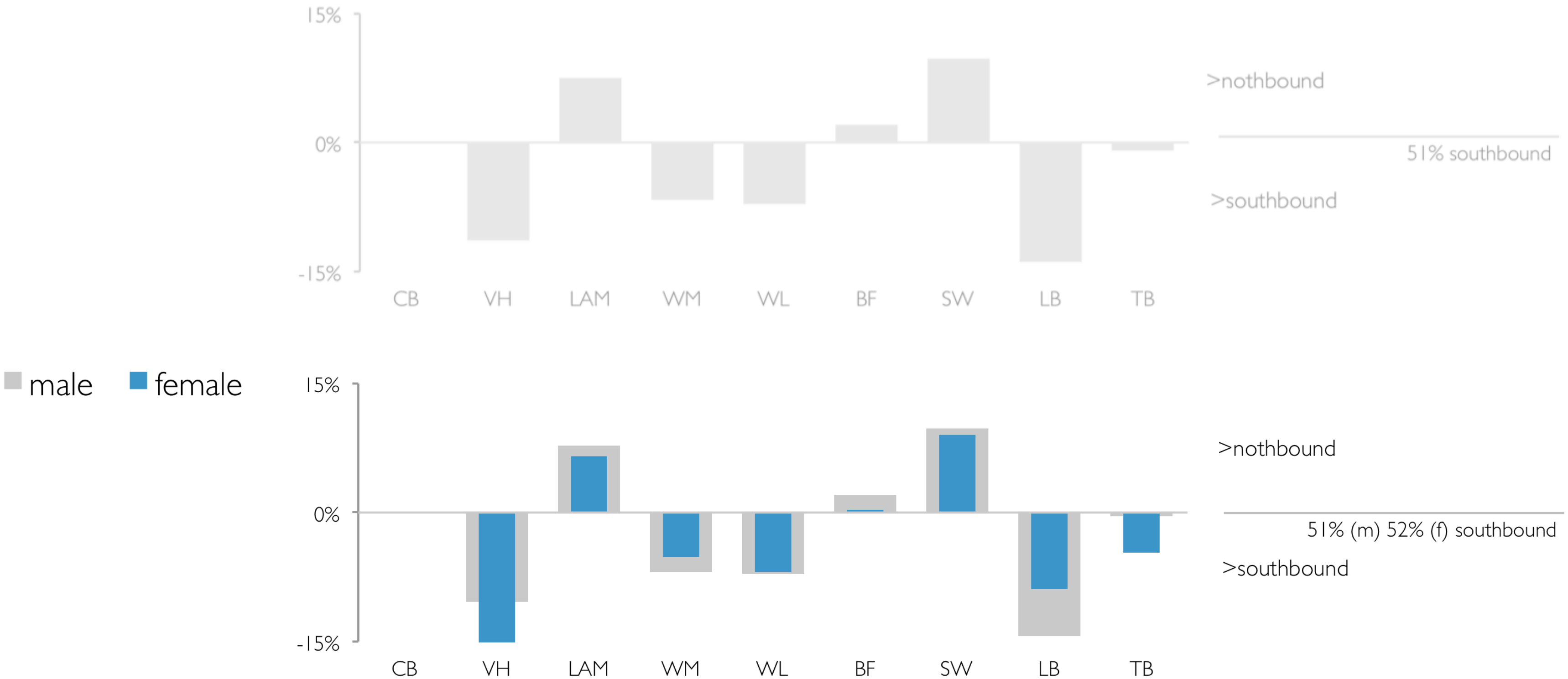

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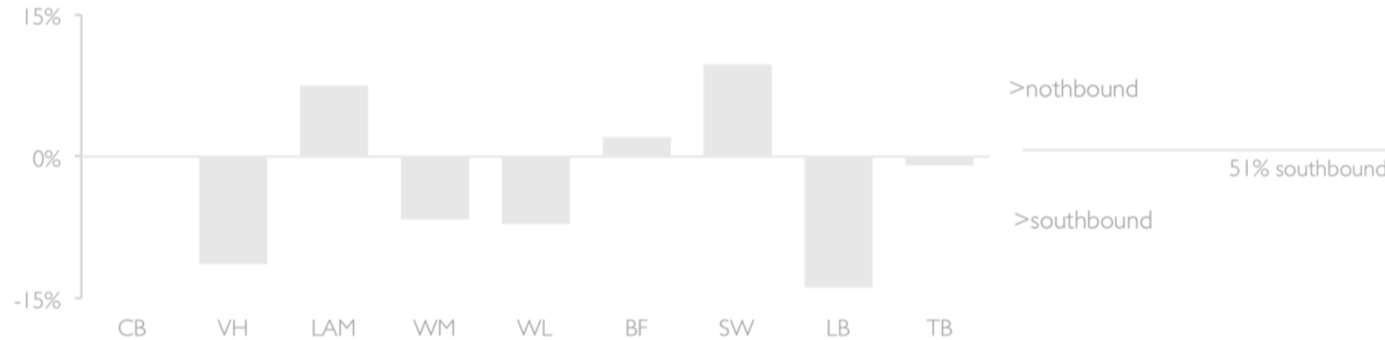

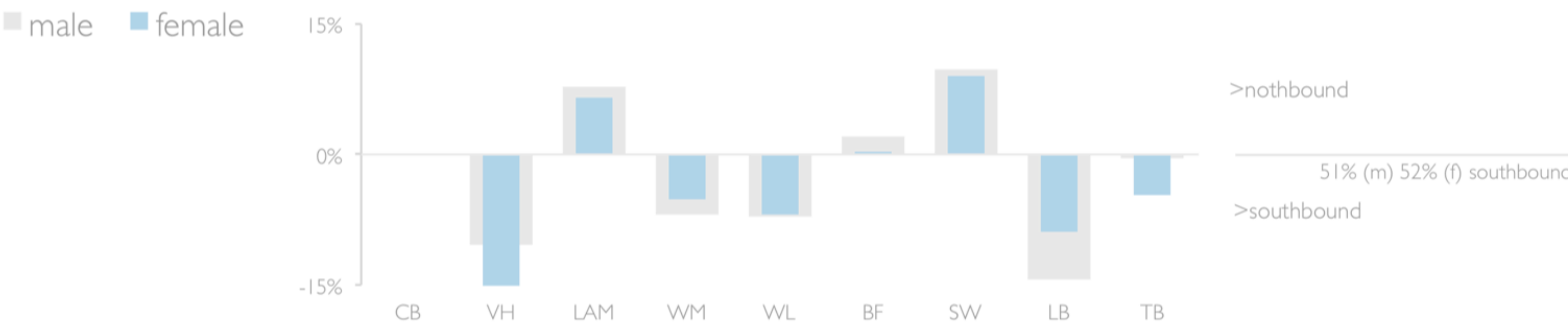

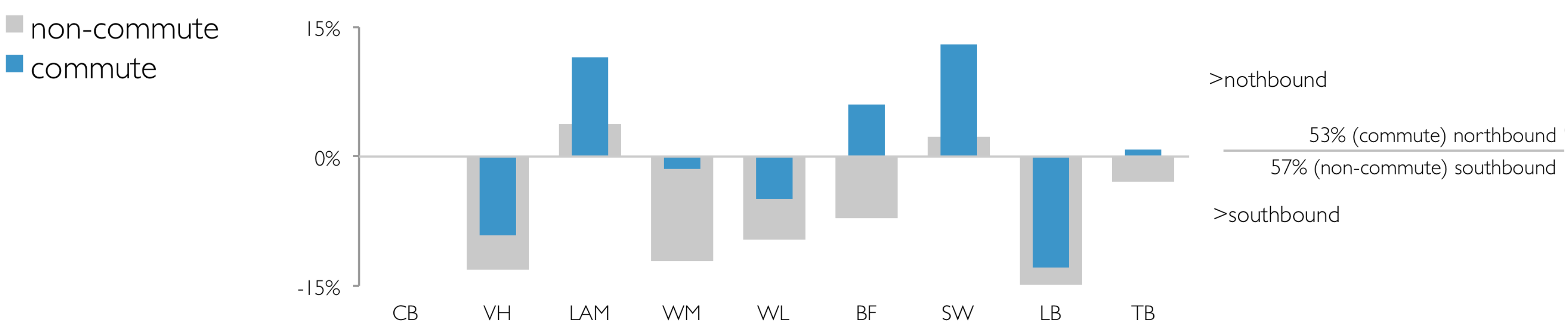

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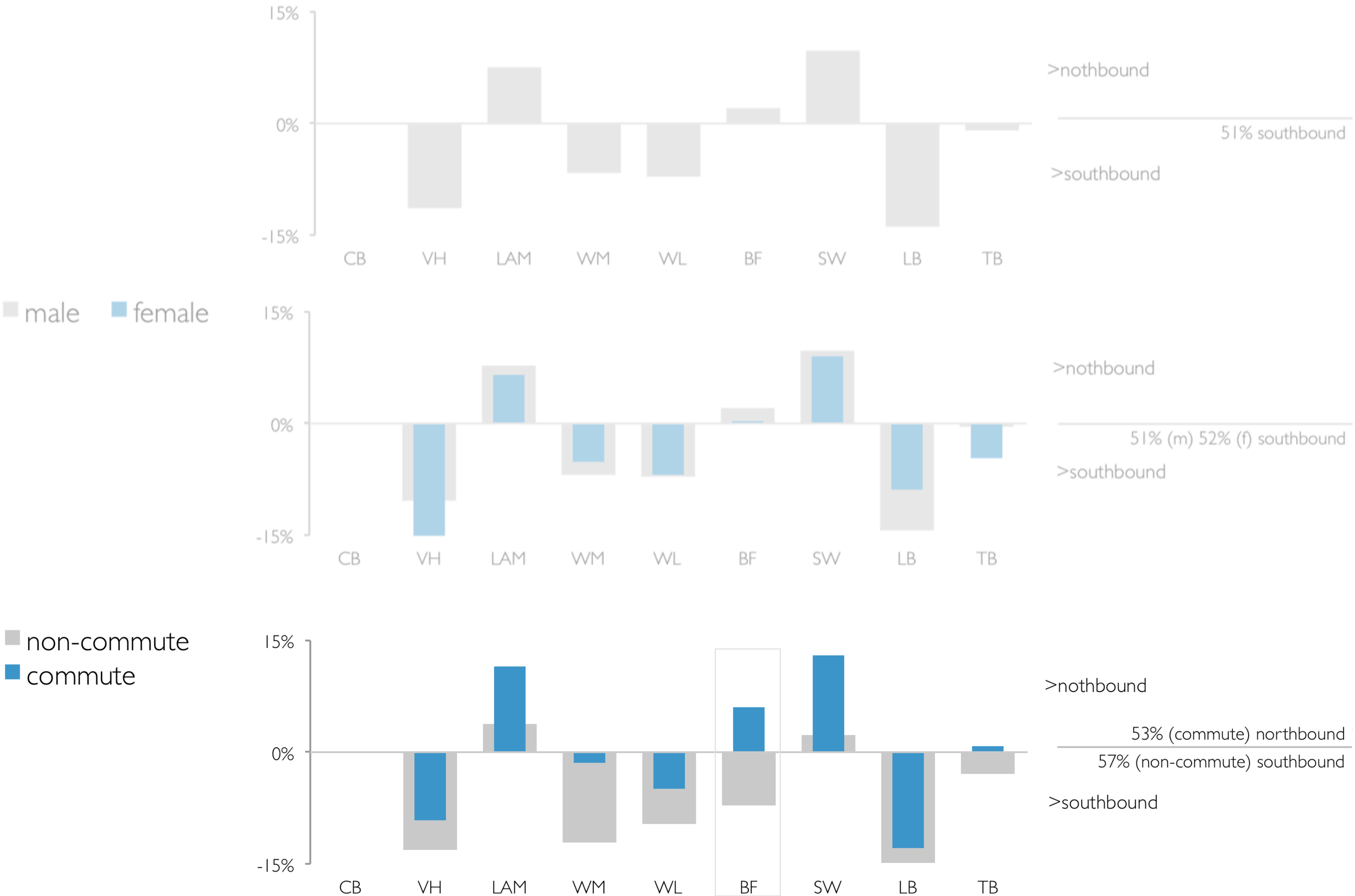

Are (suggested) cycled journeys over certain bridges more demanding than others?

	quietness	effect size (*d.*)	crossings	effect size (*d.*)	crossings / km	effect size (*d.*)	rights	effect size (*d.*)	rights / km	effect size (*d.*)
male	51.4	-0.02	3.6	0.06	1.4	-0.02	5.5	0.06	2.2	-0.02
female	51.6		3.4		1.4		5.4		2.2	
commute	51.7	0.05	3.7	0.19	1.4	0.02	6.0	0.37	2.2	0.03
non-commute	51.1		3.3		1.3		5.0		2.2	
group journeys	52.2	0.08	3.1	-0.20	1.3	-0.13	5.1	-0.17	2.2	0.01
non-goup journeys	51.4		3.5		1.4		5.5		2.2	
bridge	52.2	0.09	4.7	0.69	1.5	0.30	6.4	0.44	2.0	-0.35
non-bridge	51.2		3.3		1.3		5.3		2.3	
High RF	51.4	-0.02	3.6	0.07	1.3	-0.04	5.6	0.28	2.2	0.06
Low RF	51.6		3.4		1.4		4.9		2.2	
weekend usage	51.0	-0.05	3.2	-0.16	1.3	-0.11	5.0	-0.25	2.2	-0.06
non-weekend usage	51.5		3.6		1.4		5.6		2.2	

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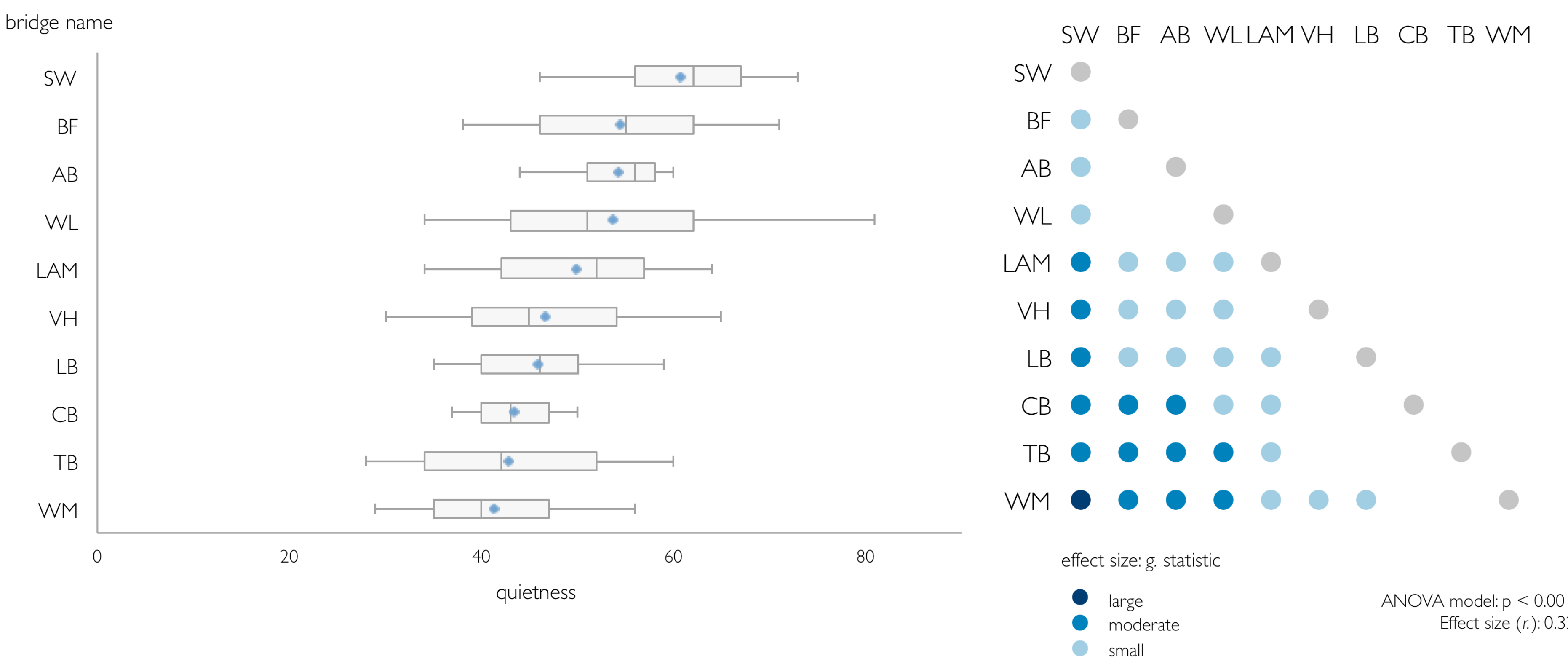
Frequency-weighted quietness



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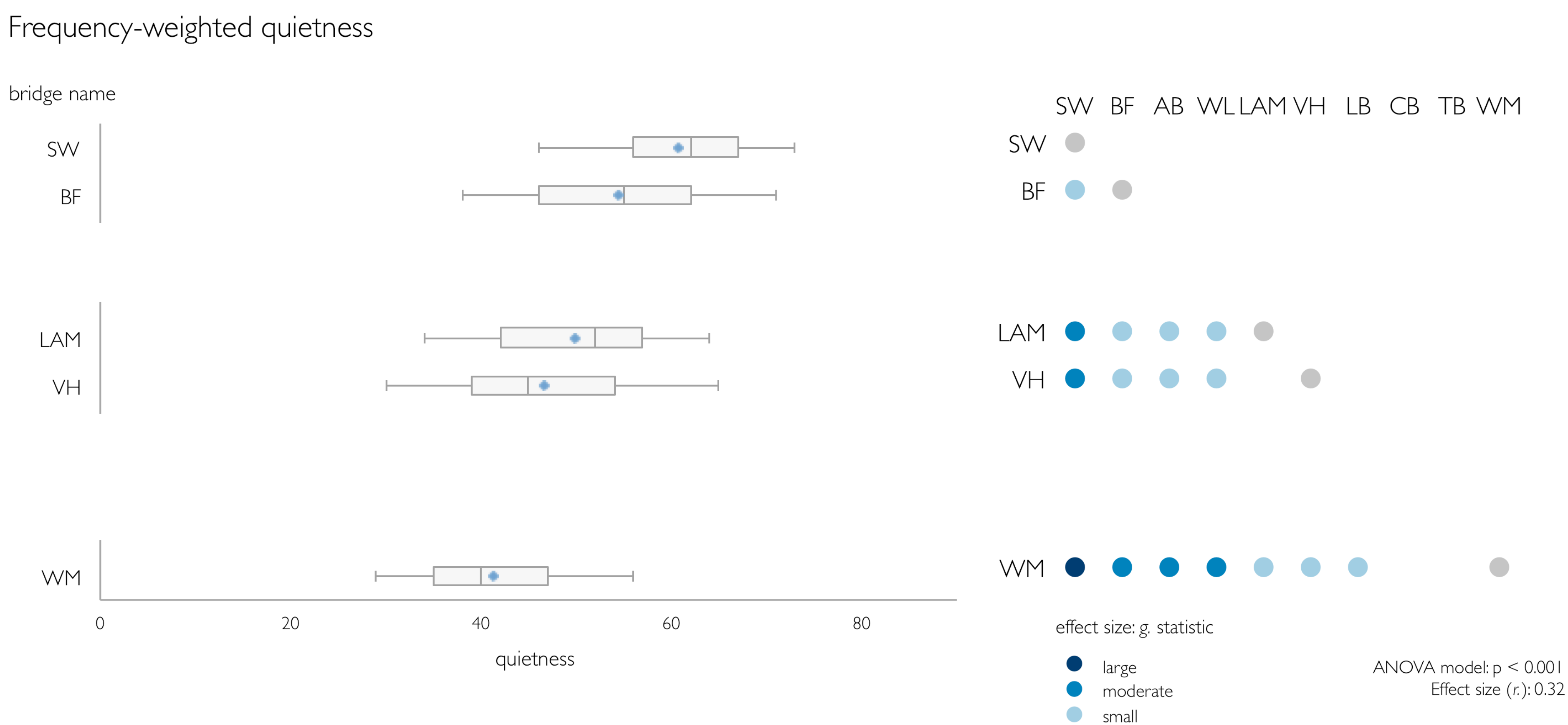

Conclusion

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