# Methods for observing pedestrian behaviour : ethologic observation and declared questionnaire

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Pedestrian Issues

- Pedestrian: person traveling on foot, walking or running, as opposed to one that uses a vehicle
- Walking speed: 1 meter /second (around 5km/h) among healthy pedestrians…
- Julien et Carré (2002), in the region of Paris:
  - ≤ 2km daily, outside the collective transport network (≤ 24mn)
  - Traffic exposition: 3mn18s per day (10% of the walking activity). During of a crossing: 7seconds
- 519 pedestrians killed et 11.911 injured in 2011
  - 14,6% of the traffic injured and 13,09% of the crash deaths (increased compared to 2009)
  - Especially the older (killed or seriously injured) and the younger (minor injuries) pedestrians
 - Ignore falls in road space
  - Major issue with increasing age…
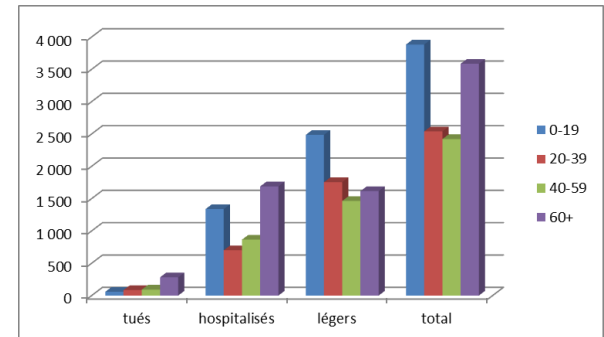
- Transport mode called « soft » (in terms of green house gas) and « active »(in terms of health)
- Increasing pedestrian mobility ➜ safety issue (real and perceived) :
  - Measures concerning public transportation (safety) and urbanism (mobility)
  - Environment: road planning, infrastructure
  - Accidentology
  - Pedestrian behaviours, interactions with other road users and environment
    - By direct observation
    - By self-reported declaration

Direct observation of behaviours

- Based on ethology: describing what an individual actually does (objective reality) in a giving context

- Two types of direct observations
  - Naturalistic observation (non- participating, in a natural situation, in the everyday environment)
  - Experimental context (some behaviours are controlled but other are biased)

- Three conditions need
  - Staying to a descriptive level (without interpretation in the data collection)
  - Determining the behavioural unit (according to the micro- or macro-level of analysis)
  - Elaborating an ethogram (repertoire of the observed behavioural units: action verbs)

- Pedestrian: Van der Molen, H. H. (1983). Pedestrian ethology. Groningen: University of Groningen.
  - Video recording of pedestrian behaviours
  - 200 different subtasks in the pedestrian activity

Pedestrian ethogram developed by IFSTTAR

- Built on existing ethograms[1] and adapted
- Crossing observed in its 3 stages: approach, preparation, crossing
- Observer on the sidewalk facing pedestrians observed
- Voice recording then coding of each behavior
- 13 behavioural categories, 51 behaviours
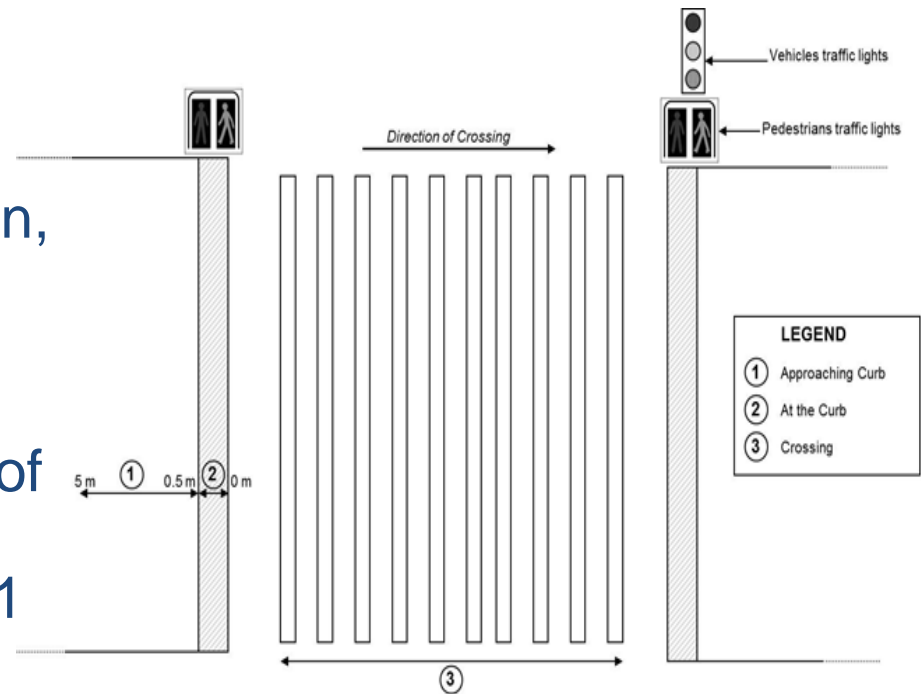
[1] Latrémouille et al., 2004; Routledge et al., 1974; Rivara et al., 1991; Van der Molen, 1983; Zeedyk & Kelly, 2003

Before and while crossing categories

Walking pace approaching the curb (0,5-5m)	Stops	A
	Slows down	B
	Runs	C
	Regular walking pace	D
	False start	E
Crossing site	Crosswalk	A
	Less than 5m of a crosswalk	B
	Less than 5m of a crosswalk between parked vehicles	C
	More than 5m of a crosswalk	D
	More than 5m of a crosswalk between parked vehicles	E
Total number of pedestrian crossing	Pedestrian alone	A
	2 pedestrians	B
	3 to 5 pedestrians	C
	More than 6 pedestrians	D
Walking pace on the curb (0-0,5m)	Stops	A
	Slows down	B
	Runs	C
	Regular walking pace	D
Head movement before crossing	Toward the traffic light	A
	Toward the moving vehicles	B
	Toward the other pedestrians	C
	Toward the ground	D

Starting position	Curb	A
	Pavement	B
Starts crossing in the crosswalk	Yes	A
	No	B
State of the traffic light when the crossing starts	Green light	A
	Orange light	B
	Red light	C
	Green pedestrian	D
	Red pedestrian	E
Walking pace during crossin	Stops	A
	Slows down	B
	Runs	C
	Regular walking pace	D
Head movement while crossing	Toward the traffic light	A
	Toward the moving vehicles	B
	Toward the other pedestrians	C
	Toward the ground	D
In case of interaction with driver during crossing	Visual contact	A
	Friendly actions / words Amicaux	B1
	Hostile actions / words	B2
	Neutral action / words	B3
	Gives right of way to the driver	C
	Other	D
End of the crossing in the crosswalk	Yes	A
	No	B
Crossing orientation	Straight	A
	Diagonal	B
	Between parked vehicles	C
	Other (specify)	D

- Adaptable to age (adding categories): poussette, tenue main, aide à la marche, etc.
- Possibility to study pedestrian interactions (Supplementary grids): accompanying behaviors, verbal interactions, etc.

Study results 1

- 162 children aged 5-6 (83 boys, 79 girls): follow-up of school-home accompanied travels
  - analyse of the safe behaviour frequency according to child sex

- Girls are more compliant and dependent of the accompanying adult
- Boys explore environment more

Granié, M. A., (2007). Gender differences in preschool children's declared and behavioral compliance with pedestrian rules. *Transportation Research Part F: Traffic Psychology and Behaviour*, 10, (5), 371-382.

Behaviour	Total	Boys	Girls
Moving			
Walk (not run) on the sidewalk	75	60	91
Regular walking pace	33	24	43
Safe position on the sidewalk	49	51	47
Look ahead	54	65	43
Crossing			
Cross on crosswalk	56	58	54
Perpendicular crossing	65	53	77
Stop on the sidewalk before crossing	15	12	18
Look both sides	32	43	20
Wlak (not run) while crossing	68	57	81
Hold adult's hand	52	34	70
Take adult's hand	34	24	46
Proximity of the adult	49	47	51

Study results 2

- 400 adult pedestrian (50% W): behaviours on intersection with and without traffic lights

  - Analyse of spatial (where) and temporal (when) compliance and looking target according to sex

- Temporal compliance more frequent among W
- Spatial compliance did not differ between W and M
- Spatial compliance varied with type of intersection
- Type of intersection influences M more than W

Tom, A., & Granié, M. A. (2011). Gender Differences in Pedestrian Rule Compliance and Visual Search at Signalized and Unsignalized Crossroads. *Accident Analysis & Prevention, 43*(5), 1794-1801
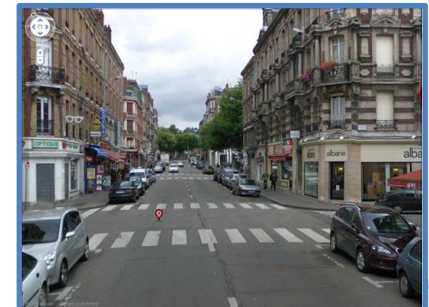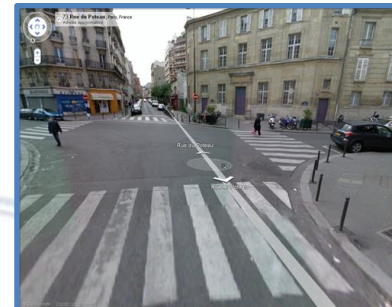
Study results 3

- 575 pedestrians observed on regulated crossing (5 sites): 335 young adults (17-59 years) et 347 older adults (60-91 years)
  - Prediction of the occurrence of behaviors depending on 4 variables: age, sex, other pedestrians, parked vehicles (logistic regressions)

- Careful behaviours are reinforce
  - ✓ With increasing age reinforce careful behaviours
  - ✓ With presence of parked vehicle reinforce careful behaviours
  - ✓ When crossing with other pedestrians

	fréqu.	AGE		SEXE		GROUPE		STATIONNEMENT	
		jeunes	âgés	F	H	seul	groupe	aucun	présence
No stops before crossing	24%	67%	33%	49%	51%	63%	37%	60%	40%
Look at the ground approaching the curb	14%	30%	70%	51%	49%	45%	55%	86%	14%
Look at the traffic approaching the curb	66%	54%	46%	52%	48%	57%	43%	61%	39%
Wait on the pavement before crossing	10%	67%	33%	65%	35%	60%	40%	67%	33%
Crossing against the traffic light	22%	61%	39%	49%	51%	71%	29%	44%	56%
Run while crossing	09%	73%	27%	52%	48%	63%	37%	69%	31%
Look at the ground while crossing	44%)	43%	57%	56%	44 %	54%	46%	70%	30%
Look at the traffic while crossing	47%	54%	46%	49%	51%	61%	39%	45%	55%
Jaywalking	19%	56%	44%	55%	45%	46%	54%	57%	43%

Dommes, A., Granié, M. A., Cloutier, M. S., Coquelet, C., & Huguenin-Richard, F. (2015). Red light violations by adult pedestrians and other safety-related behaviors at signalized crosswalks. *Accident Analysis & Prevention, 80*, 67-75.

Conclusions

- Observation is useful when the aim is to:
    - Describe contextual behaviours within different pedestrian categories
    - Understand effects of the physical environment (ex: effect of a new road planning)
- But does not permit to:
    - Describe general behaviours (style) within different contexts
    - Understand effects of intraindividual or social factors

    ➢ Declared behaviours

Self-reported behaviours

- = Questionnaire

- Crossing <u>and</u> travel behaviours

- Injury-risk behaviours: difficult to measure by localized and limited observations

- Studies on psychological, social and demographical factors of general attitudes towards risk

  - Antisocial behaviours, psychoactive consumption, risk in sport, etc.

Declared pedestrian behaviour scales

- Few validated tools
- Based on the aberrant behaviour framework (Reason, et al., 1990): violations, errors, lapses
- Adolescents: ARUB (Elliott & Baughan, 2004):
  - 21 items, 3 dimensions: unsafe crossing behaviours, dangerous play, planned protective behaviour
  - No « violation » dimension
- Adults: scale built by Moyano-Diaz (1997, 2002)
  - 16 items, 3 dimensions: violations, errors, lapses
  - Validated in Chile, Brazil et Turkia only

EPCUR (road user behaviour perception scale)

- 15 pedestrian behaviours, 2 dimensions
  - Self-endangerment (lapses)
  - Voluntary risk-taking (violation and carelessness)
- 5 Likert scales in 5 points
  - Declared behaviours (never → very often)
  - Danger perception (not at all dangerous → very dangerous)
  - Risk perception (not at all risky for me→ very risky for me)
  - Normative beliefs (not at all wrong → very wrong)
  - Rule internalisation (if I had the right I will absolutely do it → I will not do it at all)
- Validated among adults and adolescents (+ adaptation to measure cyclist behaviour among children)
- No "error" dimension

Granié, M.-A. (2008). Influence de l'adhésion aux stéréotypes de sexe sur la perception des comportements piétons chez l'adulte. *Recherche - Transports - Sécurité, 101, 253-264*. doi: http://dx.doi.org/10.3166/rts.101.253-263

Granié, M.-A. (2009). Effects of gender, sex-stereotype conformity, age and internalization on risk-taking among adolescent pedestrians. *Safety Science, 47(9), 1277-1283*. doi: http://dx.doi.org/10.1016/j.ssci.2009.03.010

1- Cross forgetting to look properly because you are talking with someone
2- Do not cross straight to get closer to where you want to go
3- Cross while running without looking because you are late
4- Cross forgetting to look properly because you think to something else
5- Join someone on the other sidewalk, crossing the pedestrian red light in a car-free street
6- Cross while vehicles obstruct visibility
7- Cross outside the crosswalks to save time
8- Cross even if there are vehicles, thinking they will stop for you
9. Walking on the pavement to be next to your friends who are on the sidewalk or overtake someone walking slower than you
10- Crossing between parked vehicles, while there was near a safer place to cross
11- Cross the pedestrian red light because you think you have the time to do it
12- Start to cross while walking, and then have to run on the remaining of the road to avoid vehicles arriving
13- Cross at the pedestrian crossing when the pedestrian light is red
14- Crossing, on a pedestrian crossing, when you see a small gap between moving vehicles
15. Follow people crossing at pedestrian red light

ECP-PBS

Pedestrian Behaviour Scale

- Validated among adults
- 20 declared pedestrian behaviours
  4 dimensions
  - Transgressions (offenses and errors)
  - Lapses
  - Aggressive behaviours
  - Positive behaviours
- Likert scale in 6 pts (never → very often)

Granié, M.-A., Pannetier, M., & Guého, L. (2013). Developing a self-reporting method to measure pedestrian behaviors at all ages. *Accident Analysis & Prevention*, 50, 830-839.

Offense

I cross diagonally to save time
I cross outside the pedestrian crossing even if there is one less than 50 meters away
I cross the street even though the pedestrian light is red
I cross even though the light is still green for vehicles

Error

I cross the street between parked cars
I start to cross on a pedestrian crossing and I finish crossing diagonally to save time
I cross between vehicles stopped on the roadway in traffic jams
I walk on the roadway to be next to my friends on the sidewalk or to overtake someone who is walking slower than I am

Lapse

I forget to look before crossing because I am thinking about something else
I forget to look before crossing because I want to join someone on the sidewalk on the other side
I cross without looking because I am talking with someone
I realize that I have crossed several streets and intersections without paying attention to traffic

Aggressive

I get angry with another user and insult him
I get angry with another user (pedestrian, driver, cyclist, etc.) and I yell at him
I get angry with another user (pedestrian, driver, cyclist, etc.) and I make a hand gesture
I get angry with a driver and hit his vehicle

Positive

I let a car go by, even if I have the right-of-way, if there is no other vehicle behind it
When I am accompanied by other pedestrians, I walk in single file on narrow sidewalks so as not to bother the pedestrians I meet
I stop to let the pedestrians I meet by
I walk on the right-hand side of the sidewalk so as not to bother the pedestrians I meet

Filter

I walk for the pleasure of it
I take public transportation (buses, metro, tramway, etc.)
I walk because I have no other choice

Study results 1

- 258 adults
- Influence of gender identity on normative beliefs

Sex	Gender identity	Rejection of self-endangerment	Rejection of voluntary risk-taking
M	Masculine	24,00 (3,00)	33,00 (14,00)
	Feminine	25,00 (1,25)	38,00 (14,50)
W	Masculine	23,50 (3,00)	31,00 (10,50)
	Feminine	23,00 (4,00)	35,00 (14,00)
Total	Masculine	24,00 (3,00)	31,00 (13,00)
	Feminine	24,00 (3,00)	35,00 (14,50)

I act as leader
When someone feels sad, I try to make it get better
I am able to order other people
Usually I can tell if someone needs help
When it is necessary make a decision, it's easy for me to take a stand
I am concerned about what happens to others
I feel confidence in myself
When I like someone, I shown him/her
I like others to do what I tell them to do
For me it is important to be kind to others
I make a strong impression to most people I meet
I can well understand the problems of others
When I play a game, it's to win
I kindly show people I care of them
It's easy for me to tell others what I think, even if I know they will not agree with me
I feel sad when someone feels sad
I am energetic

Sex difference: men disapprove self-endangerment and lack of control

Gender effect: female individuals condemn voluntary risk taking and offenses

Granié, M.-A. (2008). Influence de l'adhésion aux stéréotypes de sexe sur la perception des comportements piétons chez l'adulte. *Recherche - Transports - Sécurité*(101), 253-264.

Study results 2

- 278 adolescents (11 and 15 years)
- Influence if the gender identity on injury risk behaviours and rule internalisation

Femininity reinforces internalisation
Masculinity reinforces whereas internalisation inhibits injury risk behaviours

I am always ready to listen to others	
I am sweet	
I have a competitive spirit	
I am sensitive to the pains and problems of others	
I have leadership qualities	
I am affectionate	
I am sure of myself	
I like to serve	
I am energetic	
I am attentive to the needs of others	
I am dominating	
I am warm	
I love children	
I am athletic	
I'm ready to console people	
I act as a leader	
I am tender	
I feel confidence in myself	

	Masculinity	Femininity	Age	Sex	Danger perception	Internalisation
Internalisation	-.07	.17**	-.009	.06	.50***	
Risk taking	.12**	-.10	.17***	-.08	-.19**	-.33***

Granié, M.-A. (2009). Sex differences, effects of sex-stereotype conformity, age and internalization on risk-taking among pedestrian adolescents. *Safety Science, 47*, 1277-1283.

Study results 3

- 289 Turkish (15-78 years)
- Roles of cultural variables on pedestrian risky behaviours (individualism / collectivism, horizontal / vertical)
- Using PBS dimensions: transgression, lapses and aggressive behaviours

The 3 dimensions of the PBS are confirmed: PBS validated in Turkish
The collectivism influences pedestrian risky behaviours:
Vertical collectivism (Compliance with authority and hierarchy inhibits risk-taking
whereas non-hierarchical collectivism reinforces pedestrian risk-taking

'I would sacrifice an activity that I enjoy very much if my family did not approve of it'

'The well-being of my coworkers is important to me'

'I often do my own thing'

'It annoys me when other people perform better than I do'

Nordfjærn, T., & Şimşekoğlu, Ö. (2013). The role of cultural factors and attitudes for pedestrian behaviour in an urban Turkish sample. *Transportation Research Part F: Traffic Psychology and Behaviour, 21, 181-193.*

Conclusions

- Strong relationship between self-reported measures and objective measures of behaviours (West et al., 1993)

- Self-reported tools to measure different behaviour dimensions
  - Allows a more detailed understanding of the behavior of pedestrians and psychological factors and mobility related

- Validated from school childhood to older ages
  - Allows a lifespan transversal approach of the determinants of injury risk behaviours