

# An Investigation on PFLOW in View of Generic Transform

Mikio Sasaki<sup>1\*</sup>

1. Music Scene Research,

## Abstract

In this paper, we will investigate the generic transform and specific transform of PFLOW (people flow) in order to find the prospective applications regarding CV (connected vehicles) and AV (automated vehicles).

## Keywords:

People flow, generic transform, specific transform.

## Introduction

This paper describes the investigation on PFLOW in view of generic transform.

## Generic Properties of PFLOW

### Transformation of PFLOW

Here, the generalized form of the transformation can be expressed by the next formula:

$$\begin{aligned}\Phi[F_i, P_{spc(j)}] &= F_i^{spc(j)}, P_{spc(j)} = P_{spc(j,t)} + \dots + P_{spc(j,j)} \\ \Phi[F_i, \theta] &= G_i = \Phi_{gnr}[F_i, P_{spc(i)}] = \Phi_{spc}[F_i, -P_{spc(i)}] \\ \Phi_{spc}[G_i, P_{spc(i)}] &= F_i = F_i^{spc(i)}\end{aligned}\quad (1)$$

where,  $P_{spc(i)}$  includes the specific properties of the  $i$ th flow  $F_i$ .  $F_i^{spc(j)}$  means the transformed flow of  $F_i$  using the specific conditions of  $F_j$ .  $G_i$  means the final status of generic transform with no specific conditions which is denoted by  $\theta$ . Composite functions are also definable.

### Mapping of PFLOW

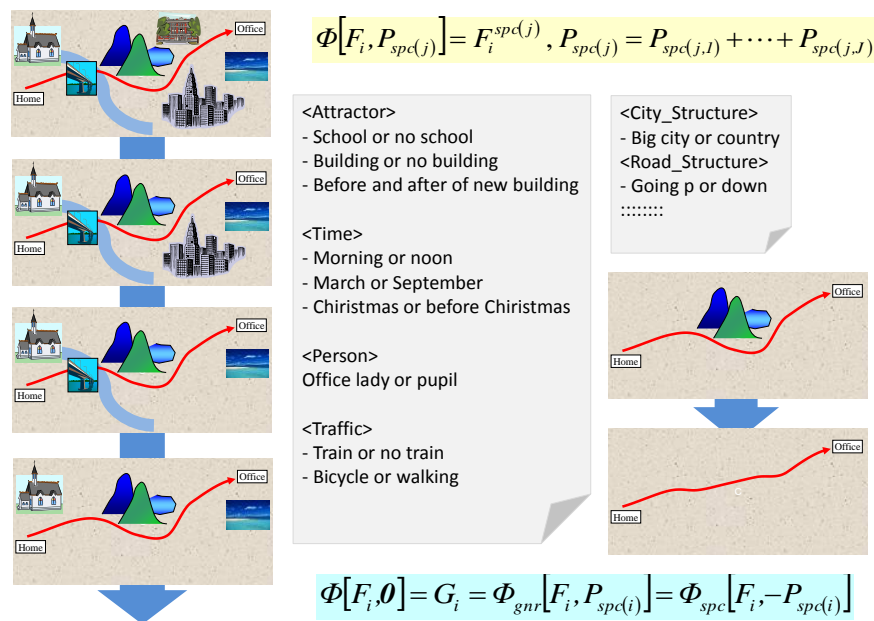
The transformation described above is extended to the notion of the generic mapping:

$$\begin{aligned}M_{FLOW}[F_i, F_j] F_k &\equiv [H_k, X_k, A_k, S_k] \\ H_k &: \text{Human attributes of person } k \\ X_k &: \text{Numerical values of spatio-temporal trajectory} \\ A_k &: \text{List of generators and attractors on } X_k \\ S_k &: \text{Other situation and environmental information}\end{aligned}\quad (2)$$

## An Investigation on PFLOW in View of Generic Properties

By using the above formula, any trajectory information can be mapped to different specification of trajectory. Therefore, transformation, modification, creation, copy, relational networking are expressed in the same form. When considering the mapping from one category  $I\$$  to another category  $J\$$ , each of  $I\$$  and  $J\$$  is an instance of {trajectory, purpose, period, DB, region, traffic means, work, road, resident, attractor, generator, etc.} Note that actually, there exist some inappropriate mappings caused by differences of social structures and lifestyles.

To gather many datasets of PFLOW over different countries and different times and to condense them will reach a minimum number of unique datasets and plural number of parameter sets each of which corresponds to each spatio-temporal condition for each database. After the iterations over the multi-layer mapping operations, if the target properties reach the completely parameterized status for



**Figure 1. Examples of Generic transform.**

the prediction problem, they are “generic”, otherwise, something remain as “specific”.

### Action and Behavior

When describing a person trip using G (generator) and A (attractor), for example, PT (G, A), generally, G and A correspond to Origin (or Start) and Destination (or Goal), respectively. Usually, O (origin) and D (destination) themselves do not refer to the spot category. On the other hand, G and A focus on the features of facilities, and we can utilize the temporary characteristics of them as the auxiliary information. More extended form is as follows:

$$PT = PT(g, a | x, s, h)$$

$x$  : descriptions of spatio-temporal trajectory.

$s$  : descriptions of situations.

$g$  : descriptions of generator.

$a$  : descriptions of attractor.

$h$  : descriptions of human attributes.

(3)

An example in Figure 1 is written as follows:

$$\begin{aligned} \Phi[PT_1, (x_2, s_2)] &= PT_2 \\ PT_i &= PT(\text{home, office} | x_i, s_i, \text{worker}) \quad (i = 1, 6) \end{aligned} \quad (4)$$

**Facilities**

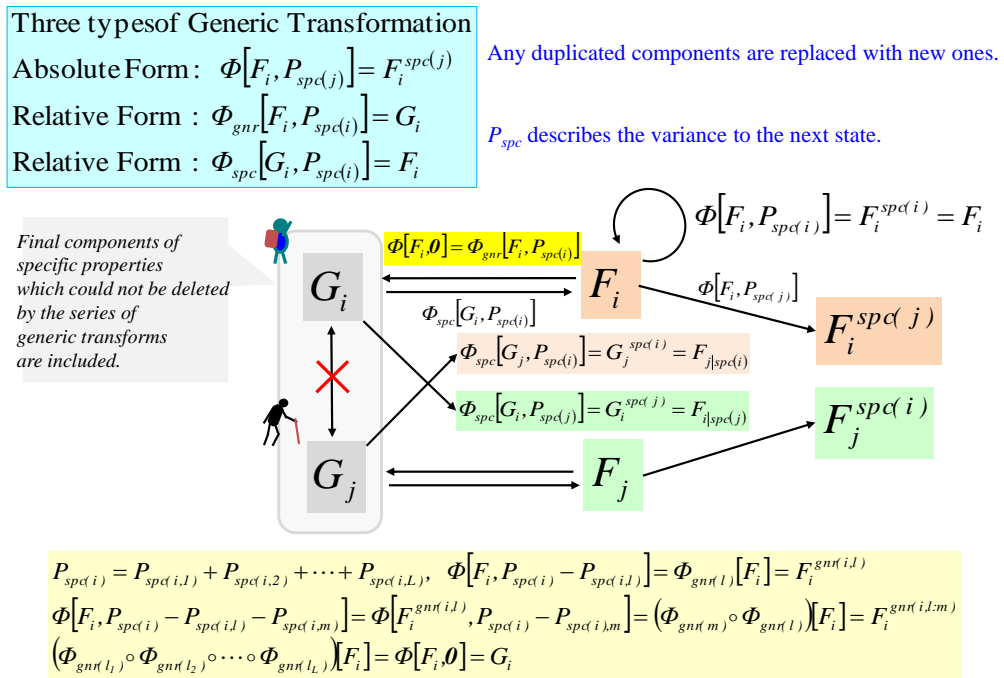
Facilities are to be described in the attractor descriptions  $A_k$  in the formula (2) or  $a$  in formula (3).

Primary relations are schematically summarized in Figure 2.

**Conclusion**

We have summarized the concept of generic transforms. Consequently, the generic transform will enable the prediction even if no sufficient data exist at the target space and time under the condition that human attributes are dominant factors for behaviour modelling.

**References**



**Figure 2. Generic transform.**

1. M. Sasaki, Y. Sekimoto (2014). Towards Risk Prediction Considering People Flow, *ITS World Congress 2014*, Detroit, Sep. 2014.
2. Filippo Simini, et al., "A universal model for mobility and migration patterns", *Nature* 484, 96-100 (05 April 2012).