

THE STANCE LOGISTICS: An Attempt to Adapt Logistics Principles on Human and Inter-human Movement Behaviors

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The broad span of Logistics Management encompasses control of time, place, movement, energy (efforts, labor), as well as the positioning, stance and movement of products, materials, commodities, and people. This study coins the term Stance Logistics to focus on the stance and movement of people within the range of Logistics principles. The philosophy behind this is to enhance the required sensitivity with respect to management and control of time, place, movement, motion, stance and energy in material and nonmaterial exchanges and in all types of human encounters. Stance Logistics includes not only the “on foot” (pedestrian) or “in-vehicle” (automated) movements and public behaviour in stopping, standing, and positioning, but also individual predisposition of physical and mental response, and awareness (aesthesia). This essay describes the application of the scientific principles of Logistics to the personal experiences of people. Current Logistics literature includes mostly models developed on pedestrian and evacuation movement behaviour [1]. To the author’s knowledge, however, there is nothing documented on the issue of personal individual Logistics Stance. Behaviours, especially that of blocking other people’s ways and passages, intervening, rudeness and queue-jumping in various environmental settings have not been extensively studied, if at all, whether during walking, pausing, stopping, face-to-face encounters, standing or waiting in lines and lanes or waiting for an elevator or metro train door to open.

This study seeks underlying clues to increase sensitivity and awareness of people’s movement particularly in public areas by shedding light on Logistics behaviours of people. When combined with applicable models of pedestrian movements and integrated with the general principles of Logistics, Stance Logistics can serve as an important guide to facilitate the daily activities of many people. It is believed that, this exploratory study will pave the way for further research to produce promising results on the aspects of this new concept of Stance Logistics.

Keywords: Logistics, Stance Logistics, Logistics Sensitivity, Pedestrian movement, Pedestrian Logistics, Social allergens, personal space.

1. ADAPTATION OF GENERAL LOGISTICS PRINCIPLES INTO THE STANCE AND MOVEMENT OF PEDESTRIANS

From a managerial point of view, Logistics is the process of planning, implementing, and controlling the effective and efficient flow of goods and services from the point of origin to the point of consumption. The broad span of Logistics Management encompasses control of time, place, flows, movement, energy (efforts, labour), as well as the positioning, stance and movement of products, materials, commodities, and people [2]. The activities involved in the flow of products from the point of origin to the point of

consumption are customer services, demand forecasting, inventory management, logistics communications, materials handling, order processing, packaging, part and service support, plant, warehouse and store site selection, procurement, reverse logistics, traffic, routing and transportation, warehouse and storage. An important part of achieving transportation efficiency is shipment routing. Routing and scheduling is an important component of Transportation Management Systems [3]. A Turkish quote says “one’s feet pay the penalty for mindless behaviour “ that is to mean if you don’t make good plans you might unwarrantedly have to repeat your movements which causes loss of time, energy and maybe money. Logistics

includes" wayfinding" as well. Wayfinding is the procedure that is used for the orientation and navigating, in order an individual to navigate from one place to another, especially in very huge and complex environments indoors or outdoors [4]. Kikira et. al., tried to build a User Navigation Ontology (UNO) that can be used in a navigation system for personalized path selection [5].

Downs and Stea suggested that wayfinding involves the following four steps [6]; 1. Orientation: Finding out where someone is with respect to nearby landmarks and the navigation destination. 2. Route Selection: Selecting a route, under certain criteria, that will eventually lead the individual to the desired destination 3. Routing Control: Constant control and confirmation that the individual follows the selected route 4. Recognition of destination: The ability of an individual to realize that she has reached the destination or is located in a nearby area. In general, the wayfinding ability of individuals is greatly influenced by a number of factors, based on findings from research in human neurophysiology. The most important of these are [7]; 1. Individual Characteristics 2. Characteristics of the environment 3. Learning Processes Furthermore, the wayfinding ability of individuals is mainly affected by the following four factors: spatial ability, fundamental information processing capabilities, prior knowledge of the environment and motor capabilities.

In a sense, Logistics is the science of purposeful and logical movement, stopping (at Logistics nodes) and placement (materials handling, facility sites etc.). It is a philosophy and an instrument that will create or lead to sensitivity or responsiveness towards other people in the management of time, place, energy, motion, movement and stance. The same philosophy applies to Pedestrian Logistics and the broader concept of Stance Logistics in material, nonmaterial exchanges and all types of human encounters with other human beings and objects. Stance Logistics involves not only principles and techniques on flows, movements and stops but also the philosophy of proper conduct in movements. The Oxford English Dictionary defines logistics as "the branch of military science relating to procuring, maintaining and transporting material, personnel and facilities. Logistics which stemmed from military to mean art and science of preparation and deployment for war, particularly as it moved from a base to a forward

position, also involves strategies and tactics to avoid wars, fights, clashes, conflicts, skirmishes and also withdrawals. In the case of Stance Logistics the issue might be drawing upon principles of Logistics, for instance, to avoid collisions. Logistics inherently includes preparation and organization to accomplish the task of delivery to a destination point. It does require, purposefulness, attentiveness, consciousness and awareness and observation of rules of ethics.

One aspect of general Logistics is Pedestrian Logistics. Personal Pedestrian Logistics also needs self organization and preparedness for pedestrians' movements not only in motion while walking, running etc., but also during pausing or stopping. The word pedestrian usually connotes walking. A definition of pedestrian (on-foot) Logistics within defined spaces is made under the concept of Pedestrian Management. Accordingly, Pedestrian Logistics is defined as about the process of planning, simulating, implementing, and controlling the efficient, safe and cost-effective flow of pedestrians and passengers from A to B for the purpose of efficient and secure facilities and operations [8]. There are serious drawbacks and consequences of random or unconscious movements and stance of pedestrians. Characteristics of pedestrian movement may create inconveniences, disturbances, frictions, disputes and waste of time and space. The thoughtless and/or uncivilized, rude pedestrian movements and stance in both crowded and uncrowded environments may have a positive or negative effect on the behaviours of others as well as the individual. The larger concept of Stance Logistics which includes pedestrian or "in-vehicle" human movements and behaviour in stopping, standing, and positioning in public places is also about individual predisposition of mental response and awareness. For instance, a queue-jumping allegation that patients were being funnelled to the front of the queue in Helios Wellness Centre Alberta, Canada was taken to court [9]. This is conceptually and ethically, (maybe legally) the worst demonstration of the possible consequence of queue-jumping in service Logistics. It is striking example of how far mindless Logistics Stance mentality can go even in the area of health. Koh and Suiping Zhou states that [10].; "It is such a common sight to see pedestrians strolling along a street or squeezing through a crowded area that it is sometimes easy to forget about the complexity involved in synthesizing realistic pedestrian

behaviours.; In real-life, pedestrians may influence how other pedestrians will react with their own walking behaviours. They need to adopt a variety of manoeuvres or navigational behaviours such as following, overtaking and evading (avoidance) or separation to be able to reach their destinations.

Stance Logistics largely draws upon pedestrian Logistics but it encompasses more than that. This essay describes the application of the scientific principles of Logistics to the personal experiences of people. This study is intended to review aspects of different human movements, *including pedestrian walking behaviours*, in different settings. It also intends to complete the Stance Logistics approach by introducing marketing (competition) standpoint to account for pedestrians' "on-the-move" behaviours.

The concept of Stance Logistics covers the following; side stepping, lane and line forming, overtaking, walking abreast, lane formation, target following, steering, pathfinding, wayfinding, proactive and reactive behaviours, collision avoidance, not choosing avoidance of collision, gridlock, personal space, invisible personal space, evading path crossing, walking movements, stopping, pausing, blocking, positional data on other pedestrians, pushing, queuing, self-organizing, ad-hoc lanes, lingering, lane cutting, separation behaviour, strolling along, squeezing through crowded areas, stepping back etc. This type of study may further cover, rule bending, queue jumping, jaywalking [11] and incongruous, hastily impulsive, impetuous, reckless, inordinate way-cutting behaviours during walking, steering, navigating, pausing, stopping at an impasse, and waiting, presumably incognizant face-to-face encounters and even head-on collisions in various environmental settings.

One example that ties general principles of Logistics to the Stance Logistics is in the Retail Logistics field. Control of the movement and flow of customer, personnel and goods in retail stores is very important for the success of retailing strategies. Well planned and coordinated movements in the stores provide time saving for customers and personnel. There are two objectives of store layout [12]; (1) to bring customers and merchandise together so that the greatest gross margin per square foot of floor space is produced in a given time (2) to arrange the performance of the operations in the space so that expenses are

within an optimum amount. In other words, store activities (Customer, personnel and merchandise movement) must be arranged to minimize the frictions and optimize the cost. In order to obtain maximum sales and gross profit from one square foot of store sales area, goods, personnel and customer movements must not interfere or collide with each other. The selling and non-selling operations should be co-ordinated so that friction in the flow of customers and merchandise through the store is minimal. For instance, when the merchandise is arranged with regard to frequency of purchase, customer traffic flows with a minimum of obstruction [13]. Buying process and supply chain flows in retailing, also get affected negatively or positively by **Consumer Logistics** which encompasses each stage from the moment consumer enter, start shopping, to purchasing, to taking the goods home and finally consuming the goods [14]. The traffic patterns in the store have an important impact on sales [15]. Regarding collision and congestion avoidance from the point of view of Stance Logistics, the *Butt-Brush Effect*, coined by Paco Underhill, is also an important phenomenon [16]. Narrow corridors or aisles prevent women entering easily and that are therefore skipped surely means sales loss in the shelves there.

2. A BRIEF HISTORY OF INTEREST IN UNDERSTANDING AND MODELLING PEDESTRIAN BEHAVIOR

Since the nineties of the last century there has been a fast growing interest in understanding and modelling pedestrian behaviour. As reported by Dirk Helbing and Johansenn Anders, pedestrians have been empirically studied for more than four decades. For a long time, the main goal of these studies were to develop a level-of-service concept, design elements of pedestrian facilities, or planning guidelines [17]. In all kinds of environments the importance of analyzing and quantifying pedestrian flows is acknowledged. These range from urban design in public areas to effective product placement in a retail store to evacuation dynamics. Major reasons for this increased attention is that the quality of pedestrian flow and particularly safety in pedestrian environments, are more important than ever before [18]. According to the author, Ömer Baybars Tek, there is also the important issue of civility and socio-psychological health aspects of the people's movements or stance.

3. THE ESSENCE OF PROBLEMS THAT GIVE RISE TO THE CONCEPT OF STANCE LOGISTICS WITH REAL LIFE EXAMPLES

Pedestrian movement or motion behaviour comprises the root of Stance Logistics. Yet, pedestrian traffic behaviour has many dimensions so that understanding these kind of behaviours is a conundrum [19]. There are guides that provides information for persons conducting a business or undertaking who have management or control of a warehouse on how to manage risks of traffic movements at the workplace. Managing traffic is essential to providing a safe workplace [20]. Just as there are rules and etiquette of the road and driving, there are also rules and etiquette of walking, stopping, pausing and waiting, some apparent and some not so obvious. For instance, "standing in line, the seemingly mundane task of forming a queue at the airport, a fast-food joint or a post-thanksgiving midnight sale etc., can cause extreme boredom, annoyance and even rage, which is precisely why there is a fascinating science devoted to what makes people tick – and ticked off – when forced to wait" [21]. Real or imaginary obstructions, that are encountered anywhere, combined with impatience, can also cause the same feelings. In many cultures, especially in places where daily life is more inconsistent and challenging, or lived at a slower pace, these feelings can become what many would consider to be even repulsive behaviours. Often times repulsive behaviour can turn into violence. For instance, in crowded markets where produce must be individually weighed on a counter scale some rudely aggressive or opportunistic, customers commit the abuse of queue-jumping which might cause agitations and even fights which disturbs the peace of shopping environment. This can even lead to murder. [22]. In this regard following example is very striking: "The guardian newspaper reported that an argument between two shoppers in a supermarket queue at the Sainsbury's in Merton, south London ended with a bystander being killed... a women was jumping the queue and trying to get served out of turn" [23]. This example may prove that the associations between aggressiveness, Logistics Sensitivity and culture in all level of societies is not strong. This is best explained by Ege Cansen as follows [24];

"...In the case of vehicle traffic, violation of rules provide the drivers short term and individual

personal interest or utility. Such drivers are the thieves of public interest. Violation of rules stems from the possible gains or profits. It's inherent that human beings try to reach their goals with minimum energy. Pedestrians prefer to cross diagonally instead of passing through the pedestrian passages. Since each individual behaves economically would this lead to total societal economical behaviour? If an individual is harming others when following his own interest this will be a negative contribution to the national income. Even if individuals do not harm anybody when going after their own interests they still act uneconomically for the whole society or public. The term "Public" covers both the rights and interests of individuals and the government states' rights and interests. Therefore its important to watch the public interest.." [25].

Events and stance behaviours which disrupt the flow and may cause traffic and the civilized orders to degenerate into a disorganized mess include [26]:

- Exaggeration of ownership of personal space and proclaiming invisible personal space as their own turf.
- Not paying attention to personal physical and emotional spaces of others.
- When walking two or three abreast (mall walkers) [27], not assuming a single file during a passing manoeuvre.
- Not paying others any mind, maybe unknowingly, not considering deference and/or courtesy when approaching each other on streets or sidewalks.
- Pedestrians' carelessly, recklessly strolls with trolleys in supermarket selling aisles all over the World [28].
- In using public transport, trying to board before letting other passengers disembark.
- Passing each other rubbing shoulders when there is ample space to move around.
- Elbowing each other over arm rests on board of an airplane or bus.
- Splaying legs to grab as much real estate as possible.
- Walking towards another person without caution and without considering possible collision or hitting.
- Not complying with expected right of way (priority) issues.
- Not keeping to the right-hand side of the road.

- Not staying on the right when using metro station escalators and stairways etc.
- Crowding in front of escalators and train, bus or car doors and blocking them and not letting people exit. Not giving way in general to anyone whose way one is blocking.
- Two or more people blocking others on pavements, gateways walkways and passageways by standing and/or walking
- Not taking the right lane when walking in the pedestrian walkways.
- The people who come at you in a group and refuse to disband.
- Taking up the entire width of the sidewalk, walking towards each other and, without fail, not 'shrinking' to make room for anyone to pass.
- Cutting into lines (queuing jumps) and lanes and pushing others in supermarket cash register lines, airport check in-counters, even at the produce weighing devices in the supermarkets, self service restaurants etc [29]. An extreme example is “overtaking (or passing) other passengers in airport checkpoint queues”.
- Not getting off the phone or not pulling over to the side of the sidewalk when talking over the phone. Blocking doors while inside a vehicle, creating logjams and disrupting the flow of passengers from entering and particularly from exiting.
- Walking in the middle of the sidewalk without deliberation.
- Impolitely, unnecessarily and impatiently overtaking another pedestrian.
- Walking very quickly to pass another person only to stop directly in front of them leaving no time/opportunity for them to avoid collision.
- Slower (foot) traffic not keeping to the right or walking towards the edge of the pavement for the faster walkers to pass towards the middle.
- When near destination, not moving towards the nearest vehicle exit doors to reduce stopping time and to make exit less difficult (especially inside a crowded bus).
- Filling the width of the path or taking up the entire sidewalk when walking in groups, crowding every "lane" of the sidewalk or hallway, and preventing others to get thru
- Asking for undeserved priority.

Queue jumping is a serious problem nearly everywhere causing waste of time both for service providers and for the service receivers and sometimes may even end up with fights between people. One exception to queue-jumping behaviour is the system of “priority queues” in which some customers pay to get to the front of the line. This is implemented through the *Customer Relationship Management programs* [30]. At the outset it seems unfair and considered by some in conflict with equality. Yet it brings two kinds of culture change; first, it brings to the market the experience of waiting in line and secondly without resorting favouritism it categorizes customers for waiting in line among themselves transparently in order to treat them differently with respect to their spending power [31].

4. PEDESTRIAN, URBAN AND PAVEMENT ETIQUETTE

There has been a growing concern by officials on how to improve the flow of pedestrians in crowded situations, busy downtowns. Because, for instance, it is increasingly seen that pedestrians who are too busy looking at their phones to watch where they're walking can be an equally serious traffic hazard as text messaging while driving [32]. Pedestrians nearly everywhere say cell phone talker-walkers are so lost in their own hyperconnected universe that they are almost as likely to break the rules of walking as tourists [33]. In many cities, citizens walk two, three or four abreast and never make way for someone coming in the opposite direction. They will drive you off either side of the sidewalk or if you do decide to maintain your rightful position, striding on your fair share of the concrete, someone will walk into you rather than surrender. Similarly, they will stand in the middle of the sidewalk or footpath, or aisle at the supermarket, and chat away on their phones, completely oblivious or uncaring that others are trying to pass [34].

As reported by the National Highway Traffic Safety Administration (USA), texting distractions may have been a contributing factor in the 4,280 pedestrian traffic fatalities recorded during. By comparison, a recent NHTSA report determined that 13 percent of the 3,092 deaths during 2012 that were attributed to distracted driving (408 fatalities) were related to at least one of the drivers using a phone at the time of the accident [35]. David Melton, managing director of Liberty Mutual Insurance's Global Safety, said that “So

much attention has been paid, and rightly so, to distracted driving that we have ignored the fact that distracted walking and crossing can be just as risky,” Stance Logistics is not simply a matter of steady flow of pedestrians in the streets or pavements. It stems from many a different pedestrian behaviours in addition to walking; even though most of the stance behaviours take place during pedestrian movements. Setting out from the above *actus reus*, misconduct, social breaches and faux pas, transgressions and other wrongdoings, a start has been made to establish some rules of **Pedestrian (Urban, Pavement, Sidewalk) etiquette** which is defined as the general courtesy expected from those walking among other pedestrians. When one goes over the below listed courtesy rules or guidelines, it can easily be seen that these are mostly borrowed from vehicle traffic rules and show traces of Logistics principles. It involves staying out of the way of fellow pedestrians and not hindering their ability to travel [36]. Pavement Etiquette is a set of guidelines, that vary slightly depending on what city you are living in or visiting [37]. These guidelines, together with Logistics models and theories could be integrated further develop more definite principles. Some of these guidelines are as follows [38]; Staying to the right while traversing a linear pathway; not suddenly stopping when the path is crowded; not walking faster and not moving over, not hanging out in the middle of the pathway; not getting off the phone while walking; not leaving obstacles in other pedestrian’s way; not being careful towards the less mobile members of pavement users. These guidelines by and large, attest that most behaviours are related to the subject of Stance Logistics.

5. INTEREST OF CONTEMPORARY CITY LOGISTICS AND TRANSPORTATION MANAGEMENT IN STANCE LOGISTICS

City Logistics is an important concept that aims to arrange a host of factors to enhance liveable cities. But because of wrong urbanization policies many a city have been driven into unsustainable chaotic environmental process which could be called “Disturbanization” [39]. *‘City Logistics’ is “the process for totally optimizing the Logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, traffic congestion and energy consumption, traffic safety and energy savings*

within the framework of a market economy” [40]. **“Disturbanization** is an important phenomenon especially in less developed countries and cities [41]. Contemporary civilized cities and developers have been trying to establish pedestrian friendly, convenient and safe, walkable communities and life style shopping centers all of which are very much related to City Logistics [42]. “Walkability” is the extent to which the built environment is friendly to the presence of people (domestic and tourists living, shopping, visiting, enjoying or spending time in an area. Walkable communities are designed around the human foot, truly the only template that can lead to sustainability and future community prosperity. Increased walkability also helps improve resource responsibility, safety, physical fitness and social interaction. Many countries have unspoken recommendations for which side of the pavement you walk on. i.e. Canada, Japan. Pedestrian models which are closely associated with City Logistics can provide workable and efficient tools for designing and planning pedestrian areas, undergrounds, bus stops and ferry terminals, beach piers or walkways, train stations, subways, big buildings, shopping malls, along beaches and seafronts, etc. Some firms claim having developed important simulation techniques to support these movements. i.e. the simulation titled “*simwalk*” to improve and secure the walkability of a community during the planning phase of streets, areas, passages, buildings, as well as during daily operations [43]. As can be seen from Turkish experiences retail developers have also recently recognized opportunities in walkable Lifestyle Shopping Centres [44] that offer a “**sense of place**” or “**pride of place**”. However, the gist of this study is right and proper movement and stances of pedestrians which also includes “walkability” not purely in the sense of comfortable sidewalks and other footways, entrance ways, gateways, or pavements but also proper and respectful, sensitive walking without colliding, hindering, blocking, obstructing, intercepting and disturbing other walkers or pedestrians in any place and in any encounter. Here the concept of Logistical Sensitivity [45], which means being sensitive and respectful to other people during encounters, coined by the author, is very much relevant. Logistical Sensitivity and Spatial Consciousness also describes the degree to which an individual understands/reacts with the environment using her spatial ability. It is also related to Spatial Ability which can be defined as the ability of every individual to perceive the

surrounding environment with its sensing and cognitive mechanisms [46]. Therefore the Stance Logistics may draw upon such pedestrian Logistics software that have been recently developed.

Most of the time vehicular traffic behaviours can be applied to the pedestrians traffic. Traffic laws are the laws which govern traffic and regulate vehicles, while rules of the road are both the laws and the informal rules that may have developed over time to facilitate the orderly and timely flow of traffic [47]. Vehicle and/or pedestrians may often come into conflict with other vehicles and pedestrians because their intended courses of travel intersect, and thus interfere with each other's routes [48]. As is known, the general principle of "right of way" establishes who has the right to use the conflicting part of the road and who has to wait until the other does so. In addition to the rules which normally apply to all public highway users, according to the Vienna Convention on Road Traffic (1968) [49], pedestrians, too, are subject to specific rules defined in their national legislation in order to ensure that they can travel safely and easily [50]. For instance, a more striking example is Washington's DuPont Municipal Code [51]; It shall be unlawful for persons to collect, assemble, or group together and, after being so collected, assembled, or grouped together, to stand or loiter on any sidewalk, parking strip, or any street corner, or any other place in the City, to the hindrance or obstruction to free passage of any person or persons passing on or along any sidewalk or street in the City of DuPont (Ord. 08-864 § 1).

6. THE CONCEPT OF STANCE LOGISTICS, BLOCKING BEHAVIOUR AND THE NOTIONS OF PERSONAL SPACE AND SOCIAL ALLERGENS

Stance Logistics defined above does, moreover, focus particularly on the blocking behaviour and stance of people when encountered another person or any other real or perceived obstruction on their way. The main emphasis of this paper is especially the blocking variety of Logistics Stance which, has obviously close relations with psychology and sociology. Therefore while an attempt is made for the application of the scientific principles and techniques of Logistics to this kind of personal experiences of people, it is also intended to be integrated with the notion of "Personal Space" [52], the "Frustration-Aggression Theory", Harry Stack Sullivan's Interpersonal Theory and Michael

Cunningham's "Social Allergens Theory" in psychology. Cunningham approached the topic through offensive, egocentric, intentional and uncouth annoying or rude behaviours of people which he calls social allergens that is defined as a behaviour or situation that seems unpleasant or uncivil to onlookers, but may not warrant as intense a reaction as the individual displayed [53]. "Personal Space" is the region surrounding a person which they regard as psychologically theirs. Most people value their personal space and feel discomfort, anger, or anxiety when their personal space is encroached [54]. Sometimes some people are unaware of their space or so inconsiderate of other peoples' space(s) [55]. However, in modern society, especially in crowded urban communities, it is at times difficult to maintain personal space, for example, in a crowded train, elevator or Street. Many people find such physical proximity to be psychologically disturbing and uncomfortable, though it is accepted as a fact of modern life [56]. According to Hall,

"...a person's personal space (and the corresponding physical comfort zone) is highly variable and difficult to measure. Personal space is highly variable, and can be due to cultural differences and personal experiences. For example, those living in densely populated places tend to have a lower expectation of personal space." [57].

There is also the concept of "**invisible personal space**" which is the space or territory claimed by an individual not seen around or in sight by others. The notions of personal space and interpersonal space is closely related to the pedestrian's movement and stance behaviours, particularly towards "blocking others" behaviours. One step further is violation or perception of violation of personal or interpersonal space which leads to frustration, anger and even aggression. As a matter of fact, taking into consideration the reaction of two people whose personal space are in conflict, Edward T. Hall, introduced the concept of **proxemics** which is the study of spatial distances between individuals in different cultures and situations. [58]. According to most studies, pedestrians have a smaller personal space in more crowded areas than in less crowded areas standing.

Another critical point in this respect is about the difference between the concepts of territory and personal space. Psychologist Robert Sommer made a distinction between personal space and territory

To him, "The concepts of 'personal space' can be distinguished from that of 'territory' [59].

There is, however, another kind of border violation, which is more closely related to a neighbourhood *border offence or infringement*, as far as the emotions and the possible reactions it triggers are concerned, than to a violation of a country's border and it involves another person's body. This type of border offence is frequently observed in farms, villages and among summer house owners in Turkey [60]. It is the above mentioned differences and especially that of invisibility of the boundaries of personal space that usually causes real or imaginary conflicts in interpersonal and/or extra personal space (the space that occurs outside the reach of an individual). This is one of the points where the concept of Stance Logistics steps exactly into the scene. If pedestrians can be educated on the meaning and scope of personal, and interpersonal space as well as on principles of Logistics, this may help them to view the issue from a different comfort zone and arrange their stance or positioning accordingly without resorting aggression, obstinacy and/ or blockading. If people cannot use space appropriately they will not only waste time, feel disruption, but also cause disturbances, perturbation, conflicts and even fights. "Space management" and Spatial efficiency is one of the most important field of Logistics, especially that of retail Logistics. i.e. container optimization, warehouse space management, management of retail store selling areas, shelves and non-selling areas [61].

7. STANCE LOGISTICS, BLOCKING BEHAVIOUR AND FRUSTRATION – AGGRESSION THEORY

Proposed and developed by John Dollard, Neal E. Miller and Roger Barker, et al., the theory says that aggression is the result of blocking, or frustrating, a person's efforts to attain a goal [62]. In other words, the hypothesis suggests that the failure to obtain a desired or expected goal leads to aggressive behaviour. Combined with the concepts of "Personal Space", notion of "Social Allergens", the "Frustration–Aggression Displacement Theory [63] could be used to explore the reasons behind the blocking behaviours and walk rage of pedestrians. As a matter of fact, it is alleged that the rules of "pavement etiquette" have evolved from the frustration of two main groups of

pedestrians [64]: The slower, less mobile pedestrians who feel that they are not treated with the care and respect of their fellow pavement users; and the fast moving pedestrians who are constantly obstructed by. For some people, yielding way is a kind of surrendering or sacrificing pride or personality. When this occurs, it can produce feelings of anger, which in turn can generate feelings of aggression and aggressive behaviour [65]. However, not every frustration leads to severe aggression but it might be disguised under more civilized appearances and comes out in more subtle ways such as blocking or pre-empting or displacing people who suddenly happen to show up, intercept their way or actions. The closer one gets to a goal, the greater the excitement and expectation of the pleasure. Thus the closer one is, the more frustrated he/she gets by being held back. That frustration always leads to aggression could be an overstatement. Actually different people show different reactions against frustration. The reaction might extend in a spectrum from a mild objection to extreme aggressions of pathologic behaviours. Pedestrian encounters with other pedestrians and obstructions, although mildly, lightly, may also be perceived as a kind of competition or attack that leads to frustration on part of himself/herself as defender and thereof to kind of aggressions which may encompass defensive and offensive behaviours just as in competitive strategies in business such as Defensive Marketing strategies [66].

Furthermore, it seems the impatience, egotism and intolerance factors have not been studied in depth to account for apprehension and responding with speed and sensitivity that leads to quick frustrations of people.

8. DIFFERENT DIMENSIONS OF PEDESTRIAN MOVEMENT AND BLOCKING TYPE OF STANCE BEHAVIOUR

This is a multifaceted problem. One dimension is conscious and designated actions of individuals, to mean intentionally conceived movements and stance. This covers perceptions, awareness of surroundings, sensations and thoughts and showing recognition of something. In other words, when moving, pausing, stopping, positioning and steering, some people are aware of the space and time that their behaviours will take up and lead. Therefore, conduct or the way a person behaves toward other people is an important determining

factor for human Stance Logistics. Another dimension is unconscious and random human, particularly pedestrian, movements [67]. According to Helbing, the most characteristic aspects of behaviour in pedestrian movements seem to be following [68]; People select the quickest route to their destination and dislike taking alternative (slower) routes even if congestion arises on the initial route; Each pedestrian has its own desired walking speed. This speed is dependent on both individual properties (e.g. age, gender, physical state, purpose of travel) as well as environmental properties (e.g. crowdedness, time, temperature) and pedestrians keep a certain distance to other pedestrians, walls and other obstacles. Dependent on the crowding in the area this distance between the pedestrians will differ.

Since Logistics is at the same time the science of commanding and harnessing space, time, effort, energy and position, the movement actions of humans, particularly waiting, pausing, stopping, reverencing or making room for others in spaces deserves to be studied in depth. For instance "queuing" is a significant distress for most people for most of the time [69]. Richard Larson says that "often the psychology of queuing is more important than the statistics of the wait itself. Indeed, in a system of multiple queues, customers almost always fixate on the line they're losing to and rarely the one they're beating.." [70]. Therefore the likelihood of long waits and unmoving lines might lead some people to blocking behaviours beforehand. David H. Maister brought out the following findings with respect to waits [71]; Unoccupied time seems to pass more slowly than occupied time. Uncertain waits are longer than known, finite waits. Unexplained and unfair waits are longer than explained and equitable waits. Generally people are willing to wait in longer lines for more valuable services.

Setting out from these findings, some institutions can bring out some rules concerning waiting times and lines [72]. Such findings may not always reduce wait times, but they can cut frustration and make people feel better, or even happy, about waiting in line. If taught properly, principles and philosophy of Logistics can serve as an important guide for individuals to organize their physical behaviours during walking, steering, pausing, stopping, waiting and giving way to others in a civilized manner. From a macroscopic

standpoint, same idea can be extended to human movement group behaviours as well as individual behaviours in crowds. In this respect many an evacuation models have been brought about. As a matter of fact, one of the most challenging tasks in Computer Vision is analysis of human activity in crowded scenes [73]. While understanding of actions performed by individuals is a problem yet to be fully solved, *Crowd Scene Analysis* and Crowd Behaviour analysis in Computer Vision is a new area of interest which could potentially lend itself to a host of new application domains, such as automatic detection of riots or chaotic acts in crowds and localization of the abnormal regions in scenes for high resolution analysis [74]. Crowd Behaviour analysis is thoroughly studied in the field of transportation and public safety. Especially during emergency situations Crowd Management is an important aspect. For instances, evacuation of a stadium or a building in fire, road tunnel fires, night clubs and dancing, tsunamis, disaster aid distribution, or even an entire town or region in disasters and other emergency situations. Different approaches have been developed to model and simulate this kind of pedestrian behaviours. On the other hand, the individuals' pedestrian movement behaviours and stance or position in uncrowded environments also deserves to be studied with a microscopic view [75].

This paper is for the most part about self-organization phenomenon of Pedestrian and Stance Logistics Dynamics. One last dimension to be considered is about the movement and stance of pedestrians along closed boundary conditions such as corridors at or in open areas such as moving, walking in university campuses.

9. A TAXONOMY TRIAL OF CROWDED AND UNCROWDED ENVIRONMENTS

For the purpose of this analysis, the environments in which Stance Logistics take place could be broken down into two groups: The crowded and uncrowded environments. The crowded environment could further be broken down at least into two different setting; (1) Stadiums, race tracks, cinemas, and many other temporary crowd gathering events etc [76]. (2) Service environments such as supermarkets, hypermarkets, restaurants and fast food restaurants and parking lots etc.

The uncrowded environments could be any place where the number of people are few and

scattered around either on the move or pausing or stopping. Usually walking randomly, disorderly, confusing, unpredictably and /or standing in an open or closed area or pausing, standing and obstructing in front of the doors or passage ways. The movement and stance of individuals in crowded environments may be critical and vitally important not only in emergency situations but also on many occasions such as large transient population centers i.e. campuses and buildings, all kind of retail centers or shopping malls. Although it seems insignificant, individual pedestrian movements and stance might have serious consequences as well. As a matter of fact, it is quite hard to separate the pedestrian movements and stance in crowded and uncrowded situations. As mentioned above mostly they are intertwined. Most of these Logistics Stance behaviours underlie subconscious feelings of blockade or hindrance. In small spaces or areas, establishment of the required or appropriate order could rather be easier. The issue is more complicated in crowded environments, that cannot easily be fit into one or few models.

10. IN SERVICE BUSINESSES STANCE LOGISTICS IS MADE EASY BY THE TECHNOLOGY

Service industries such as banks, restaurants, retail stores such as supermarkets and hypermarkets post offices, cargo facilities, airport check-in service counters, country border crossings service counters etc. have developed different methods to cope up with crowd or individual behaviours particularly with customer flows. Customer-centric profit making institutions has to take measures to prevent jaywalking, queue jumping and blocking behaviours of people. For instance, by managing the psychological aspects of queuing in a bank line they not only reduce perceived wait time while promoting and cross-selling their product portfolio, but also enhance the customer experience and deliver consistency, which translates to loyalty. Furthermore managing teller line flows not only reduces actual customer wait time but also improve employee productivity and generate metrics for improving line productivity optimization staff levels. Many a different Customer Flows Management or queuing devices, both hardware and a software, have been developed. Virtual Queuing Systems enhance service-oriented environments by freeing customers from waiting in line. Some sectors use

turnstiles, some use sales or service associates [77] or hostesses and some others prefer to use Q-matics. Especially banks are making use of these kind of devices, mostly called Q-matics, to reward their most valued or platinum/gold customers as part of their Relationship Marketing policies [78].

Consequently, the movement and stance behaviour of people in these kind of settings are put into order by others or through traditional barrier ropes and/or modern technology. And violation of such restraints might cause severe penalties [79].

11. DIFFERENT MODELLING TO ANALYZE AND HARNESS THE ORDER OF PEDESTRIAN MOVEMENTS AND STANCE

Pedestrian simulation has many applications in computer games, military simulations and animation systems. Helbing and Johansson argued that in order to be able to model pedestrian movements, the most important challenge is to capture the human behaviour, as result of the encountered circumstances [80]. The complexity of logistics can be modelled, analyzed, visualized, and optimized by dedicated simulation software As a matter fact, recent experimental studies have revealed quantitative details of pedestrian interactions, which have been successfully cast into mathematical equations. Furthermore, corresponding computer simulations of large numbers of pedestrians have been compared with the empirically observed dynamics of crowds. Such studies have led to a deeper understanding of how collective behaviour on a macroscopic scale emerges from individual human interactions. As of today there exists a plethora of models and modelling studies on Pedestrian Logistics and their numbers are increasing day by day. Most models are interested in pedestrian step speed, flows, frequency and collision avoidance in order to bring explanation and/or order to crowd dynamics. Many a scientist have been interested in the emergence of new, functional or complex collective behaviours in social systems [81]. However, they are mostly concerned with the originations of cooperation or coordination based on elementary individual interactions. Dirk Helbing and Johansson Anders stated that the modelling of pedestrian motion is of great theoretical and practical interest [82]. According to Koh and Zhou pedestrian navigation in a virtual environment can be achieved using [83]; (1) Social Forces (2) Flow Based approaches

(3) Cellular Automata (4) Agent Based approaches. Koh and Zhou further asserted that few existing work covers both the steering and path-finding considerations of a pedestrian. Instead, existing pedestrian navigation models usually have a more thorough solution to macro level navigation challenges due to the abundance of related work on path-planning [84]. From another perspective, approaches to model pedestrian dynamics can be classified into three main levels [85]; (1) Microscopic level: is where, each pedestrian is represented individually. The mutual behaviour of pedestrians, like collision avoidance, is also taken into account [86]; (2) Macroscopic level: is where the flow of pedestrians are described as a fluid through space [87].; (3) Mesoscopic level: in which the individuality of each particle is maintained. Furthermore, many other modelling attempts, mostly Crowd and Swarm Modelling, have been carried out and significant resolutions have been arrived to shed light on different aspects of pedestrian movement [88]. Modelling of Crowd Dynamics, is the first one of projects finalized to develop a mathematical theory referring to the modelling of the complex systems constituted by several interacting individuals in bounded and unbounded domains [89]. Also simulations of organized traffic frequently involve Queuing Theory, stochastic processes and equations of mathematical physics applied to traffic flows should be mentioned. It is increasingly expected that modelling realistic pedestrian behaviour is to continue mainly due to the continuous increase in the computational power of modern computers.

Although this paper heavily focused on mostly “blocking movement behaviours, positioning and stances of pedestrians individually “, it is almost impossible to study them in isolation from other crowd behaviours etc. Few of the models tried to analyze free pedestrian stance and blocking movement behaviours adequately and established connection with human moral values and psychology that lead why pedestrians behave or act as they do. Some studies emphasized the influence or role of culture on pedestrian movement Dynamics [90]. The issue needs to be tackled with different approaches. Still, some other studies took up particularly “route and destination selection behaviour” issues. Nevertheless a brief account of some of these models and studies is in order. Setting out from these models, many elements could be picked out from each to integrate a new

model to account for particularly pedestrian blocking behaviours and Logistics stances. Yet it is not the intention of this paper to address, analyze and integrate all those theories and models to create a new one. Here just the narratives of some relevant models and/or studies, mostly with the authors ‘own telling, are covered as follows;

- 1) A Distributed Behavioural Model; Craig Reynolds introduced the concept of “*steering behaviours*” in his study titled “Flocks, Herds, and Schools: A distributed Behavioural Model”. He showed that by combining three behaviours (collision avoidance, velocity matching, and flock centring) it was possible to efficiently simulate the movement of a flock of birds in real time [91].
- 2) Continuous Distance Model (CDM) for the Single-file Pedestrian Movement” have been developed by Fang et.al, [92] in an effort to analyze movement algorithm of pedestrians. They did find that both the pedestrian step length and frequency decreases with the increasing global pedestrian density.
- 3) Self-Organizing Pedestrian Movement Model. According to Helbing, Molnar, Farkas and Bolay [93]; the dynamics of pedestrian crowds is surprisingly predictable. Pedestrians can move freely only at small pedestrian densities. Otherwise their motion is affected by repulsive interactions with other pedestrians, giving rise to self-organization phenomena. Examples of the resulting patterns of motion are separate lanes of uniform walking direction in crowds of oppositely moving pedestrians or oscillations of the passing direction at bottlenecks. Chattaraj et.al., also studied study [94] self-organizing pedestrian movement with a work titled Comparison of Pedestrian Fundamental Diagram Across Cultures. They studied relation between speed and density which is connected with every self-organization phenomenon of pedestrian dynamics. i.e. self-organization phenomena like the formation of lanes at bottlenecks.
- 4) Crowd Dynamics Model: With this model [95] Crowd Dynamics Model assumes that each individual movement velocity is restricted by the action of the people surrounding the individual as well as by their own self-motivation. For effective management of overcrowding, measures may be taken to lower the crowd density to achieve the maximum flow rate. The stopping force of each individual are also assumed to consists of the following three

parts: (1) Effect of people in front and behind (2) Effect of people in the lateral directions, (3) Effect of the individual self-driving motion. They found that the effect of crowd interaction in the flow direction is the most important factor and the effect of crowd interaction in the lateral direction is very weak.

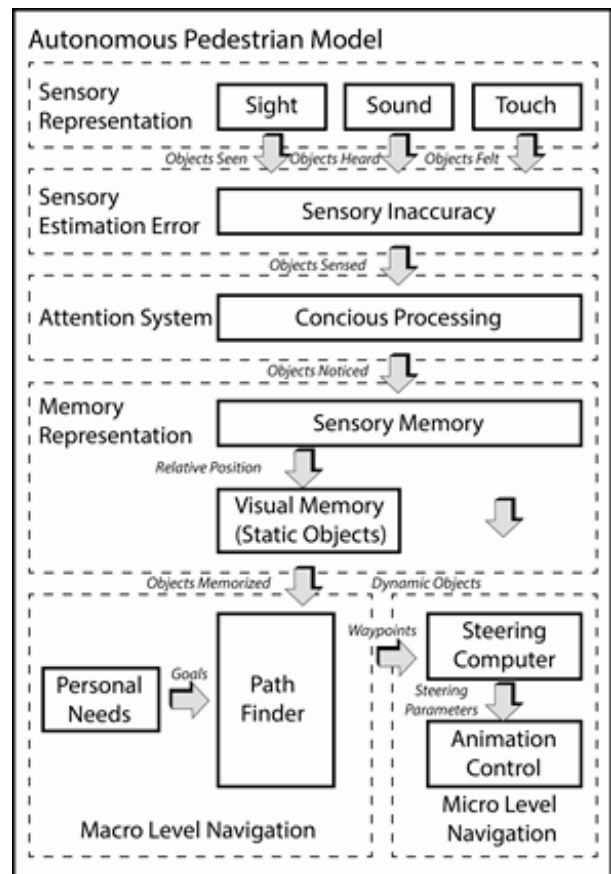
- 5) Queuing Theory : As is known, this theory is about mathematical modelling of waiting lines, whether of people, signals, or things. It entails the construction of a model that comes in handy in predicting queue lengths and waiting times. But they are not optimization techniques; rather they determine measures of performance of the waiting lines, such as average waiting lines in queue, average waiting time for service, and utilization of service facilities. The results obtained through Queuing theory are put to use to formulate business decisions on the resources that will be needed to offer a particular kind of service to others. The theory views the issue from the efficiency standpoint of the firm and/or organizations. Queuing theory examples are evident in different areas like supermarkets, banks, public transport, computers, failure situations etc. The theory and its applications is helpful to find remedy to queue jumping problem which is only one aspect of Stance Logistics [96].
- 6) Social Force Model: Based on socio-psychological studies, Helbing *et al.* [97]. originally introduced Social Force model to investigate the pedestrian movement dynamics. The social force captures the effect of the neighbouring pedestrians and the environment on the movement of individuals in the crowd. As Dirk Helbing and Peter Molnar [98]. suggested that the motion of pedestrians can be described as if they would be subject to "social forces." These "forces" are a measure for the internal motivations of the individuals to perform certain actions. Computer simulations of crowds of interacting pedestrians show that the Social Force Model is capable of describing the self-organization of several observed collective effects of pedestrian behaviour very realistically." Using social forces, the model tries to delineate the conditions under chaotic, irregular and unpredictable human behaviours e.g. in pedestrian traffic, where people are confronted with standard situations and react "automatically" rather than taking complicated decisions, such as to evade others. According to Helbing and Molnar, the automatic behaviours

of pedestrians can be simulated with evolutionary algorithms. For example, pedestrians have a preferred side of walking, since an asymmetrical avoidance behaviour turns out to be profitable. Compared to people following each other, oppositely moving pedestrians have more frequent interactions until they have segregated into separate lanes by stepping aside whenever another pedestrian is encountered. Despite its simplifications, the Social Force Model of Pedestrian Dynamics allows one to explain various self-organized spatio-temporal patterns that are not externally planned, prescribed, or organized, e.g. by traffic signs, laws, or behavioural conventions. Instead, the spatio-temporal patterns emerge due to the non-linear interactions of pedestrians even without assuming strategic considerations, communication, or imitative behaviour of pedestrians [99]. An extension of Social Force Model is on Abnormal Crowd Behaviour Detection using Social Force model. Here randomly selected spatio-temporal volumes of Force Flow are used to model the normal behaviour of the crowd. This model, using videos, introduced a novel method to detect and localize abnormal behaviours according to *Escape Panic Scenarios* in crowd [100]. Fuzzy Associative Memory (FAM) is proposed to infer abnormal behaviour of the walker [101]. Detecting Pedestrian Abnormal Behaviour Based on Fuzzy Associative Memory : Visual analysis of human motion in video sequences has attracted more and more attention to computer visions in recent years.

- 7) Agent Based Approaches: Agent based studies have been increasing in recent years. And they are promising for paving the way for Stance Logistics. From Agent-Based Modelling of the crowd in a station, every pedestrian is driven by one type of agents with three properties: the belief of starting point and destination, movement dynamics, and the timing of emerging. And the whole crowd is modelled as a mixture of pedestrian-agents with different three properties. [102]. Recently, inclusion of psychological factors in the representation of individual pedestrians has become common in Agent Based Approaches [103]. For example, Sakuma *et al.* proposed an agent model that considers the memory and vision capabilities of a pedestrian. For the decision to avoid collision, Sakuma proposed the use of a two stage personal space [104]. When agents are found in

the inner personal space, these agents should be avoided immediately. In these models, on the other hand, agents found in the outer personal space represent agents that should be avoided without making sudden changes in velocity.

“Two-level navigation model to generate realistic Navigational Behaviour” by Koh and Zhou. They say that the inclusion of individual memory and vision will help enhance the diversity of the generated behaviour among different agents [105]. They argued that in order for the agents to demonstrate realistic navigation behaviours, an accurate representation of a pedestrian is needed. Because during navigation, real pedestrians need to sense the changes in the environment to plan their paths and steer through the environment to avoid both structural obstacles and other moving objects, they proposed a pedestrian representation which aimed to mimic how a real pedestrian collects and uses information about the environment for navigation. To this end, they equipped the agent with individual and limited sensory and memory capabilities (*sight, sound and touch modules*). They believe the modelling of an agent's perception about the environment will allow for individual route-plans based on the agent's own knowledge about the environment. This navigation model is able to combine various considerations used by pedestrians during navigation by formulating collision avoidance, speed and orientation constraints. They discussed how physical, psychological and situational factors can be modelled using different steering constraints. They also demonstrated that their model is able to naturally demonstrate lane formation behaviours in a scenario with higher pedestrian density without explicit instructions. However, they explain that pedestrian behaviours such as queuing and pushing are still not part of their current pedestrian navigation module. According to Koh and Zhou In representing a pedestrian using an autonomous agent will allow agents to react according to the situation in their local area.



As reported by Koh and Zhou, Pan et. al. proposed one such framework to model pedestrian behaviours in an egress simulation [106]. Pan describes an agent to have age, gender, sensory inputs and navigation decision modules. In particular, the movement of a pedestrian is described using steering behaviours such as random walk, collision avoidance and target following. Higher level navigation behaviours are achieved by combining several basic steering behaviours. However, Koh and Zhou argues that Pan's model is focused on the egress scenario where the primary goal of an agent is to reach an exit or safe zone as soon as possible; thus, the resultant behaviours may not be generally suitable for other situations. For example, the herding effect, where pedestrians will attempt to move towards a general direction where most of the other pedestrians are moving, is hardly seen for commuters in a underground passage way. This Agent Based Navigation Model consists of a Macro-Level Model and a Micro-Level Model. This pedestrian model is asserted to be able to generate various realistic behaviours such as overtaking, waiting, side stepping and lane-forming in a crowded area. In Micro-Level Navigation Model, Pedestrian navigation is an

interactive and dynamic process. The movement of a pedestrian is affected by the movement of other pedestrians in the environment. In turn, a pedestrian's own movement will also affect the movement of other neighbouring pedestrians. At the same time, different pedestrians have different personalities which may also influence their navigation choices [107].

settings. Therefore, they argue that realistic models of pedestrian dynamics will also promote the understanding of opinion formation and other kinds of collective behaviours [109].

Lamarche and Donikian proposed a two-level approach to achieving realistic pedestrian movements (A Model For Real-Time Navigation

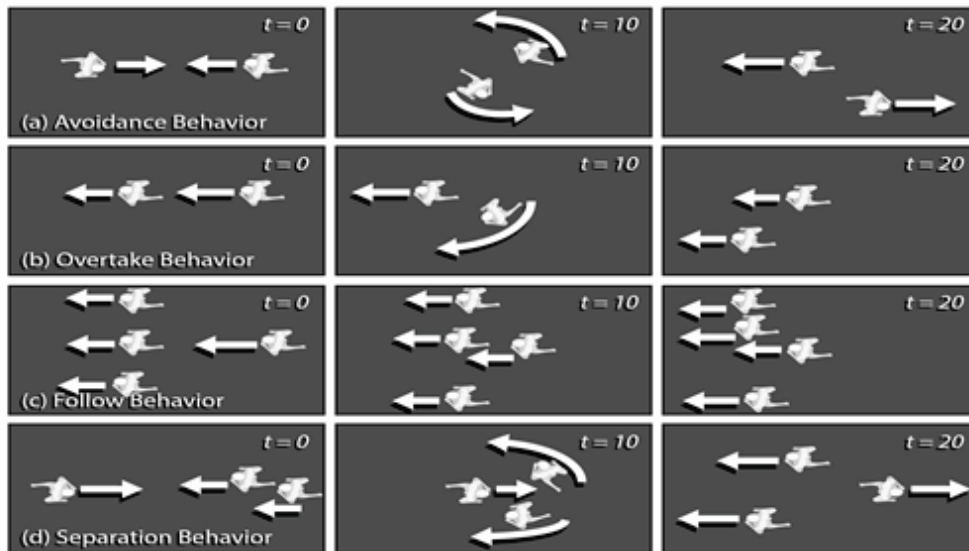


Fig. 1. Representation of an autonomous agent

However, these mutual influences in navigation are localized and do little to affect the overall path plan for a pedestrian. For example, pedestrians do not re-plan their path just because they are about to collide with the pedestrian in front of them. Koh and Zhou therefore term this interactive steering to minimize physical contacts with other pedestrians in the environment as *reactive planning* which consists of two main challenges, *collision prediction* and *collision avoidance*.

Multi-Agent Approach to Pedestrian and Crowd Dynamics: Helbing and Anders argued that despite the great effort required, pedestrian interactions can be well quantified by video tracking [108]. Examples for observed self-organization phenomena in normal situations are lane formation, stripe formation, oscillations and intermittent clogging effects at bottlenecks, and the evolution of behavioural conventions (such as the preference of the right-hand side in continental Europe). Under extreme conditions (high densities or panic), however, coordination may break down, giving rise to “freezing-by-heating” or “faster-is-slower effects”, stop-and-go waves or “crowd turbulence”. Similar observations as in pedestrian crowds are made in other social systems and

in Complex and Structured Environments) [110]. They recursively divide the environment into smaller blocks to represent the areas that are accessible to an agent. In this model, collision avoidance is achieved by predicting the time to collision and the type of collision, e.g. rear or front collision. In this model, based on the expected type of collision, several collision avoidance strategies are proposed, evaluated and then the best strategy is used for the agent to determine its new speed and orientation. One problem with this approach is that the model focuses on avoiding physical contacts between different agents and does not give sufficient consideration to the different factors that may influence a pedestrian's navigation behaviour, e.g., a pedestrian may even choose because of stubbornness not to avoid the collision with others in certain situations and cultures such as in Turkey.

8) The Behavioural Force Model of Pedestrian Motion study touches upon one generally agreed upon observation on the issue of blocking [111].; “Pedestrians normally do not reflect their behavioural strategy in every situation anew but act more or less automatically. This becomes obvious when

pedestrians cause delays or obstructions, for example, by entering and elevator or train even though others are still trying to get off.” Many people have the feeling that human behaviour is ‘chaotic’ or at least very irregular [112].; This may be true for behaviours in complex situations. In standard situations, however, individuals will usually not take complicated decisions between various possible alternative behaviours, but apply an optimized behavioural strategy, which has been learned over time by trial and error. Hence a pedestrian will react to obstacles, other pedestrians, etc, in a somewhat automatic way. The optimal pedestrian behaviour can in principle be determined by simulating the learning behaviour of pedestrians. Farkas et.al., investigated pedestrian motion for several years and evaluated a number of video films. They argued that despite the sometimes more or less ‘chaotic’ appearance of individual pedestrian behaviour, one can find regularities, some of which become most visible in the time-lapse films such as the ones produced by Arns. While describing these, they also summarized results of their pedestrian studies and observations [113].; (1) Pedestrians show a strong aversion to taking detours or moving opposite to the desired walking direction, even if the direct route is crowded. Consequently, pedestrians normally choose the fastest route to their next destination [114]. If alternative routes are of the same length, a pedestrian prefers the one where he or she can go straight ahead for as long as possible and change direction as late as possible (provided that the alternative route is not more attractive, for example, because of less noise, more light, a friendlier environment, less waiting time at traffic lights, etc). This behaviour sometimes produces ‘hysteresis effects’; that is, at some locations, pedestrians tend to use a typical way to a certain point, but another way back.(2) Pedestrians prefer to walk with an individually desired speed, which corresponds to the most comfortable (that is, least energy-consuming) walking speed [115] so long as it is not necessary to go faster in order to reach the destination in time. (3) Pedestrians keep a certain distance from other pedestrians and borders (of streets, walls, and obstacles) [116]; This distance is smaller as the

pedestrian hurries, and it also decreases with growing pedestrian density. Resting individuals (waiting on a railway platform for a train, sitting in a dining hall, or lying at a beach) are uniformly distributed over the available area if there are no acquaintances among the individuals. Pedestrian density increases (that is, interpersonal distances lessen) around particularly attractive places, and it decreases with growing velocity variance, for example, on a dance floor [117]. (4) Pedestrians normally do not reflect their behavioural strategy in every situation anew but act more or less automatically. As mentioned before, this becomes obvious when pedestrians cause delays or obstructions, for example, by entering and elevator or train even though others are still trying to get off. The biggest cause of walk rage are those people who don’t stand aside on an escalator when others are trying to pass [118].

As a matter of fact most models do not take advantage of modern Agent-Based Simulation Techniques performed in a precise, continuous 3D environment, including Optimization of Navigation Geometry, and also “locally quickest” path selection system for more intelligent path planning. Emergency egress simulators are developed by many a firm such as Pathfinder Thunderhead Engineering Consultants, Inc. to find a remedy to these kind of situations [119].

12. SOME TECHNOLOGICAL PEDESTRIAN LOGISTICS DEVELOPMENTS TO BE PATTERNED AFTER

For the purpose of putting the pedestrian movements and stances into a reasonable order, the latest technologies are introduced in many countries [120]. The Pedestrian Logistics software of many firms are usually built around walkability, safety, attractive, and eco-friendly and orderly facilities and cities. There are many different software developed for Pedestrian Logistics for different purposes. For instance the Commhoist company provides a solution for Pedestrian Management during any of the works they undertake, such as closing the footway place walkways dependent upon traffic flows and road layouts, traffic control in the form of stop and go, priority signage or traffic signals where necessary when a pedestrian walkway is placed into the

carriageway [121]. An important software solution developed recently by the Savannah Simulation AG firm is the “SimWalk”. It is another software to support authorities, contractors and communities to analyze and design sustainable Pedestrian Logistics solutions [122]. It is a computer technology that realistically simulates and analyzes the movement of people in virtual environments for improving the operational efficiency of real infrastructures and the comfort and security of pedestrians. The firm claims that “they do for pedestrians what Logistics does for goods and services” [123]. It is asserted that through simulation and analysis, SimWalk software helps to solve inefficiencies in Pedestrian Logistics to implement cost savings for facility operators and a seamless travelling experience for pedestrians and passengers. The simulation Simwalk is used for many other applications such as evacuation of a soccer stadium, pedestrian flows train station, a railway station and metro safety simulation etc. This application indirectly supports the Stance Logistics. Another application is *SimWalk Transport* which is the leading simulation solution specializing in passenger operations, safety and comfort in rail, metro and bus stations. SimWalk Transport allows modelling realistically passenger flows, boarding and alighting, different rolling stock, varying time schedules, train switching and much more. This software is the passenger flow solution for transport planners, public transport authorities, operations managers, rail, metro and bus companies as well as transport consultancies. Jason Daniel Martina, Jens Kröscheb, Susanne Boll tried to develop an approach to provide a software-based solution for a more correct position to a mobile pedestrian by relying on consumer-grade GPS receivers [124]. Birgit Elias presented an approach to generate a tailored geo-database for routing which is accustomed to the specific needs of pedestrians for navigation applications [125].

13. CONCLUSION AND FUTURE WORK

The purpose of this exploratory study is merely to draw attention to certain dimensions of pedestrian movements, especially that of blocking behaviours, with a larger concept called Stance Logistics, under some designed environments or settings. Yet brief analyses above have shown different dimensions of the topic which have already arisen. As a consequence, here a random review of some models and studies are needed to portray how some models have been derived to

point out the vast area of human movement behaviour studies. In the final analysis it seems a challenging and formidable task to derive a consistent and holistic model especially for the pedestrian blocking and stance behaviours in public places and in far flung open areas. The viewpoints of these models could be likened to the maxim or parable of “**blind men and an elephant**“. Because each one of these models touches the different part of the pedestrian or Stance Logistics. Actually Stance logistics has all the has all the features mentioned in most of the models created. Each model and theory creates or reflects its own version of reality from that limited experience and perspective. Therefore, it is impossible to properly understand an entity, such as Stance behaviour, consisting of almost infinite properties without the method of modal description consisting of all viewpoints.

The main emphasis of this article is especially the “blocking variety” of Logistics Stance behaviours which, obviously have a close relationship with psychology and sociology. Actually the purpose of this study is to understand the whys, whens, and hows of these behaviours and to develop, improve, and expand these guidelines further and to put in place through the help of general Logistics principles and techniques. This study is for the most part about the self-organization phenomenon of Pedestrian and Stance Logistics Dynamics. However, the gist of this work is the right and proper movement and stances of pedestrians which also includes “walkability” not purely in the sense of comfortable footways, entranceways, gateways, or pavements but also proper and respectful, sensitive walking without colliding, hindering, blocking, obstructing, or intercepting and disturbing other walkers or pedestrians in any place and in any encounter. Here the concept of “Logistical Sensitivity”, coined by the author is very much relevant. Many attempts have been made to develop consistent, comprehensive and working models to improve pedestrian movements for different purposes. Most of these models are based on simulation studies and created for Pedestrian Logistics in crowded and/or uncrowded environments, although not pronounced as logistics strongly. Most models are interested in pedestrian step speed, flows, frequency and somewhat of a “collision avoidance” in order to explain, and/or bring order to, pedestrian crowd Dynamics, be it self-organized or not. The models that emphasized “collision avoidance” have the capacity to

encompass the most frequently met occasions of the Stance Logistics concept offered here. Yet among the simulation models the Agent Based models, particularly the one advanced by Koh and Szhu, seem to be more promising to explain the many aspects of Logistics stances of people, even though the authors don't use the term. Yet they do too admit that there are many challenging factors that need to be dealt with this issue. It is found from this study that the term Pedestrian Logistics confirms and refines the possible occasions of people Stance Logistics movements and behaviour spectrum. The model developed by Koh and Szhu, if integrated, for instance, with Social Force Models, might provide fruitful answers to the Stance Logistics. This study introduced somewhat different concepts and variables to be included in the new models to come. The importance of adapting general principles of Logistics and Retail Logistics has also been stressed for the first time here.

The major new points introduced by the author in this study are as follows; (1) A new name, that is Stance Logistics, is given to the broader Pedestrian Logistics actions. (2) The Pedestrian Logistics concept is expanded to cover More pedestrian Logistics behaviours not so far adequately thought or focused. (3) The importance and adaptation of the instruments of Logistics sub-function into the models is suggested. (4) Some ideas drawn from the discipline of Retail Logistics and their association with Pedestrian or Stance Logistics are established (5) The issue is tied to the Pedestrian or Pavement Etiquette (6) The critical importance of considering blocking type of stance behaviours of pedestrians in the models are brought forward. (7) An almost exhaustive list of blocking behaviours is created. (8) The technological developments, such as Simwalk, taking place in this area is also introduced. (9) Defensive and Offensive Marketing, Logistics and Competition strategies are also introduced to be considered in future modelling studies and mathematical equations. (10) The concept of "Personal Space" and the "Frustration-Aggression Theory" are tied together to shed further light on stance and blocking behaviours of pedestrians (11) Ample evidences of universality in stance behaviours of people.

Of course there are many limitations of these approaches: One important limitation is many different personalities walk either with an aim or destination in mind or wander around aimlessly in open areas. Most often the common denominator is

their blocking each other in random encounters with either human beings or any other obstructions. Through the Mall Intercept Interview survey technique the motivations and grounds of these people could be asked but it may be very difficult to collect information from such people. Because if caught in a blocking behaviour on-the-spot they may become offended to be questioned about their movement and stance behaviours and therefore won't disclose anything. Another important remark on using simulations is that developing simulation models is costly in both time and resources. Also some mathematical models may be so complex that it is impossible to solve them by any of the available optimization algorithms. Therefore, in such cases it may be necessary to abandon the search for the optimal solution and just seek a good solution using heuristics or rules of thumb. Although there may be difficulties, integration of models may end up with suggestions to pass new laws or regulations against violations and misbehaviours. As of today, most models lack clarity and cannot thoroughly account for the Stance Logistics. They are largely imprecise and inconclusive. Yet each attempt to study pedestrian movement and stance will help to shed light on these movements in the long run which in turn will serve as a guide or compass to individuals to organize and adjust pedestrian movements and stances in many different dimensions. One of these dimensions may be acculturation and adjustment of walking or pedestrian etiquette. Another dimension is about relationship of blocking behaviour and frustration and aggression.

14. FUTURE WORK

Movement Research is an emerging field and many extra miles need to be covered for it to provide effective and efficient results. It is believed that this exploratory study will pave the way for further research to produce promising results on the aspects of this new concept of Stance Logistics. Researchers might try to draw upon almost endless pedestrian and crowd movement models to form a unique model for blocking movement and stance Logistics behaviour. Further, advanced interdisciplinary, particularly socio-cultural and psychological, studies are also needed to understand the motivations behind blocking movement and stance behaviours of pedestrians to infer logistical cues for correction and self-monitoring. Stance Logistics may also draw upon pedestrian Logistics software that have been

developing recently. These kinds of applications directly or indirectly support Stance Logistics. The models mentioned above and others should also consider including competitive marketing and Logistics strategies in their equations. The pavement etiquette guidelines, together with Pedestrian models and theories could be integrated to develop further more solid principles. Last but not least, Integrative Logistics strategy and tactics are what is needed. These factors must be integrated with new models to be created. When combined with applicable models and theories of pedestrian movements and integrated with the general principles of Logistics, Stance Logistics can serve as an important guide to facilitate the daily activities of many people. If pedestrians can be educated on the meaning and scope of personal, and interpersonal space as well as on principles of Logistics, this may help them to view the issue from a different comfort zone and arrange their stance or positioning accordingly without resorting to aggression, obstinacy and/or blockading. If taught properly, principles and philosophy of Logistics can serve as an important guide for individuals to organize their physical behaviours during walking, steering, pausing, stopping, waiting and giving way to others in a civilized manner. The point—that people should be made aware of pedestrian movement is also a Logistics issue and they must be made to internalize the Pedestrian Etiquette Guidelines to take the issues seriously to be acted upon. One can easily see the the DNA's of Logistics principles in the recent courtesy guidelines or pedestrian etiquette mentioned above. In the long run, proper strategic and tactical Stance Logistics teachings and applications on behavioural responses might be implanted into the DNS's of pedestrians. From the above analyses it seems that the integrated model will have to be an eclectic one. More studies need to be carried out in order to weave each elements of logistics into a coherent whole.

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