A preliminary analysis of the Bicincitta data

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Contents

0.1 Problems in the Bicincitta data set from 2013

There are problems with the Bicincitta data that we need to address before loading the data into a reliable and proper data-base. We will point out these problems using examples, and measure their magnitude using systematic analysis, and then speculate about the cause behind these problems.

0.1.1 Data

We load the data from JSONs provided to us by Bicincitta at the end of April 2015.

The resulting data is in the form of lists of dictionaries.

```
a subnetwork is described by,
        id
        name

 a station is described by,
        latitude
        name
        id
        longitude
        subnetwork_id

 a user is described by
        subnetwork_id
        gender
        expires
        postal_code
        address
        id

 a transaction is described by,
        direction
        user_id
        event_time
        created_at
        updated_at
```

```
station_id
id
```

The resulting dictionaries have ids that are UTF-8 strings. We change these to integers to make our work easier. The addersses in the user data are web-quotes, which we need to *unquote*. We will also unquote the station names, just to be safe. There are keys in a transaction that do not seem to correspond to the data, but refer to the time at which the data was loaded into the JSON provided to us.We will drop these variables, and change the *event_time* to a time object.

0.1.2 Who are the users?

The simplest question may be the fraction of females vs males,

```
Of all the users  60  percent are female  and  39  percent males.
```

It would be interesting if 60% of the users were in fact female. However, as we will see later there seems to be a problem of user duplicacy biased towards females. This bias towards is much worse among the users for whome an address is available. More than ninety percent of the users with an available address in the data are female.

0.1.3 Subnetworks for stations users, and transactions

We have a data table for subnetworks, which contains the subnetwork's id and name. Both users and stations have been assigned a *subnetwork_id* which should be an integer pointing to the *id* variable in the subnetwork table. We would expect all the subnetworks in this table to be conceptually equivalent. Thus the subnetworks *PubliBike* and *Campus* should refer to the same concept of a subnetwork. However a peek at the data hints against this assumption. **It seems that there are two distinct concepts of a subnetwork in the subnetwork table.** There are several lines of evidence leading us to this conclusion.

First of all, only 11 of the 18 subnetworks have a station assigned to them, and 7 have no stations (see table in the appendix).

While none of the stations have been assigned the subnetwork, most of the users are in subnetwork PubliBike,

```
Number of users from subnetwork PubliBike is 58927
```

The subnetworks thus appear to mean two different things:

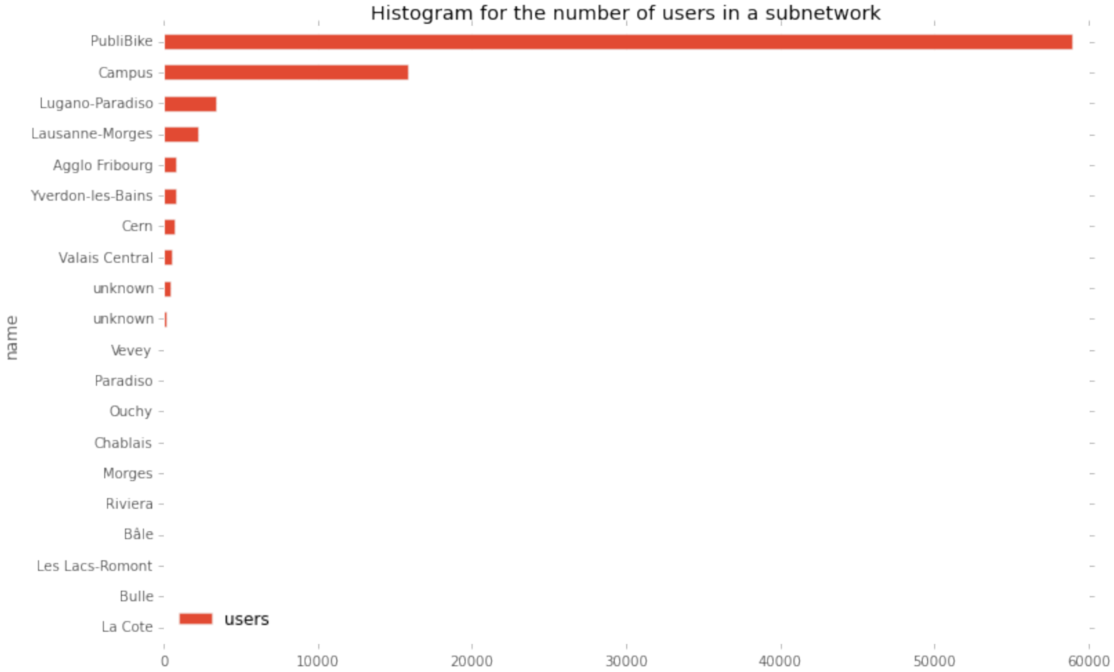
1. a geographic subnetwork that has stations
2. an administrative subnetwork that is assigned to a user when she signs up.

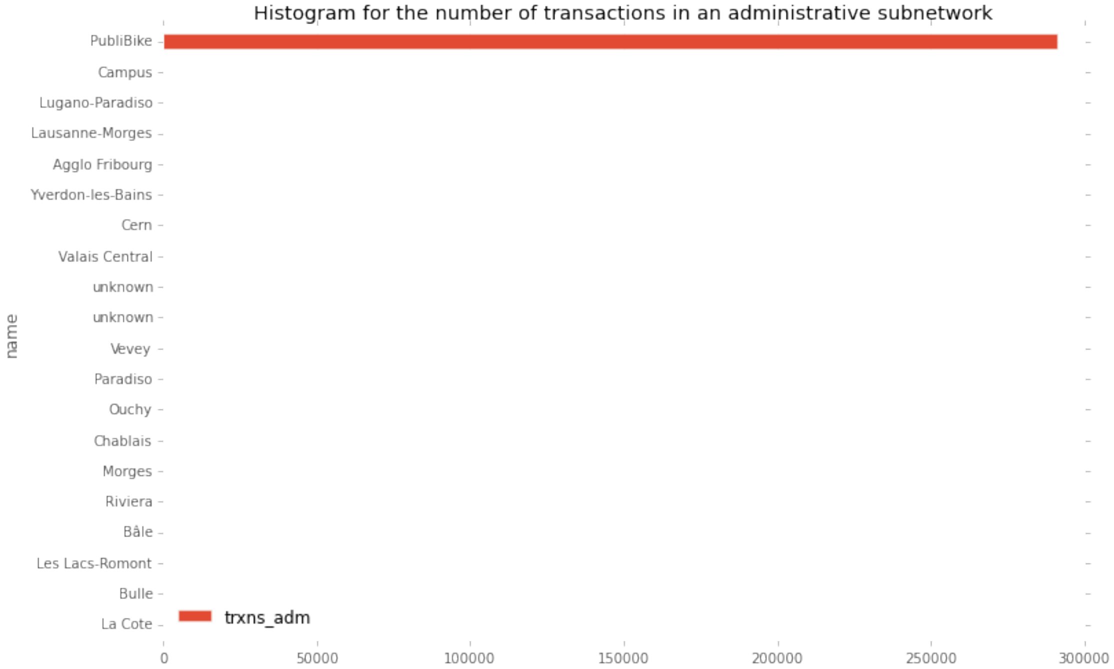
So we assign each transaction an administrative and a geographic subnetwork. The administrative subnetwork is the subnetwork that the user of the transaction has been assigned, and the geographic subnetwork is the subnetwork that the station of the transaction has been assigned. So administratively, all the transactions are in PubliBike, while geographically they are in 11 different subnetworks. In the appendix we present a table for subnetworks, showing the number of transactions that fall in a subnetwork, both administratively and geographically, along with the number of users.

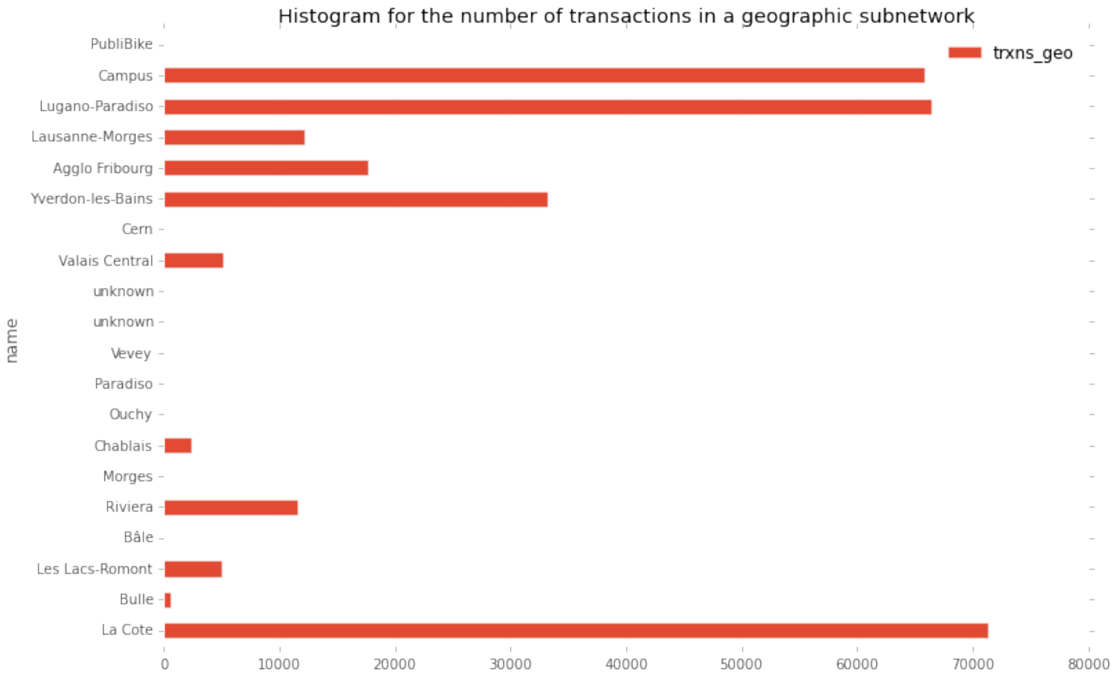
Looking at the actual number of users who have registered a transaction makes us question the validity of the user data base.

```
Fraction of users who have registered a transaction 0.10673152586
```

With only 10% users with registered transactions, where are the remaining 90% users from ? Are they left-overs from previous versions of the system? Or is there an error in the database? Additionally, all the users with the transactions have been assigned the subnetwork *PubliBike*.


Histogram for the number of users in a subnetwork
name
PubliBike
Campus
Lugano-Paradiso
Lausanne-Morges
Agglo Fribourg
Yverdon-les-Bains
Cern
Valais Central
unknown
unknown
Vevey
Paradiso
Ouchy
Chablais
Morges
Riviera
Bâle
Les Lacs-Romont
Bulle
La Cote
users
0
10000
20000
30000
40000
50000
60000


Histogram for the number of transactions in an administrative subnetwork
name
PubliBike
Campus
Lugano-Paradiso
Lausanne-Morges
Agglo Fribourg
Yverdon-les-Bains
Cern
Valais Central
unknown
unknown
Vevey
Paradiso
Ouchy
Chablais
Morges
Riviera
Bâle
Les Lacs-Romont
Bulle
La Cote
trxns_adm
0
50000
100000
150000
200000
250000
300000



0.1.4 User addresses

There are several problems associated with user addresses. We have already noticed, and fixed, that the provided addresses in the JSON have not been *unquoted* from their web encoding. Here we continue to explore other problems that may arise in the addresses.

We want to count the number of users at one address. Because the addresses have been provided as strings, we have to be able to aggregate all address strings that describe the same address. We have written a python function to do this task, which takes the address and postal-code strings to provide a combined string taking into account some empirical disambiguation criteria such as *Av, Ave*, for *Avenue*.

Addresses are not available for all the users.

```
Number of users with available address 21659  of which only  15446  unique
```

What fraction of unique addresses have multiple users?

```
0.230545124951
```

How many users at addresses with multiple users?

```
9774
```

which corresponds to a fraction of all users with available address,

```
0.451267371531
```

Multiple users at the same address could be actual multiple people, or multiple registrations by the same person, or a database error. We can consider as an example the address with the most multiplicity of 53,

```
address:  via lambertenghi 1; 6900 , number of users:  53
```

We could say more about the multiple users at the same address if we look at their transactions. However as it turns out, we **do not have addresses for users who have registered transactions in the data**.

0.2 Appendix

```
Table characterizing subnetworks
                     id  stations  trxns_adm  trxns_geo  users
name
La Cote               1        13          0      71292      0
Bulle                 3         2          0        566      0
Les Lacs-Romont       4         9          0       4964      0
Bâle                  5         0          0          0      0
Riviera              11         5          0      11576      0
Morges               15         0          0          0      0
Chablais              6        10          0       2377      3
Ouchy                16         0          0          0      3
Paradiso             17         0          0          0      3
Vevey                14         0          0          0      4
unknown            2011         0          0          0    152
unknown            2005         0          0          0    469
Valais Central        7         7          0       5077    530
Cern                 18         0          0          0    721
Yverdon-les-Bains     8         9          0      33227    773
Agglo Fribourg        2        10          0      17630    810
Lausanne-Morges       9        11          0      12157   2183
Lugano-Paradiso      12        13          0      66415   3425
Campus               10        15          0      65853  15871
PubliBike            13         0     291134          0  58927
```

```
Table for addresses with multiple users
                                             females  males  users
address
via lambertenghi 1; 6900                          52      1     53
chemin des falaises 3; 1005                       52      0     52
chemin des berges 12; 1022                        41      0     41
avenue des bains 9; 1007                          37      0     37
via monte carmen 4; 6900                          33      0     33
route cantonale 33; 1025                          25      0     25
via madonnetta 23; 6900                           24      0     24
place du tunnel 17; 1005                          23      0     23
avenue des bains 11; 1007                         23      0     23
rue de genève 76; 1004                            22      0     22
route cantonale 35; 1025                          22      0     22
via zurigo 1; 6900                                20      1     21
rue du valentin 27; 1004                          19      0     19
route de chavannes 40; 1007                       19      0     19
chemin de la prairie 60; 1007                     18      0     18
etudiant unil en &atilde;&copy;change; 1015       16      0     16
chemin des triaudes; 1024                         16      0     16
route de chavannes; 1007                          15      0     15
rue de la blancherie 17; 1022                     14      0     14
via zurigo 3; 6900                                13      1     14
route de chavannes 46; 1007                       13      0     13
route cantonale 37; 1025                          13      0     13
cern;                                             10      3     13
route de chavannes 50; 1007                       13      0     13
12 avenue de l'eglise anglaise; 1006              13      0     13
11 avenue des bains; 1007                         12      0     12
```

92 avenue du tir fédéral; 1024	12	0	12
33 route cantonale; 1025	12	0	12
avenue de rhodanie 64b; 1007	12	0	12
chemin de rionza 5; 1020	12	0	12
rue de lausanne 11; 1020	12	0	12
chemin des triaudes 5; 1024	11	0	11
via buffi 13; 6900	11	0	11
avenue de rhodanie 64a; 1007	11	0	11
avenue de l'eglise anglaise 10; 1006	11	0	11
route de chavannes 44; 1007	11	0	11
18 chemin des triaudes; 1024	11	0	11
chemin de la prairie 62; 1007	11	0	11
via beltramina 10a; 6900	11	0	11
via fola 1; 6963	11	0	11
chemin des triaudes 11; 1024	11	0	11
route de chavannes 42; 1007	11	0	11
12 avenue de l'église anglaise; 1006	11	0	11
avenue de rhodanie 64; 1007	10	0	10
9 avenue des bains; 1007	10	0	10
etudiant unil;	10	0	10
rue de geneve 76; 1004	10	0	10
station 18; 1015	10	0	10