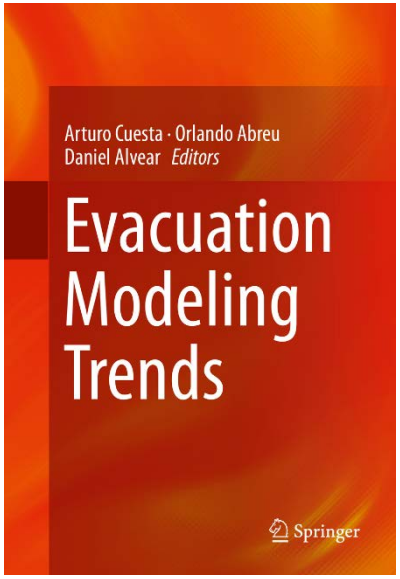
Retos de futuro en el modelado de evacuación: conductas colectivas

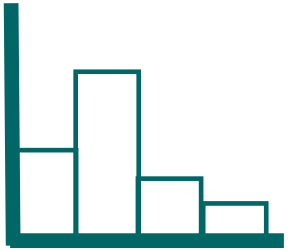
EVACUACIÓN, SEGURIDAD Y CONFORT
Diseño para grandes multitudes con MassMotion

Contenido

Retos de futuro



Retos de futuro



Datos

Escenarios

Aplicaciones

Retos de futuro

Datos

The lifeblood of any field of study

"Data that bridges the gap between observation, understanding and application"

Steve Gwynne
NRC-Canada

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The collection and compilation of school evacuation data for model use

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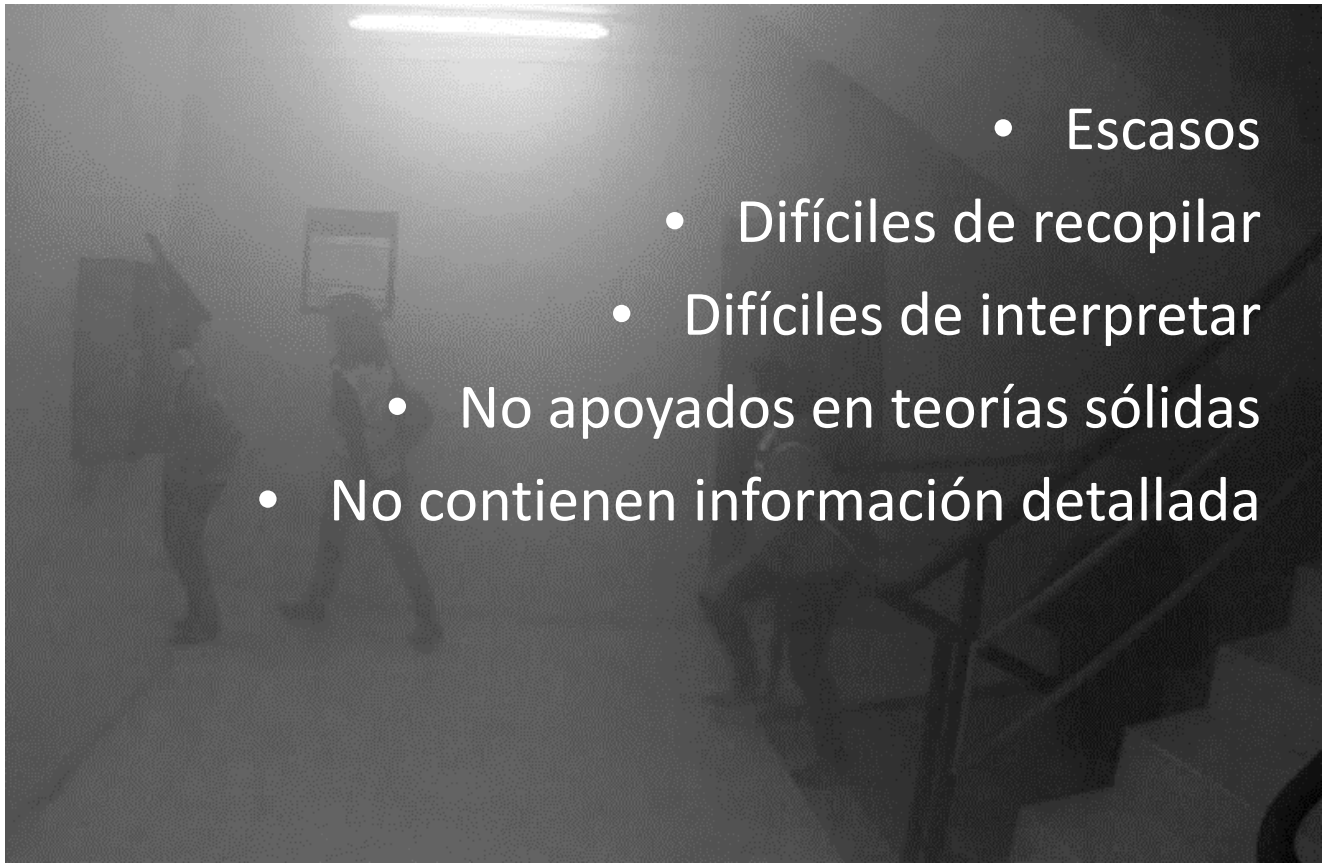
ABSTRACT

Numerous evacuation models are now able to represent populations with different movement abilities. However, this representation is not always supported by empirical data; i.e. the functionality can occasionally overreach the empirical support for it. The goals of this work are: (1) to provide data that adds to the understanding and quantification of vulnerable population's evacuation performance, and (2) to provide sufficiently detailed and transparent data-sets for model configuration and validation.

Data was collected during five evacuations from the same school, conducted between 2011 and 2014. Children from 4 to 16 years old were involved in these drills. Four of the evacuations were unannounced, while one was semi-announced (i.e. staff were aware that the drill would be conducted on a particular day). In addition to the initial scenario conditions (e.g. the building geometry, population, procedures employed, etc.), a number of different performance data-sets were collected: pre-evacuation times, travel speeds, route use and evacuation arrival curves. Through the provision of detailed architectural diagrams and other initial conditions and raw data/analysis describing evacuee performance it is hoped that this data-set will be used in the development of evacuation models and their application. The limitations in the data collection and analysis process are outlined allowing the modeler to identify where issues might arise and take corrective actions where possible.

Retos de futuro

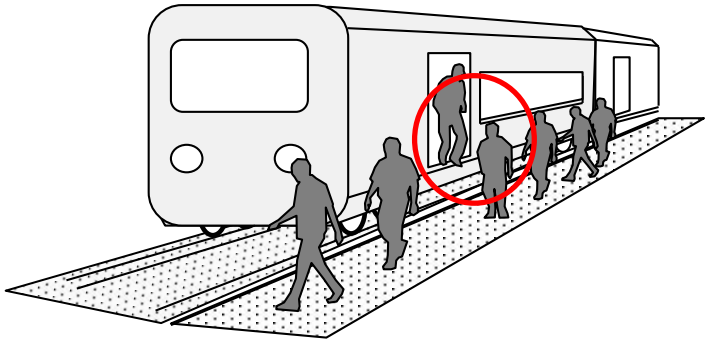
Datos



- Escasos
- Difíciles de recopilar
- Difíciles de interpretar
- No apoyados en teorías sólidas
- No contienen información detallada

Retos de futuro

Datos



Retos de futuro

Datos

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SPECIAL ISSUE PAPER

School egress data: comparing the configuration and validation of five egress modelling tools

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SUMMARY

Data were collected between 2011 and 2014 from five evacuations involving the same school buildings located in Spain. Children from 6 to 16 years of age were observed during the evacuation exercises. Background information was collected on key factors deemed to influence evacuation performance: a description of the geometry, the population involved, the procedures employed and the organization of the drills conducted. Using live observations and video footage of these drills, evacuation data were collected, focusing on the pre-evacuation times, the routes employed, the travel speeds adopted and the arrival times. These data informed a range of *a posteriori* simulations, conducted by using four computer models (buildingEXODUS, MassMotion, Pathfinder and STEPS) and the Society of Fire Protection Engineering hydraulic model (i.e. Society of Fire Protection Engineering hand calculations). Comparisons were drawn between the models' output and against the observed outcome for one of the trials to determine the accuracy of the model predictions given that they were configured by using the initial conditions for a specific evacuation. The purpose of this work is to (1) provide insight into the configuration of these models for equivalent scenarios, (2) examine any variation in the simulated conditions given equivalent initial conditions, and (3) provide suggestions on how to perform validation studies for multiple evacuation models. Copyright © 2016 John Wiley & Sons, Ltd.

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KEY WORDS: data collection; evacuation modelling validation; school evacuation; egress simulations; unannounced evacuation drills

1. INTRODUCTION

Evacuation models are frequently employed to quantify evacuee performance. In order to credibly do so, they require testing. Real-world observations are required, in as complete and refined a manner as possible, to enable validation of model performance. In this way, detailed comparisons can be made to compare the simulation of specific evacuation scenarios against representative data. The work presented here outlines a series of real-world observations and the application of these data in five evacuation models.

The evacuation process in schools is particularly challenging as children are not typically expected to self-evacuate but will instead be reliant upon direction from staff [1,2]. The behaviour of school

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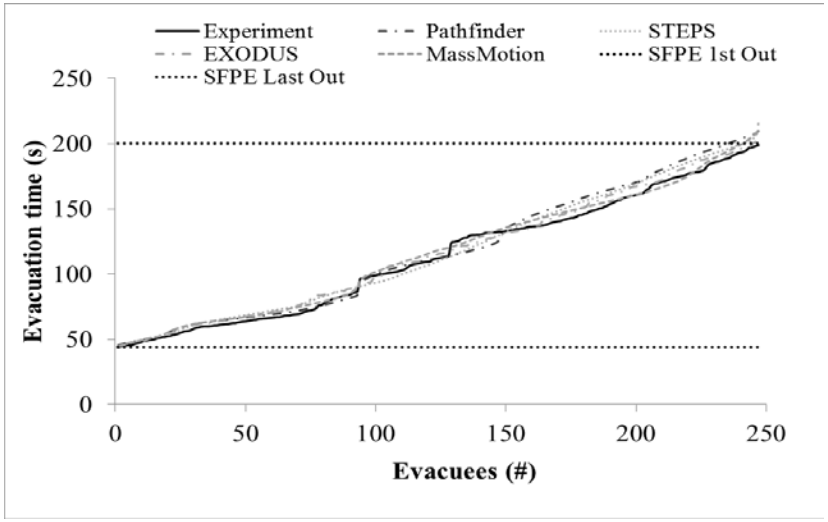
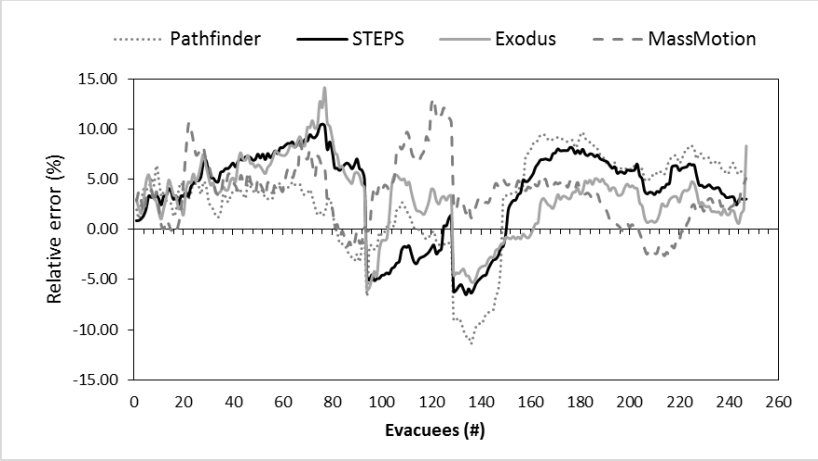
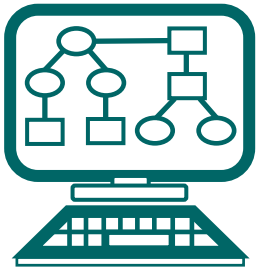




Retos de futuro

Datos



Escenarios

Aplicaciones

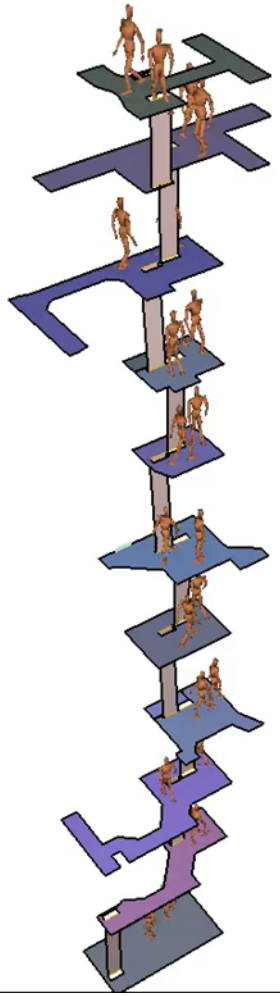
Retos de futuro

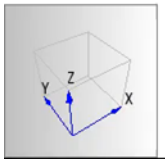
Escenarios/procesos

- Nuevos entornos
- Nuevas amenazas
- Nuevas estrategias de seguridad
- Nuevas conductas

Retos de futuro

Escenarios/procesos





Retos de futuro

Datos

Escenarios

Aplicaciones

Retos de futuro

Aplicaciones

Tiempo

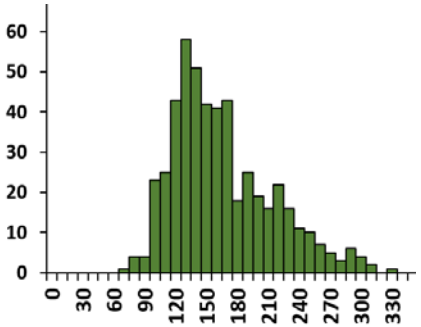
Pre-evento	Evento	Post-evento
PBD	Tiempo-real	"Forense"
¿Qué pasaría?	¿Qué está pasando y cómo resolverlo?	¿Qué pasó?

Retos de futuro

Aplicaciones

1. Tiempo de cómputo

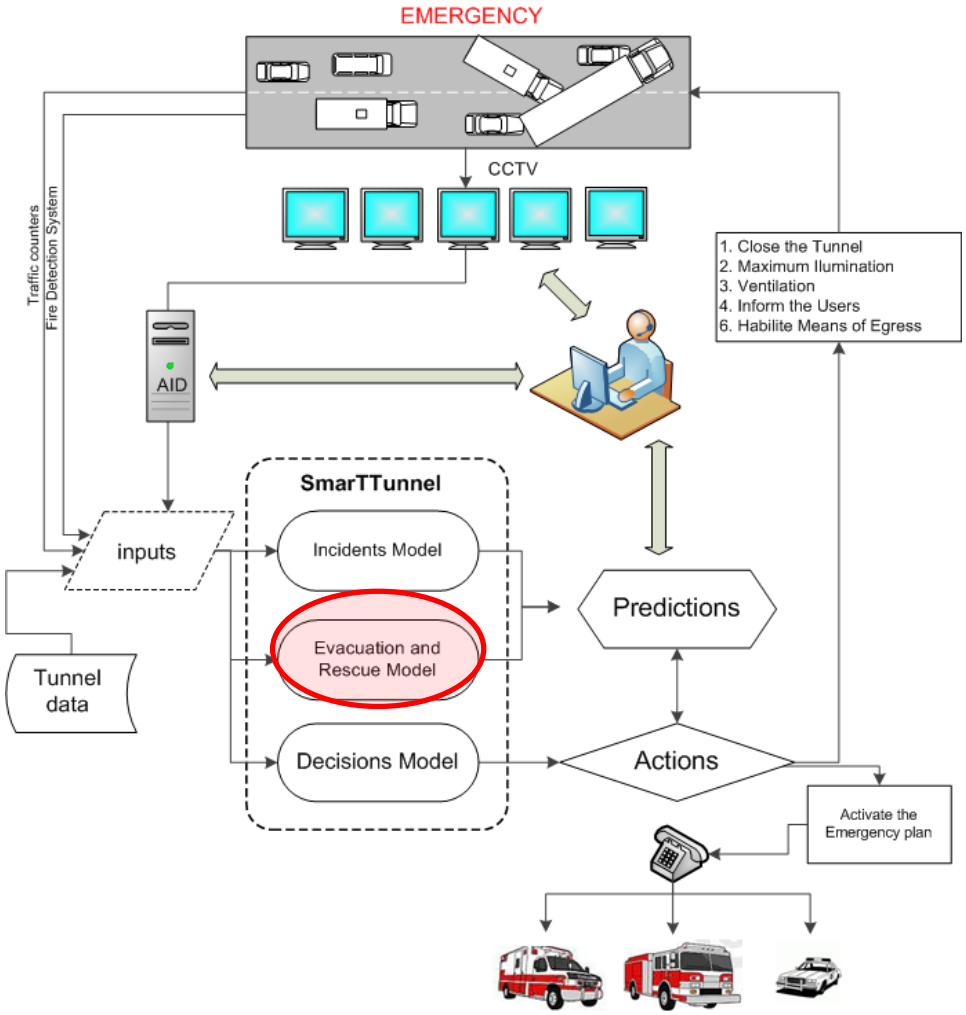
2. Enfoque estocástico

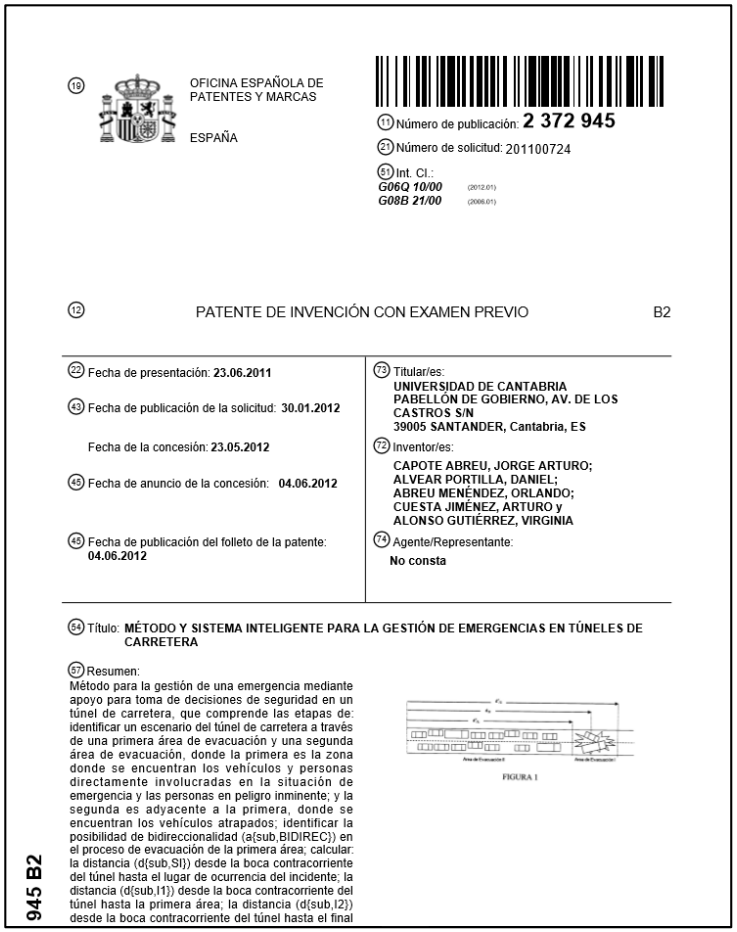


3. Uso (inputs-outputs)

Retos de futuro

Aplicaciones





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(74) Agente/Representante:
No consta

(54) Título: **MÉTODO Y SISTEMA INTELIGENTE PARA LA GESTIÓN DE EMERGENCIAS EN TÚNELES DE CARRETERA**

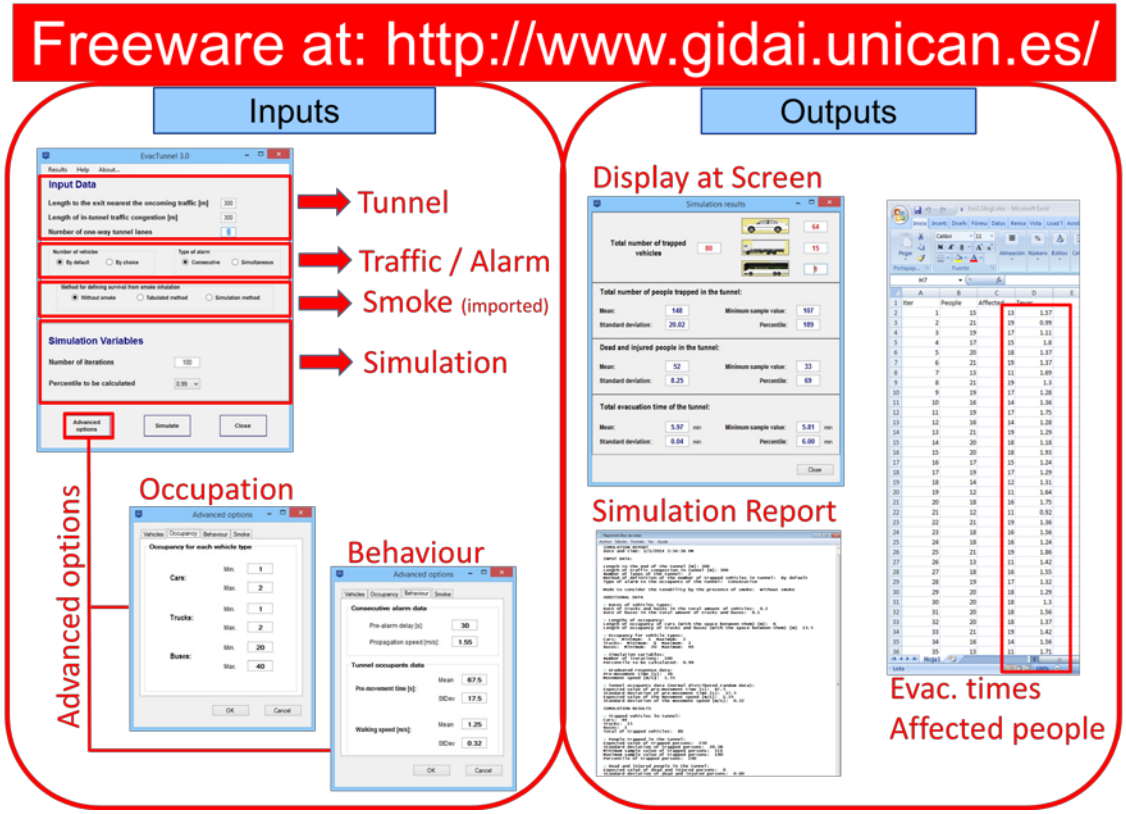
(57) Resumen:
Método para la gestión de una emergencia mediante apoyo para toma de decisiones de seguridad en un túnel de carretera, que comprende las etapas de: identificar un escenario del túnel de carretera a través de una primera área de evacuación y una segunda área de evacuación, donde la primera es la zona donde se encuentran los vehículos y personas directamente involucradas en la situación de emergencia y las personas en peligro inminente; y la segunda es adyacente a la primera, donde se encuentran los vehículos atrapados; identificar la posibilidad de bidireccionalidad (a{sub,BIDIREC}) en el proceso de evacuación de la primera área; calcular: la distancia (d{sub,SI}) desde la boca contracorriente del túnel hasta el lugar de ocurrencia del incidente; la distancia (d{sub,I1}) desde la boca contracorriente del túnel hasta la primera área; la distancia (d{sub,I2}) desde la boca contracorriente del túnel hasta el final

FIGURA 1

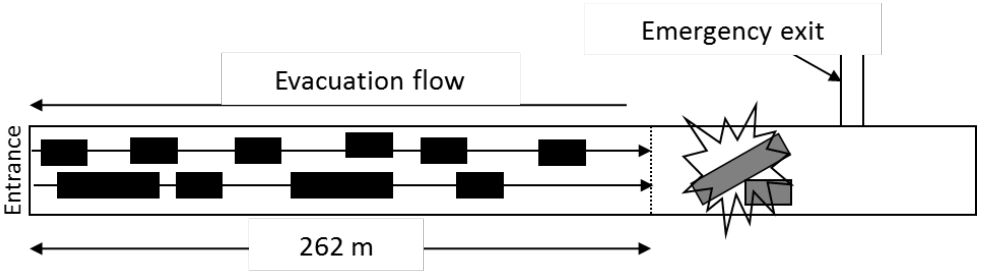
945 B2

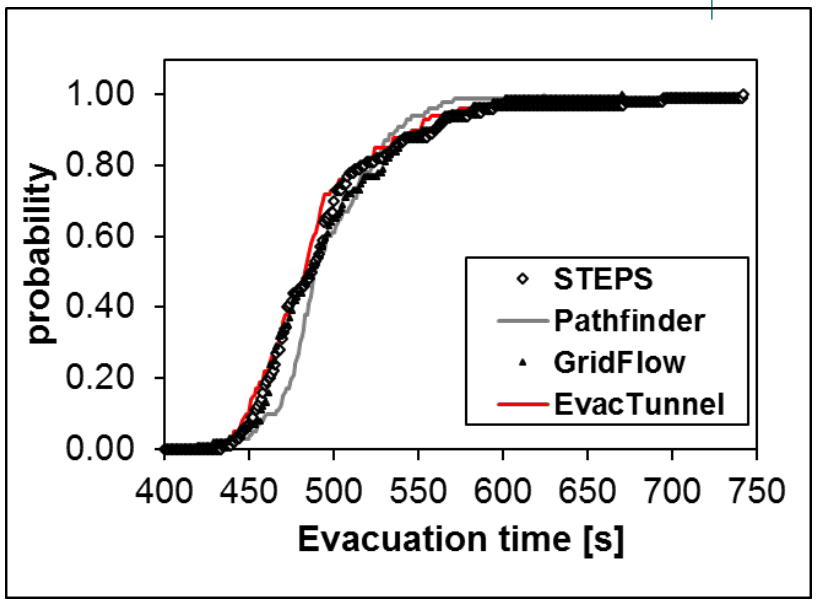
EvacTunnel 3.0

- Estocástico
- Perspectiva individual
- Importa datos de incendio



EvacTunnel 3.0





Model	Batch run?	Batch run time (100 runs)	Plotting data?	Statistical processing?
EvacTunnel	Yes	**< 5 s**	**Yes**	**Yes**
STEPS	Yes	400 s	No	No
Pathfinder	No	>3600 s	No	No
GridFlow	Yes	403 s	Yes	No

J.A. Capote, D. Alvear, O. Abreu, A. Cuesta, V. Alonso; 2013; 'A real-time stochastic evacuation model for road tunnels'; ***Safety Science***; volume 52; pp.: 73-80.

Conducta colectiva

Influencia social

1. Miramos a otros

Latane and Darley, 1968; Nilsson and Johansson, 2009; Kuligowski, 201

2. Cooperamos

Jones and Hewwitt, 1986; Fahy et al., 2011, 2012; Gwynne et al., 2006

3. Decidimos juntos

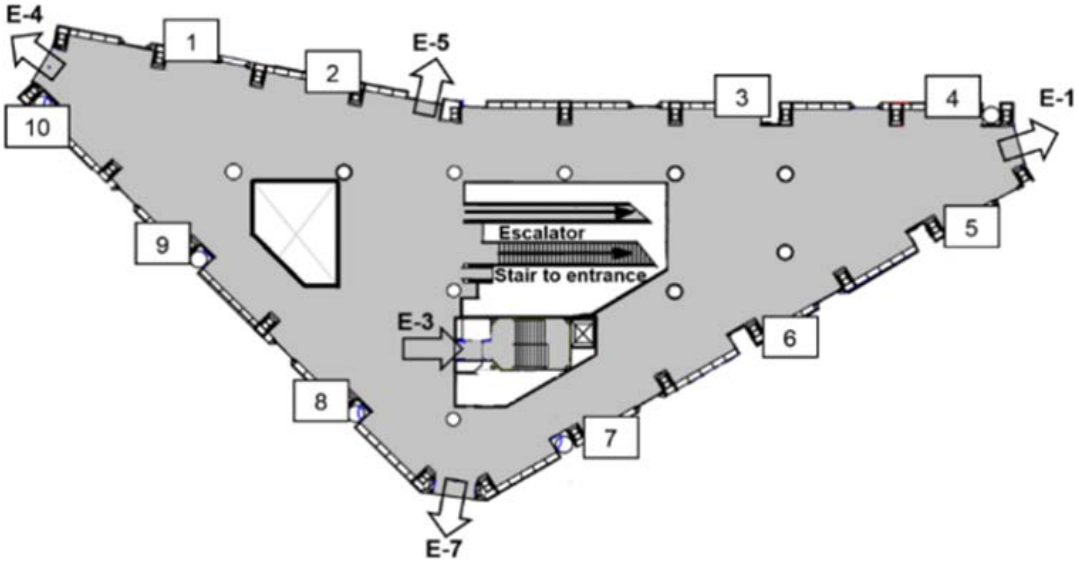
Emergent norm theory (ENT), Turner and Killian, 1987

4. Evacuamos en grupo

Feinberg and Johnson, 2001; Kuligowski, 2016

Conducta colectiva

Experimentos



Conducta colectiva

Experimentos

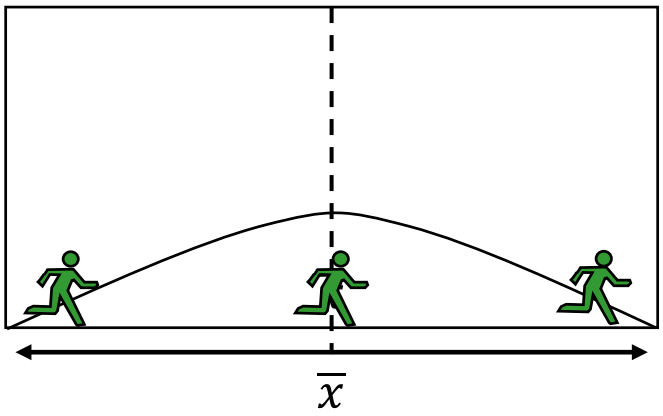
$$H_0: UCV(X)_i < LCV(X)_t$$
$$H_1: UCV(X)_i \nless LCV(X)_t$$

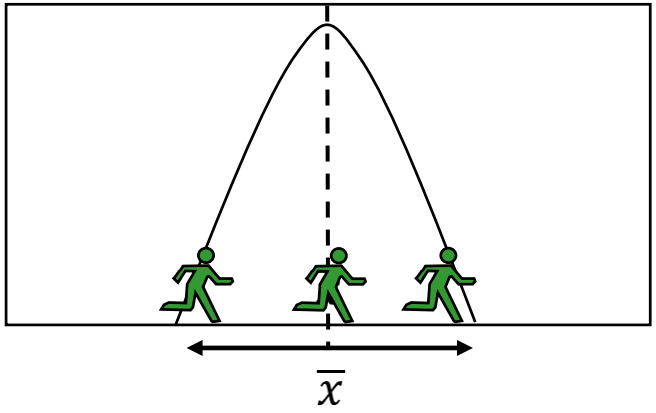
Donde:

$UCV(X)_i$ = Intervalo de confianza superior del Coeficiente de Variación de la variable X para el i-th grupo (CV(X)i);

$LCV(X)_t$ = Intervalo de confianza inferior del Coeficiente de Variación de la variable X para todos los grupos ($CV(X)_t$);

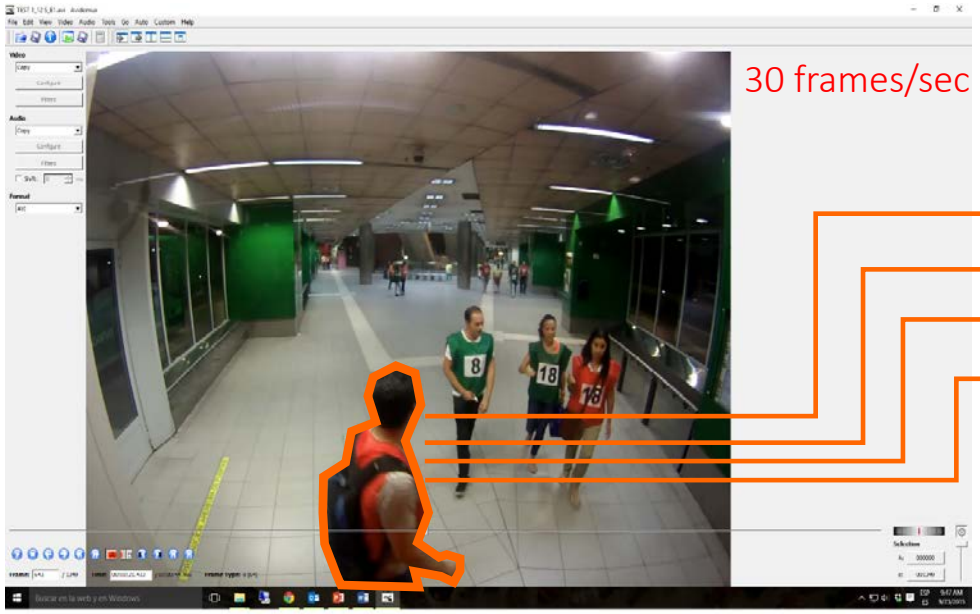
$$G(X)_i = 1 - \frac{CV(X)_i}{CV(X)_t}$$





Conducta colectiva

Experimentos



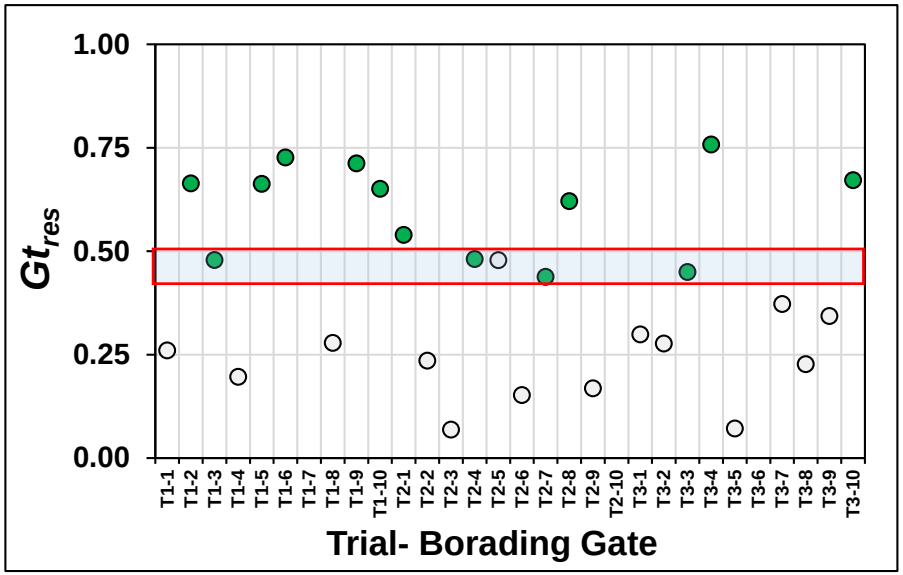
- Localización inicial
- Salida utilizada
- Tiempo de respuesta (t_{res})
- Tiempo de salida (t_{exit})

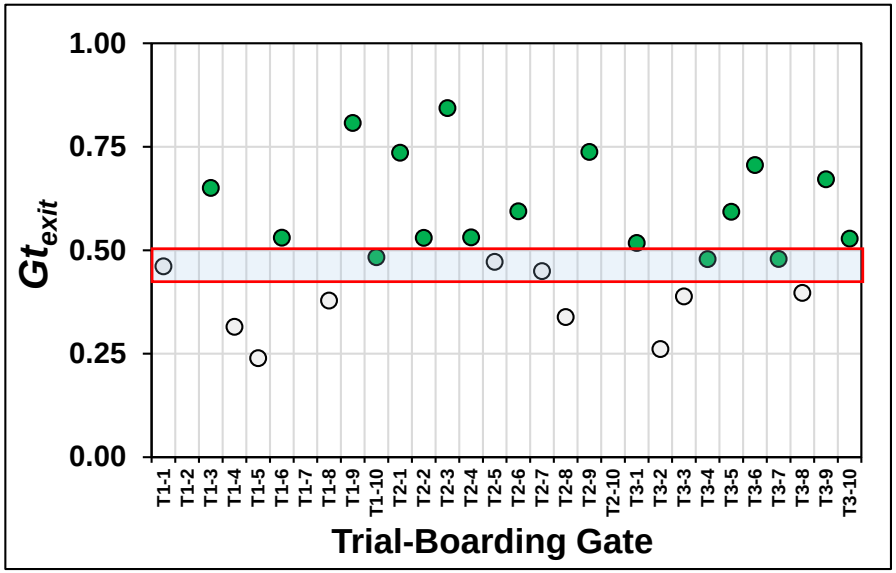
Conducta colectiva

Experimentos

$$G(X)_i = 1 - \frac{CV(X)_i}{CV(X)_t}$$

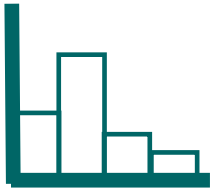
● = H_0: ; ○ H_1:





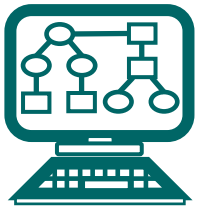
Región de incertidumbre entre 0.44 y 0.50

Conclusiones



Datos

Necesidad:
Enfoque científico (observación-conocimiento-aplicación)



Escenarios

Reto:
Modelos especializados (nuevos procesos)

Aplicaciones

Tendencia:
Modelos para gestión en tiempo real

Gracias!

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-

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