Crowd Behavior

Aleardo Cossi

81

81

every year more than 80 people are trampled or crushed to death at stadiums, concert halls or other crowded events

- Simulate collective human behavior and predicting crowd dynamics
- Simulate people behavior in situations such as fires in crowded buildings
- Explore how to design public buildings

My project was about simulating crowd behavior and predicting crowd dynamics

I wanted to focus on people behavior in situation were fire start in crowded buildings

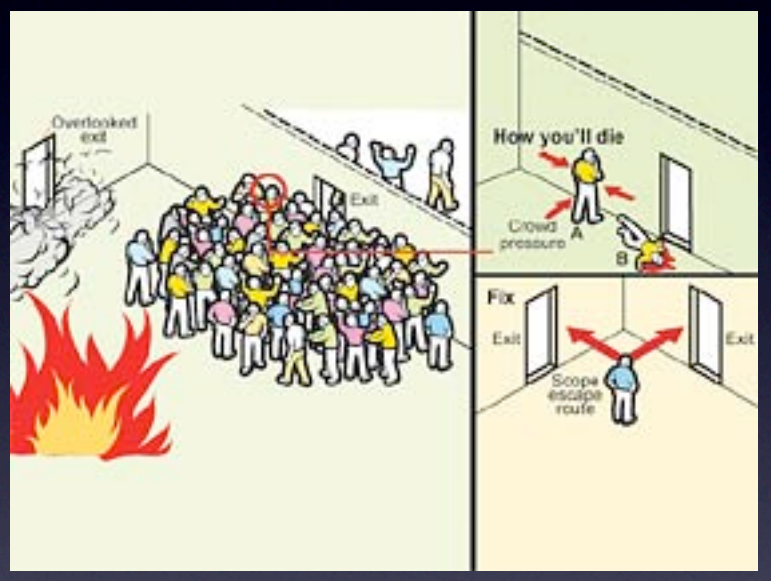
The idea behind those kind of simulation is to explore how to design public buildings in order to make them safer

- Previous simulations of crowd behavior have used a model based on fluid flow through pipes, but these ignored the actions of individuals
- This is an agent based simulation that use collaborative diffusion to simulate pedestrian behavior

Until recently simulation of crowd behavior were based on fluids simulation and ignored the actions of individuals

my approach is to take in consideration those actions using and agent based simulation that take advantage of collaborative diffusion.

- Simulate a particular case of crowd behavior
- Smoke filled rooms, reduced visibility
  - Dangerous herding behavior
  - Herding versus Individualism



I decided to focus on crowd behavior in smoke filled rooms were visibility is low

As you can see in the picture people feel safer when grouped together and this can be very dangerous, for example an other door is available but nobody seems to notice it.

Demo

Now a short demo, this is a very simple situation only to show you, I have some more complex one

As you can see there is a fire, a lot of peolpe, an exit, and this area on the right that is safe.

Now i run the simulation and you can see that people start to flee.

The Red ,Green and Blue Colors are the plotted diffusions, the diffusion influence the behavior of people,

the red one represent the heat,

the blue one instead signal were people will be safe, note that the blue diffusion trespass a little the exit door , if an individual happen to be near the door it will sense it and exit.

The green is the diffusion that represent the presence of people, it is using this diffusion that i can model individualism and the hearding behavior

Results

Now the result of the simulation

Some Info

- Fixed values
  - 80 persons
  - 1 exit
  - 60 seconds
- 3 different conditions
  - No smoke, visibility 100%
  - Smoke, visibility 50%
  - Smoke, visibility 10%

this are the vales used in the simulation

Visibility 100% Visibility 50% visibility 10%

Individualism Herding

This graph will show the result of different simulations

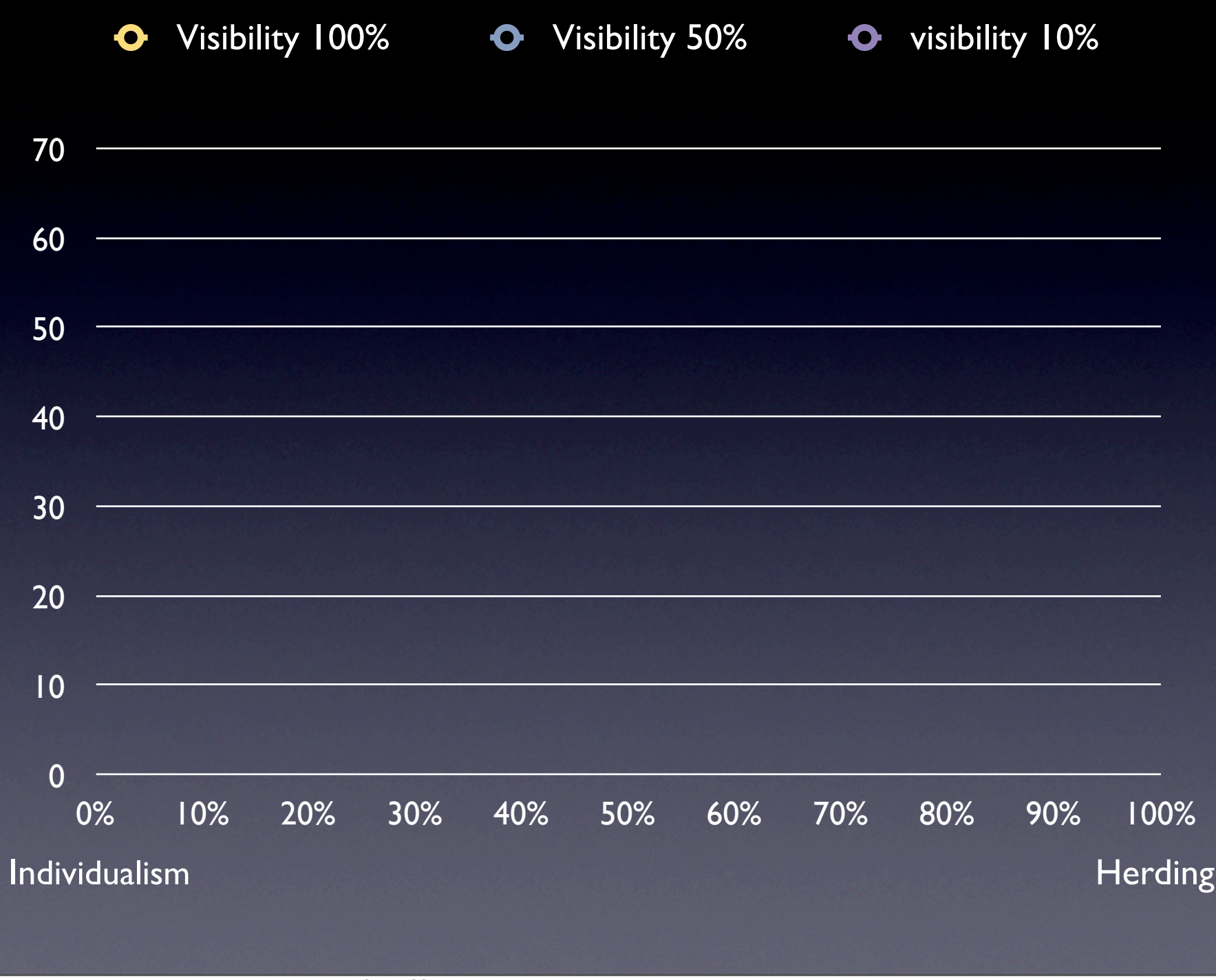
On the vertical axis there is the number of people that was able to escape from the room

On the horizontal axis there is the amount of herding used for the test

With a visibility of 100% 70 people can escape from the smoke filled room in 60 seconds

when we reduce the visibility to 50% only an average of fifty persons is able to escape

It is reducing the visibility to 10% that we begin to see an interesting behavior, now i will change the scale in order to better see the shape



This graph will show the result of different simulations

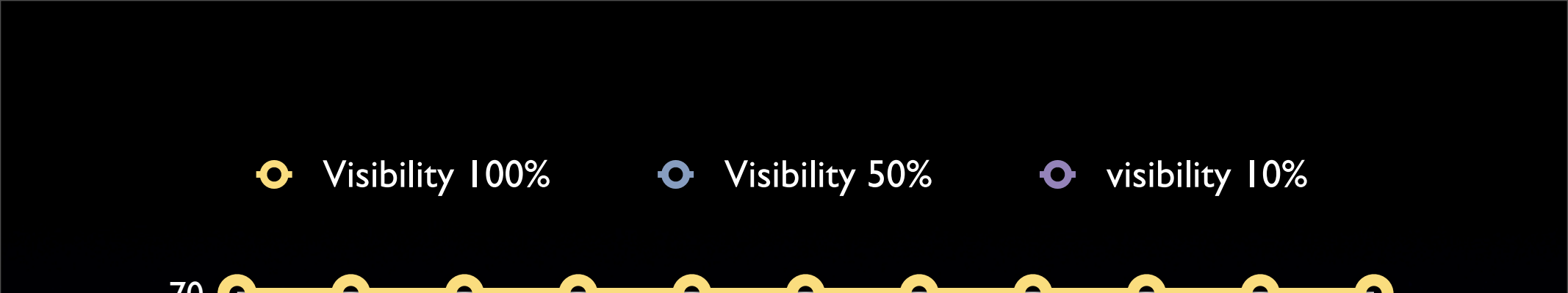
On the vertical axis there is the number of people that was able to escape from the room

On the horizontal axis there is the amount of herding used for the test

With a visibility of 100% 70 people can escape from the smoke filled room in 60 seconds

when we reduce the visibility to 50% only an average of fifty persons is able to escape

It is reducing the visibility to 10% that we begin to see an interesting behavior, now i will change the scale in order to better see the shape



This graph will show the result of different simulations

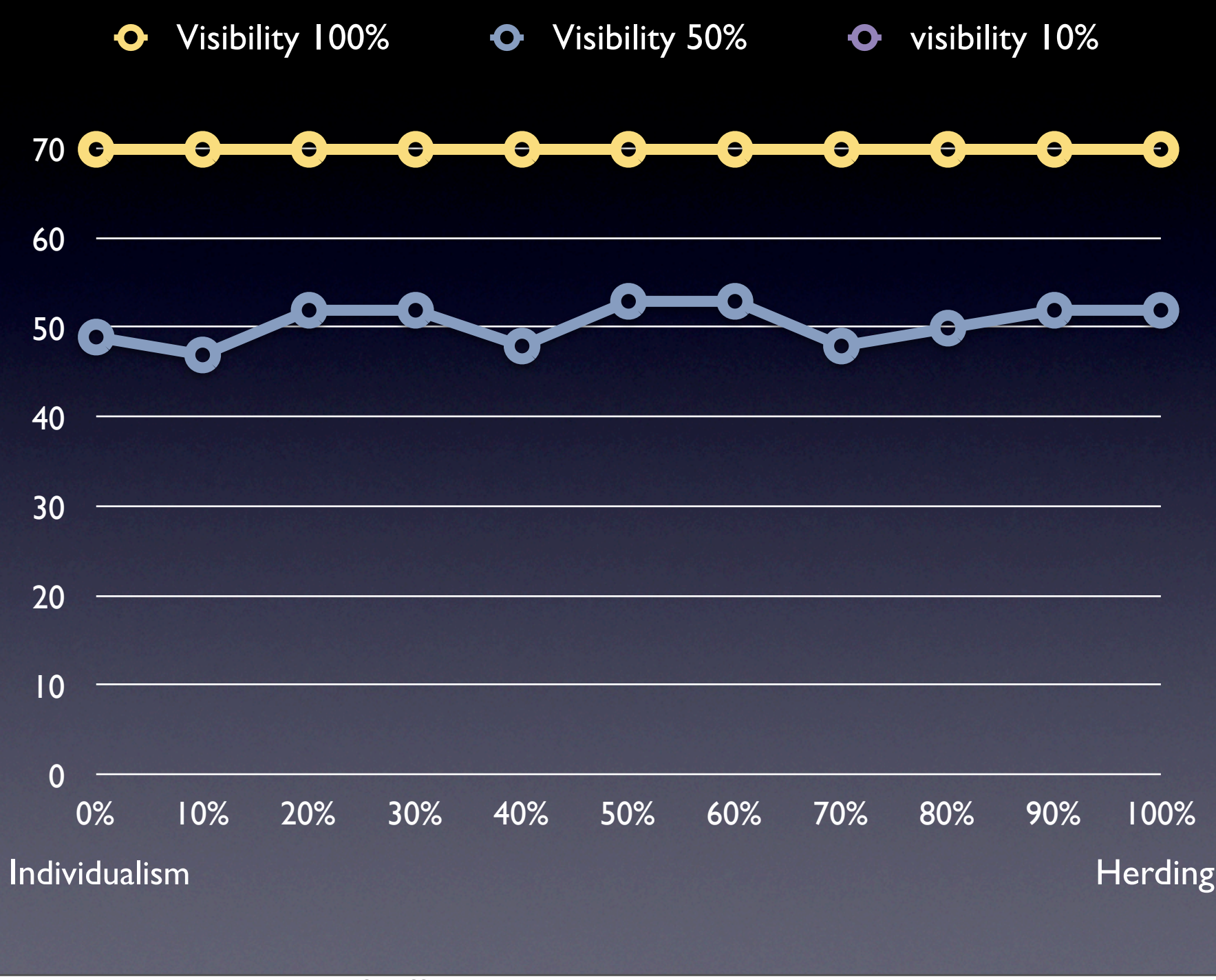
On the vertical axis there is the number of people that was able to escape from the room

On the horizontal axis there is the amount of herding used for the test

With a visibility of 100% 70 people can escape from the smoke filled room in 60 seconds

when we reduce the visibility to 50% only an average of fifty persons is able to escape

It is reducing the visibility to 10% that we begin to see an interesting behavior, now i will change the scale in order to better see the shape



This graph will show the result of different simulations

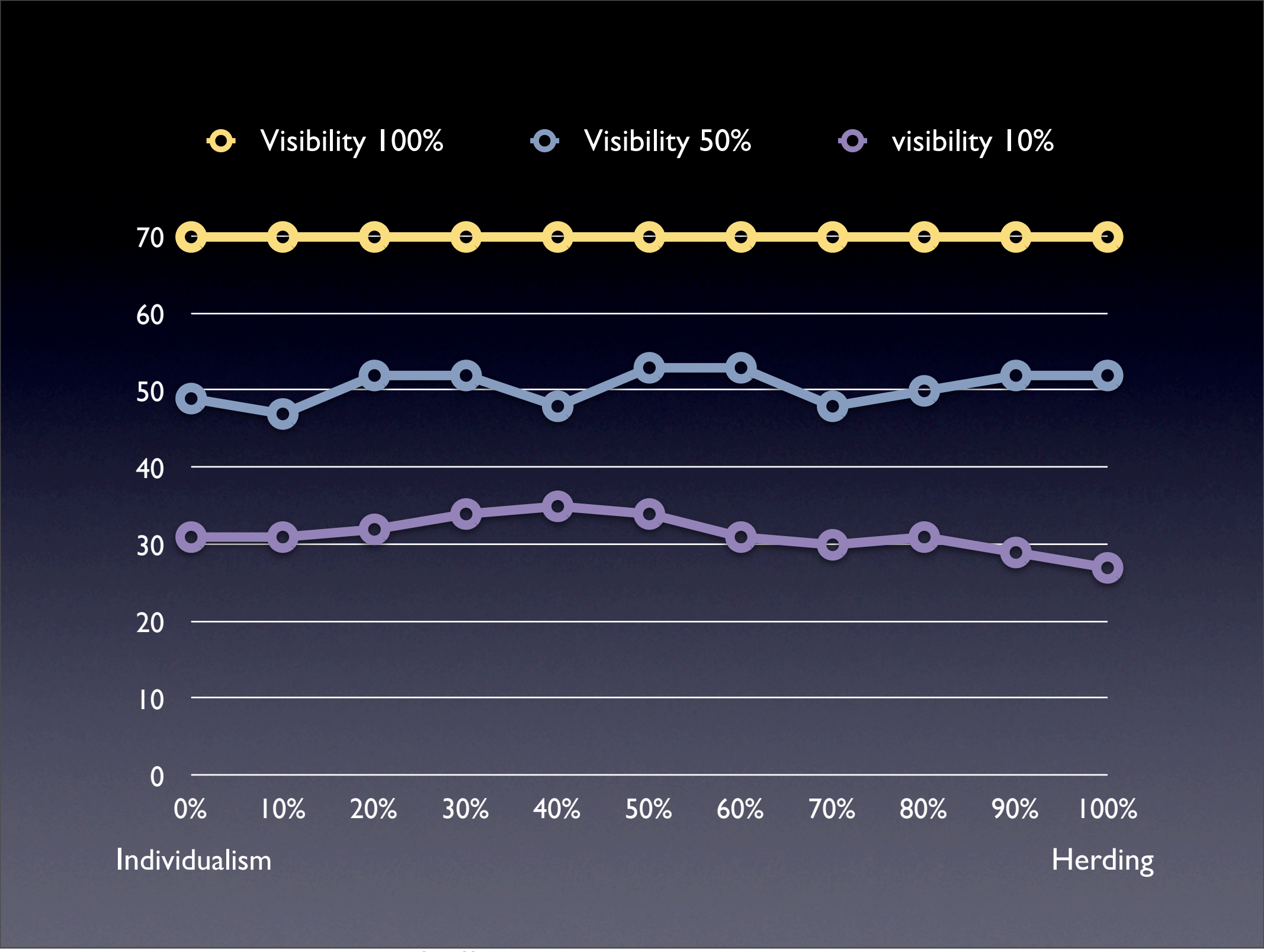
On the vertical axis there is the number of people that was able to escape from the room

On the horizontal axis there is the amount of herding used for the test

With a visibility of 100% 70 people can escape from the smoke filled room in 60 seconds

when we reduce the visibility to 50% only an average of fifty persons is able to escape

It is reducing the visibility to 10% that we begin to see an interesting behavior, now i will change the scale in order to better see the shape



This graph will show the result of different simulations

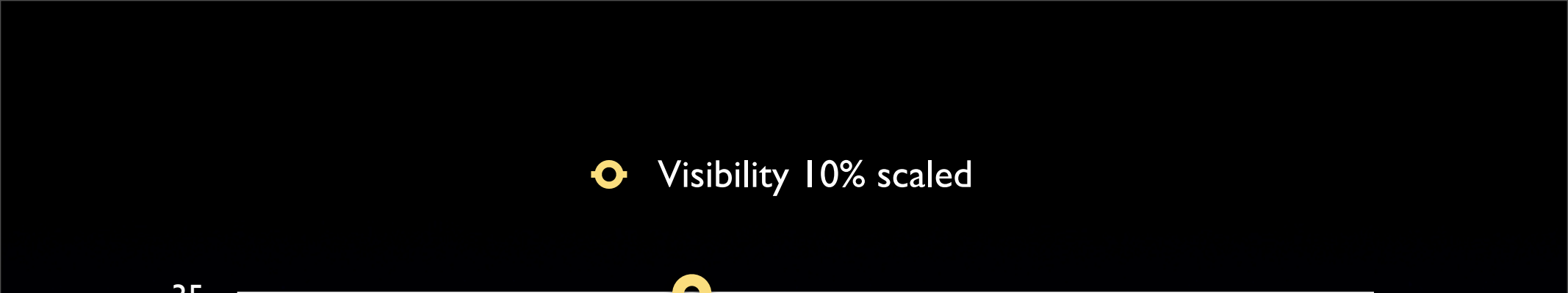
On the vertical axis there is the number of people that was able to escape from the room

On the horizontal axis there is the amount of herding used for the test

With a visibility of 100% 70 people can escape from the smoke filled room in 60 seconds

when we reduce the visibility to 50% only an average of fifty persons is able to escape

It is reducing the visibility to 10% that we begin to see an interesting behavior, now i will change the scale in order to better see the shape



This are the same values as before only the scale is changed

you still have the number of people that managed to escape on the vertical axis and the amount of herding on the horizontal one

as you can see there is, around 40%, a better chance to escape if you apply a little of herding behavior, because it can happen that one of the group has spotted an exit.

But as a more general rule individualism is better than a full herding behavior.

How To Behave

- Individualism is better than a herding behavior
- A little of herding can help you find a door faster

In conclusion the simulation has shown that if you are in room with a thick smoke and you act individually you have more chance to survive. Also a litle of herding behavior can help you.

Questions?

Acknowledgments

- D. Helbing et.al, Simulating dynamical features of escape panic. Nature 407, 487-490 (2000).
- http://angel.elte.hu/~panic/
- http://www.wired.com/wired/archive/12.01/start.html?pg=9