Healthy urban space ratios through Environmental and Human Aspects

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***Abstract*-- Since the early days of the COVID-19 epidemic, the scientific community has continuously been trying to shed light on various issues such as the mechanisms driving the spread of the virus, its environmental and socio-economic impacts, and required recovery and adaptation plans and policies. Given the high concentration of population and economic activities in cities, they are frequently spotted by COVID-19 infections.**

Changes in infectious disease transmission patterns are a likely major consequence of climate pollution. The population now lives in urban areas, we found a consistent negative association between urban green space exposure and mortality, heart rate, and violence, and positive association with wellbeing, attention, and physical activity.

The built environment, natural and social environments have a significant effect on health and wellbeing. The design and construction of new communities provide an opportunity to explore neighborhood's' design and planning for human health. Neighborhood design can contribute to a sense of place and the health of residents by changing the ratios of the car lanes, pedestrian paths, cycle lanes, green spaces, and public spaces for people.

Keywords; healthy spaces; new urbanism; urban ratios; air temperature; air quality; PMV.

I. INTRODUCTION

urban design factors can affect public health in several ways, including physical activity, traffic accident risk, and sound level, pollution exposure, access to health resources, mental health, and affordability, which affect a household's ability to affordability.

The impact of the physical environment on health and well-being has become a common concern of the "new urbanism" called for the reintegration of public health and urban design. The application of human needs in urban space includes air and water clean, safety, transportation, social interaction, and open space for leisure. Can lead to environmental space through:

- Reduction of urban fabric imbalances.
- Car use, air, and noise pollution.

- quality of public spaces, social cohesion.
- Healthy lifestyles and increase employment opportunities

II. PROBLEM DEFINITION

1- The major causes of death and injury in the urban environment today include alcohol, tobacco, drugs, environmental toxins, motor vehicles, and weapons such as guns and knives. These are all areas where the formal health sector has relatively little impact on human health.
2- Public health research indicates that bad social relationships affect human health.
3- planning policies actually incompatible with human health, in particular rigid standards of zoning and design.
4- urban spaces ratios effects on viruses spread which affect on human health

III. METHODOLOGY

in this study, we will apply some changes in Egyptian urban spaces design ratios in three locations including in streets, transportation, public space, green area, buildings to examine the change in space pollution and human thermal comfort. to get healthy urban spaces for people.

IMPLEMENTATION IN EGYPT

Egyptian zoning practices, requiring greater travel distances between where we live, work, and play, may be counter to the original health intent because of car culture, city planning and its allied professions have become aware of the health impacts that our land use and transportation decisions have on the ability to walk and bike, the most common forms of physical activity.
green space in urban areas, is good for health and wellbeing. It has been associated with reducing feelings of stress, increased levels of physical activity, more opportunities for social interaction and assisting in child development, releasing oxygen provide clean air, water and soil, and balances in Egyptian natural urban environment.

A- THE SIMULATION PROGRAMME

The simulation study was undertaken to assess the effects of redesign urban space ratios on human health. the adaptive use of a climatic modeling software innovation named ENVI-met, the program used to model climatic models of general structural changes or structural modifications that include elements of the natural and built environment such as vegetation, buildings, roads, soil and also climatic behavior simulation of people.

B- THE SIMULATION DATA

- Simulation date: 1/7/2020
- Simulation time: 16:00
- climate data from energy plus program.

Table 1 Climate data

Wind Direction (0:N..90:E..180:S..270:W..)	240
Roughness Length z0 at Reference Point	0.1
Initial Temperature Atmosphere [K]	318.5
Specific Humidity in 2500 m	10.8
Relative Humidity in 2m [%]	13

- Table 2 PMV data

PMV	
Walking Speed (m/s)	1.1
Energy-Exchange	133
Mech. Factor	0
Heat transfer resistance cloths	0.5

- Table 3 building data

BUILDING	
Inside Temperature [K] =	305
Heat Transmission Walls [W/m²K] =	0.5
Heat Transmission Roofs [W/m²K] =	0.4
Albedo Walls =	0.3

- Table 4 soil data

Car lane, parking	Asphalt Road
Bike lane	Brick Road (yellow stone)
Pedestrians and building	Loamy Soil

Table 5 soil temperature data

Soildata	
Initial Temperature Upper Layer (0-20 cm) K	318.5
Initial Temperature Middle Layer (20-50 cm) k	318.5
Initial Temperature Deep Layer (below 50 cm) K	315.5

Table 6 plants data.

plants
- Tree 4m dense, Ficus Netida
- Tree 10 m very dense, leafless base
- Grass 8 cm aver height

C- CASE STUDIES AND SIMULATION

C.1- OBOUR CITY

Obour city is second generation Satellite city located around and close to Cairo with a short and middle term objective of minimizing population density and benefiting from the available basic structures such as services, and labor in attracting population, activities, creating new job opportunities, and economic elements that are associated with the mother city.

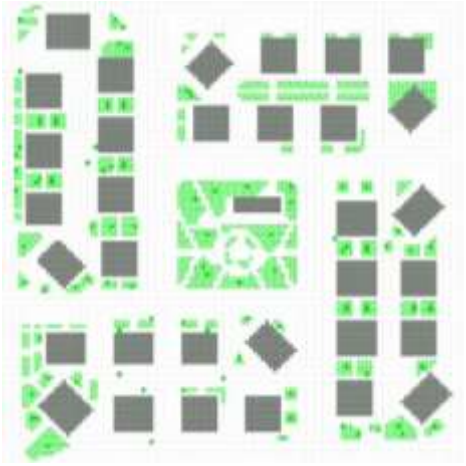


Figure 1 show the urban planning of the location.
Source: Envi mat programme.

- TABLE 7 EVALUATION OF SPACE. source: By the researcher

Elements		Evaluation		
Street	Provide legible, connected street network			
	provide safe pedestrian			
	Provide traffic planning			
	interesting and safe streets			
	encourages walking, through small connected blocks			
Transport	Locate public transport stops			
	supports public transport			
	distances that need to be travelled between activities.			
	Mixed use development			
	makes driving, walking and cycling more pleasant			
	enables the adverse effects of transport			
	reduces the need to travel			
	supports walking and cycling			
Public space	Walkable nodes people			
	Promote higher density residential activities			
	Link landmarks and nodes with strongly defined paths.			
	Use contrast and differentiation			
	supports public spaces, creating safe			
	creates safety places that have little movement			
Green area	Protect ecologically			
	Use large park areas			
	Provide for continuity of green			
	Extend tree planting			
	Provide a diverse range of plant species			
Building	Allow for stormwater treatment.			
	Promote mixed-use buildings.			
	improves energy efficiency			
	helps form active ‘edges’			

low minimum high

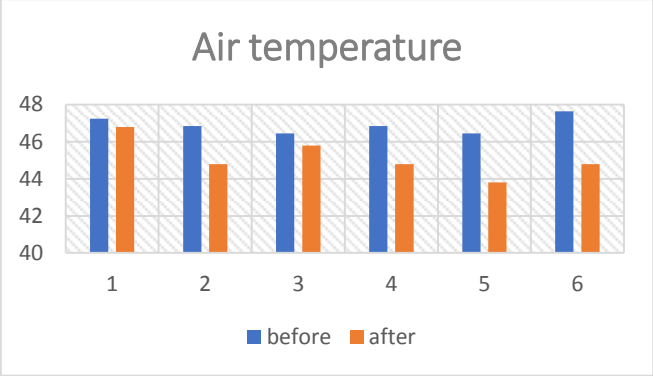
Table 8 Ratios of the urban elements in the simulation. source: By the researcher

	before	after
public space	2.6	7
green area	9.8	12.8
car road	23.7	13
pedestrians	46.5	42
cycle lane	0	7.8
building	17.4	17.4

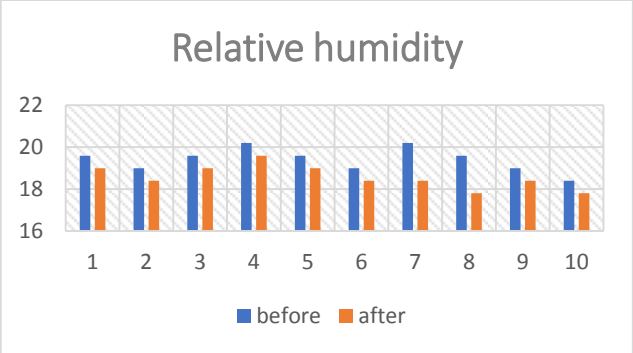
- The car road ratio includes 3% for parking area
- Buildings in new design have green roof for storm water management.

SIMULATION RESULTS IN OBOUR CITY

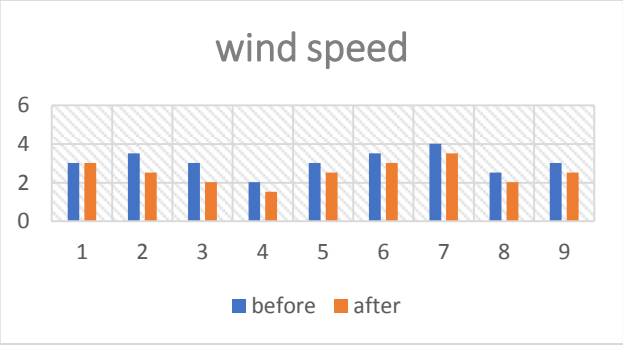
1-Figure 2 Air temperature reduction is 2:3 oC after redesign. source: By the researcher



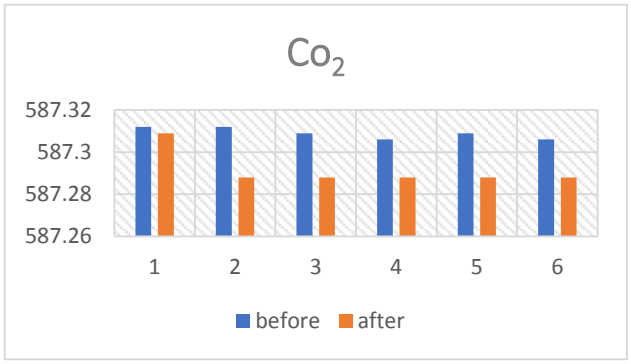
2- Figure 3 Relative humidity ratio reduction is 1% - 1.4%. source: By the researcher



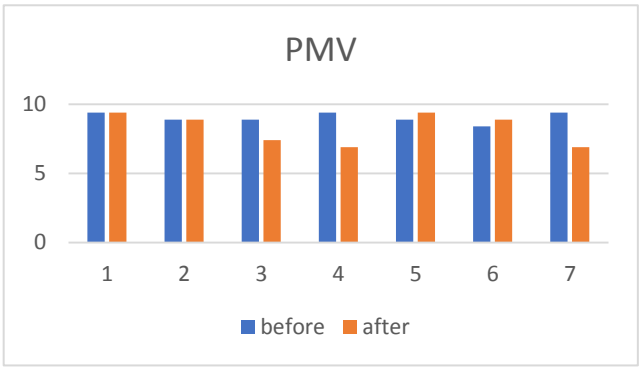
3-Figure 4 Wind speed reduction is 0.5m/s :1 m/s. source: By the researcher



4- Figure 5 Co_2 reduction average is 0.2 mg/m^3 in the space. source: By the researcher



5- Figure 6 PMV reduction average is 2 in urban space. source: By the researcher



C.2- SHUBRA AL-KHAIMAH

Shubra Al-Khaimah district is one of the most crowded areas, so the road network is developing and doubling and the density of transportation increases rapidly, so I witnessed a change in many areas, where many bridges were established to solve the traffic crisis and avoid traffic tics, which led to an increase in the pollution problem and this increased the impact on human health and increased the rate Virus spread.

Figure 7 show the urban planning of the location in the simulation program.
Source: Envi mat programme

Table 10 Ratios of the urban elements in the simulation.

	before	after
public space	0	7.4
green area	0.5	4.06
car road	62.32	27.2
pedestrians	0	17.4
cycle lane	0	6.76
building	37.18	37.18

- The car road ratio includes 1.4 % for parking area

Buildings in new design have green roof for storm water management

Table 9 Evaluation of space. source: By the researcher

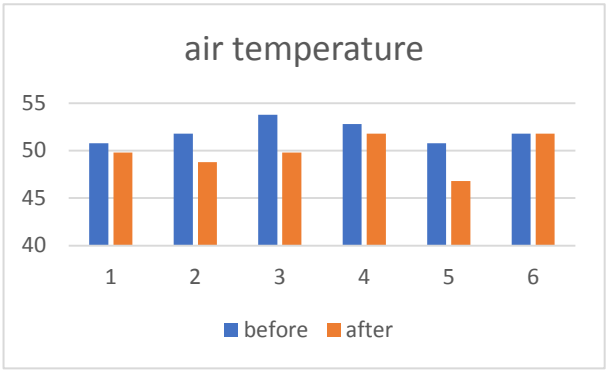
Elements		Evaluation		
Street	Provide legible, connected street network			
	provide safe pedestrian			
	Provide traffic planning			
	interesting and safe streets			
	encourages walking, through small connected blocks			
Transport	Locate public transport stops			
	supports public transport			
	distances that need to be travelled between activities.			
	Mixed use development			
	makes driving, walking and cycling more pleasant			
	enables the adverse effects of transport			
	reduces the need to travel.			
	supports walking and cycling.			
Public space	Walkable nodes people.			
	Promote higher density residential activities.			
	Link landmarks and nodes with strongly defined paths.			
	Use contrast and differentiation.			
	supports public spaces, creating safe.			
	creates safety places that have little movement.			
Green area	Protect ecologically			
	Use large park areas			
	Provide for continuity of green			
	Extend tree planting			
	Provide a diverse range of plant species			
	Allow for stormwater treatment.			

Building			
	Promote mixed-use buildings.		
	improves energy efficiency		
	helps form active ‘edges’		

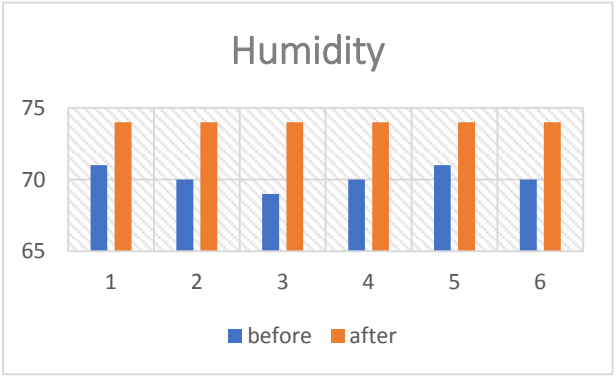
low minimum high

SIMULATION RESULTS IN Shubra Al-Khaimah

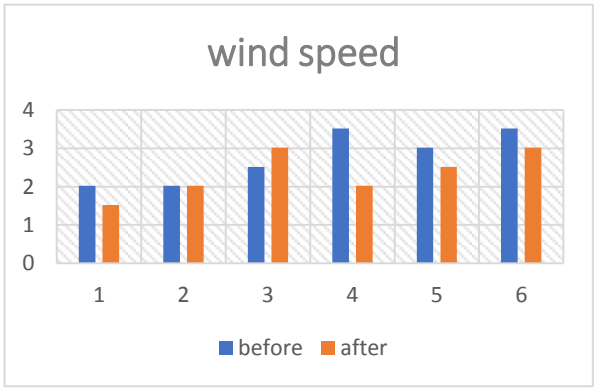
1- Figure 8 Air temperature reduction is 3:4 ^{o}C after redesign. source: By the researcher



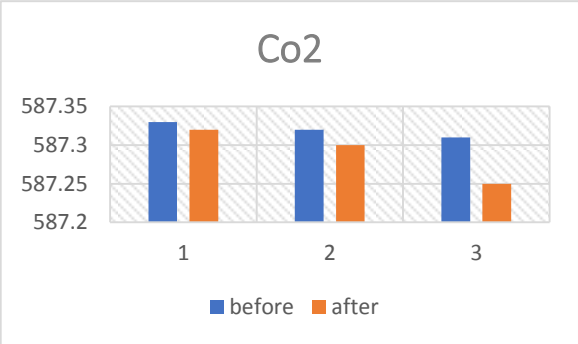
2- Figure 9 Relative humidity ratio increased about 2% - 3%. source: By the researcher



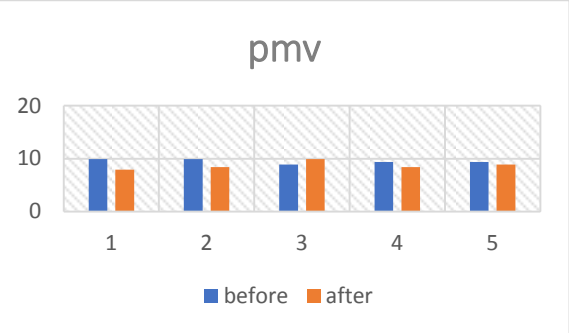
3- Figure 10 Wind speed reduction average is 0.5m/s – 1.5 m/s. source: By the researcher



4- Figure 11 Co_2 reduction average is 0.06 mg/m^3 in the space. source: By the researcher



5- Figure 12: PMV reduction average is 2 in urban space. source: By the researcher



C.3- ROXY, MISR EL-GADEDA

Modern Heliopolis was originally filled primarily with aristocratic Egyptians, as well as some European nationals. Unlike other modern Cairene suburbs around the start of the 20th century, Heliopolis had a significantly larger percentage of Egyptian citizen residents. After the 1952 revolution led by Nasser, it became home to too much of Cairo's educated middle class. As Cairo has expanded, the once large distance between Heliopolis and Cairo has vanished and it is now well inside the city.

Figure 13 show the urban planning of the location in the simulation program.
Source: Envi mat programme

- Table 11 Evaluation of space

Elements		Evaluation		
Street	Provide legible, connected street network			
	provide safe pedestrian			
	Provide traffic planning			
	interesting and safe streets			

	encourages walking, through small connected blocks			
Transport	Locate public transport stops			
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	Extend tree planting			
	Provide a diverse range of plant species			
Building	Allow for stormwater treatment.			
	Promote mixed-use buildings.			
	improves energy efficiency			
	helps form active ‘edges’			

low minimum high

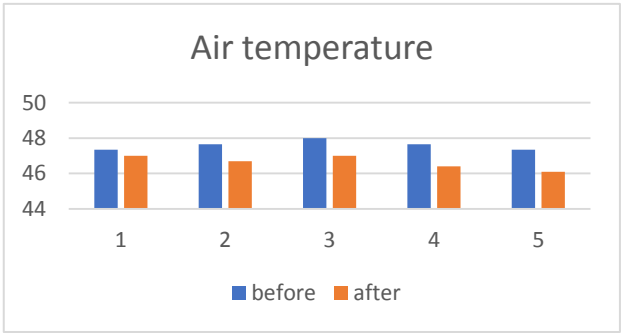
-Table 12 Ratios of the urban elements in the simulation program.

	before	after
public space	**6.3**	7.1
green area	**13.6**	14.4
car road	**15.5**	12
pedestrians	**35.3**	31.2
cycle lane	**0**	6
building	**29.3**	29.3

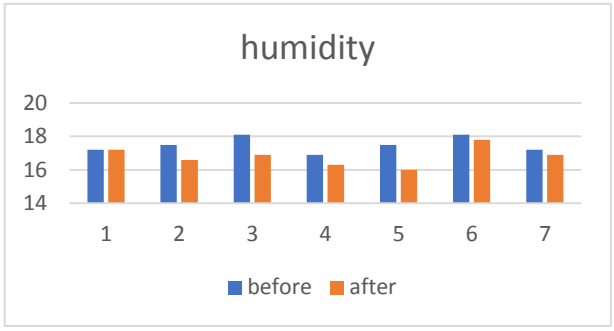
- The car road ratio includes 0.9 % for parking
- Buildings in new design have green roof for storm water management.

SIMULATION RESULTS IN Roxy, Misr El-Gadeda

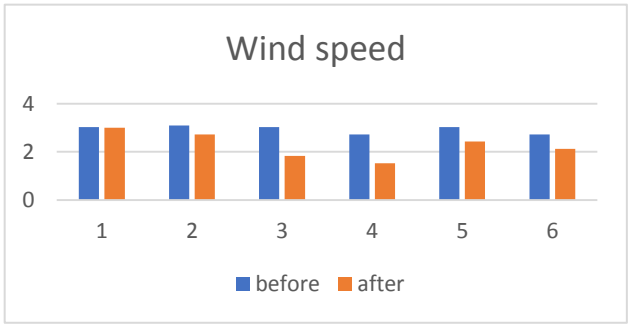
1- Figure 14 Air temperature reduction is 1:2 ^{o}C after redesign. source: By the researcher



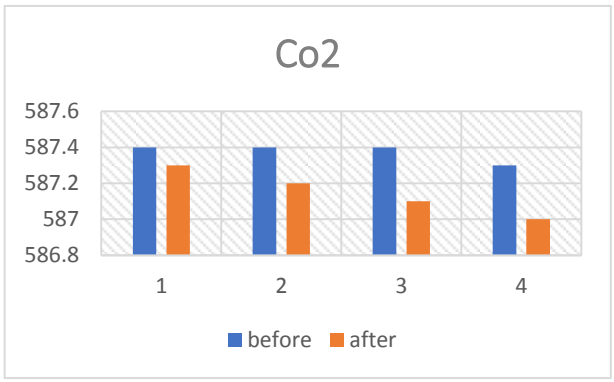
2- Figure 15 Relative humidity ratio reduction about 1.5%. source: By the researcher



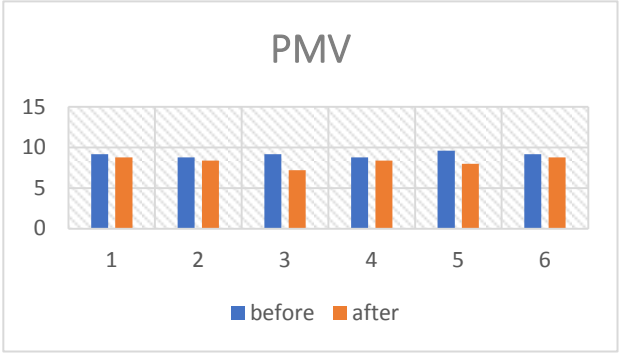
3- Figure 16 Wind speed reduction average is 0.5m/s – 1.8 m/s. source: By the researcher



4- Figure 17; Co_2 reduction average is 0.3 mg/m^3 in the space. source: By the researcher



5- Figure 18; PMV reduction average is 2 in urban space. source: By the researcher



D- COMPARISON BETWEEN CASE STUDIES

Table 13 results, Comparison between simulations in Egypt

	Obour city	Roxy	Shubra Al-Khaimah	result
Air temperature	Air temperature reduction is 2:3 ^{o}C after redesign	Air temperature reduction is 1:2 ^{o}C after redesign.	Air temperature reduction is 3:4 ^{o}C after redesign	Air temperature reduction about 1:4 ^{o}C
Humidity	Relative humidity ratio reduction is 1% - 1.4%	Relative humidity ratio reduction about 1.5%	Relative humidity ratio increased about 2% - 3%	Humidity increase in high density areas about 3%, but in low density area decreasd about 1.5%.
Wind speed	Wind speed reduction average is 0.5m/s – 1 m/s	Wind speed reduction average is 0.5m/s – 1.8 m/s	Wind speed reduction average is 0.5m/s – 1.5 m/s	Wind speed reduction about 0.5m/s – 1.8 m/s
Co_2	Co_2 reduction average is 0.02mg/m^3 in the space	Co_2 reduction average is 0.3 mg/m^3 in the space	Co_2 reduction average is 0.06 mg/m^3 in the space.	Co_2 level reduced average about 0.02 : 0.3 mg/m^3. The reduction changing according to many variables
PMV	PMV reduction average is 2% in urban space	PMV reduction average is 2% in urban space	PMV reduction average is 2% in urban space	PMV reduction average is 2%

E- CONCLUSION

The growth of cities is a new trend that has major impacts on both the global and local environment and human health, so we start to solve urban spaces problems which effect on human health.

From previous study redesign urban spaces in Egypt can improve human health by:

- ✓ reducing the ratio of car lanes
- ✓ Create safe pedestrian lanes.
- ✓ Create safe cycle lanes.
- ✓ Increase green areas
- ✓ Increase public spaces

This variable leads to:

- ✓ Air temperature reduction

- ✓ Wind speed reduction
- ✓ CO2 reduction
- ✓ PMV reduction

F- RECOMMENDATION

Now, we must take care of our spaces, buildings, and streets, everything around us affects our health and our lives, all the world is now suffering from the problem of the spread of COVID-19, we can reduce viruses spreading with our designs, we can stop its spread by using the suitable decision in our new urbanism.

G- REFERENCES:

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