

Keynote speech

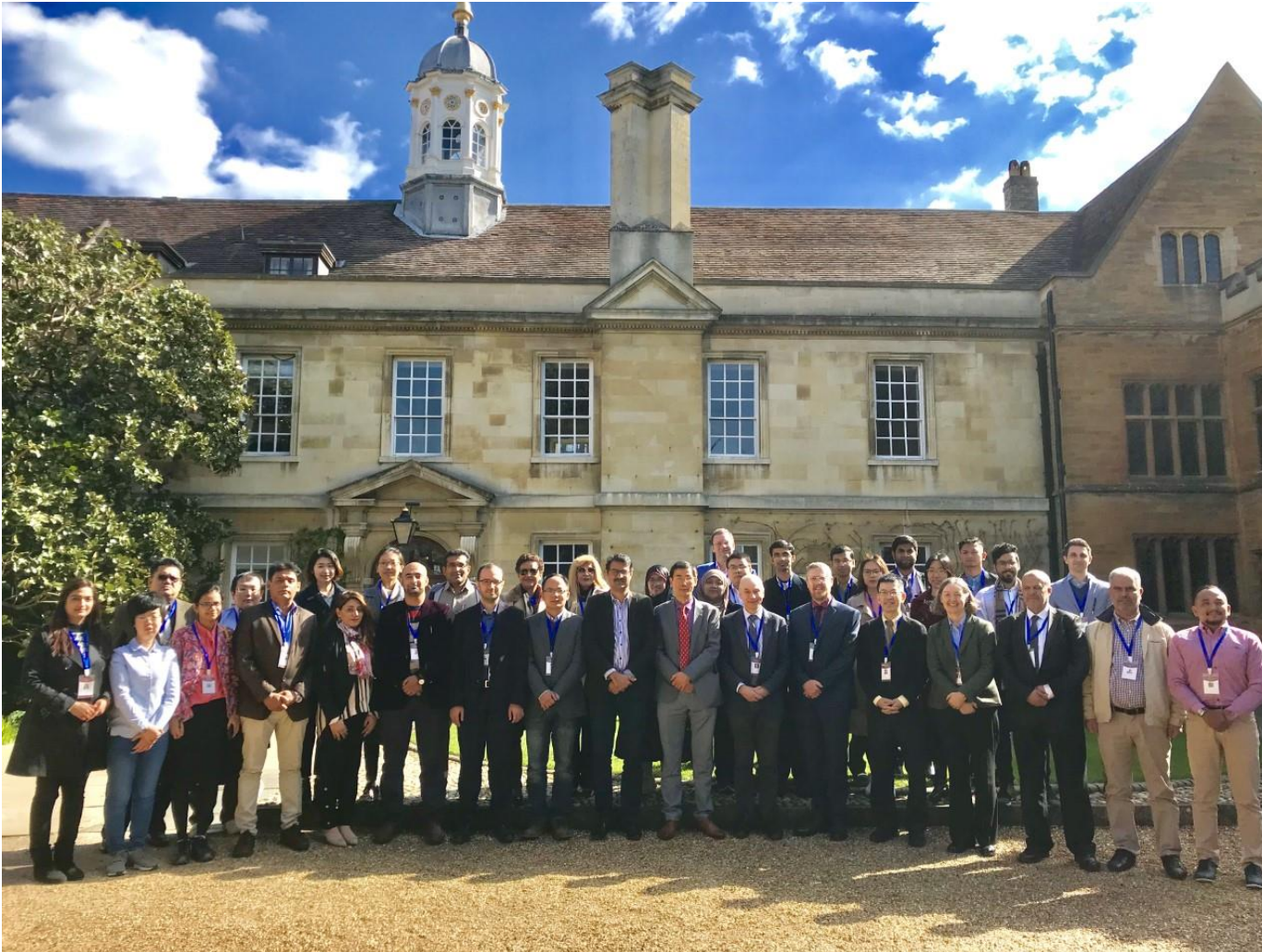
on the **Metaverse** (Meta universe) framework, strategies & technologies for the 9th ICIM 2023 conference at Worcester College, the University of Oxford, Oxford, England, UK, and the 8th ICIM 2022, Cambridge, England, UK.

By **Shuliang Li, University of Westminster**



Overview

- Framework/paradigm & technologies
- Strategies & quantum strategies
- Consumer behaviour across the worlds of the Metaverse
- Metaverse analytics



The **Metaverse** is an Internet and computer-based, and socially connected networking space of three-dimensional augmented virtual-reality worlds (*Definition by Shulaing Li, University of Westminster, 2022*)



Discover new ways to stay connected with friends and family

▶ Watch Now

-  Michael
-  Naomi
-  Mom



Connection is evolving
and so are we.



The Metaverse: Framework/paradigm & applications

- ❑ Mark Zuckerberg Meta
- ❑ Immersive
- ❑ Digital (& future quantum) avatar engagement dynamics
- ❑ 3D interactions with haptics
- ❑ Sustainability
- ❑ Entrepreneur
- ❑ Open innovation
- ❑ The Metaverse for business, finance, games, music, events, showcase and more
- ❑ Branding in the Metaverse
- ❑ Brand virality
- ❑ Avatar consumer behaviour, conversion funnel, purchase, shopping, deshoping, unethical returns, etc.
- ❑ The Metaverse for education

A simplified illustration example of random user engagement simulation for a branded content is shown in Figure 1. Persons in green color are engaged across the social networks, while the white ones are the disengaged and the yellow icons are the reached. Netlogo software tool and multiple software agents, called Turtles, are coded and created to produce the illustration and simulation with graphical animation.

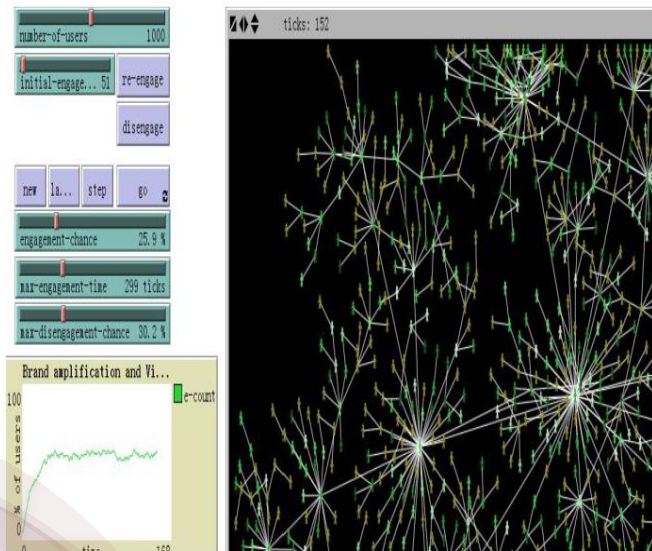
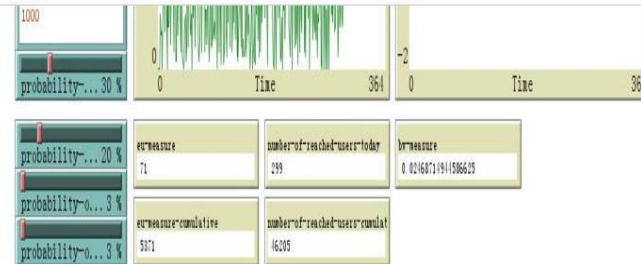


Figure 1. The screenshot for simulation of user engagement with dynamically displayed animation



Brand vitality over social media
By Jun Zhang Li & Shuliang Li, United Kingdom

Figure 2. The screenshot for simulation of the brand vitality

V. THE USE OF FUZZY LOGIC IN ASSESSING THE EFFECTIVENESS AND EFFICIENCY OF BRAND VIRALITY

A. Fuzzy logic and the space of the variables affecting brand vitality in social media

'A fuzzy set is a class of objects with a continuum of grades of membership' [12, page 338]. Let U be a universe of discourse, a collection of objects $\{u\}$. A fuzzy set A in U is characterized by a membership or compatibility function μ_A taking values in the interval $[0, 1]$. A in U is represented as [13, 15]:

$$A = \{ (u, \mu_A(u)) \mid u \in U \} \quad (2)$$

Based upon Fung et al [16]'s work, the set of

An example of brand virality
(Li, Shuliang et al., 2015, IEEE conference proceedings)

Supporting technologies

- ✓ Intelligent digital avatars (quantum avatars in the future)
- ✓ Smart bots, AI bots, live person bots
- ✓ Augmented virtual reality
- ✓ Machine learning, artificial intelligence
- ✓ AI & technologies for haptics, emotion, etc.
- ✓ VR glasses etc.
- ✓ Blockchain – secured, decentralized, internet-enabled, electronic ledger
- ✓ Cryptocurrency, bitcoin
- ✓ Mark Zuckerberg's meta AI
- ✓ Elon Musk's neuralink chips connected to the Metaverse?
- ✓ Big data, avatar analytics, avatar memories
- ✓ Leading Chips (CPU), e.g. Cambridge ARM Cortex, Intel Core
- ✓ Security support (e.g. Karvinen, Tero & Li, Shuliang: Hidden masters security framework & algorithms for client-server computer network architecture dealing with hacking & attacks)

Strategies

- ❖ Mintzberg: Innovation perspective
- ❖ Porter: Differentiation, uniqueness
- ❖ Social networking strategies
- ❖ Metaverse 4Ps marketing strategies
- ❖ Branding strategies
- ❖ Sustainability strategies
- ❖ Big data strategies
- ❖ Quantum entanglement strategies
- ❖ Quantum superposition strategies
- ❖ Quantum computing strategies

Superposed quantum strategies

By Shuliang Li, University of Westminster

Examples



Quantum entanglement strategies for Metaverse interactions



By Shuliang Li, University of Westminster



Calculate the initial state

The quantum formulation evolves by assigning the output of the classical strategies D and C to two vectors, $|C\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$, $|D\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$, where $|C\rangle$ and $|D\rangle$ are in the Hilbert space. In each case, the state of the game is denoted by a vector in tensor product space that is crossed by the classical game basis $|CC\rangle$, $|CD\rangle$, $|DC\rangle$, $|DD\rangle$. Here it is supposed that suppliers and beneficiaries started with $|CC\rangle$. Consequently, qubits $|C\rangle \otimes |C\rangle$ go through an entangling gate $\hat{J} = \exp(i\gamma \hat{D} \otimes \hat{D} / 2)$, which is a reversible two-bit gate with $\gamma \in [0, \pi/2]$.

Quantum entanglement & entangling gate

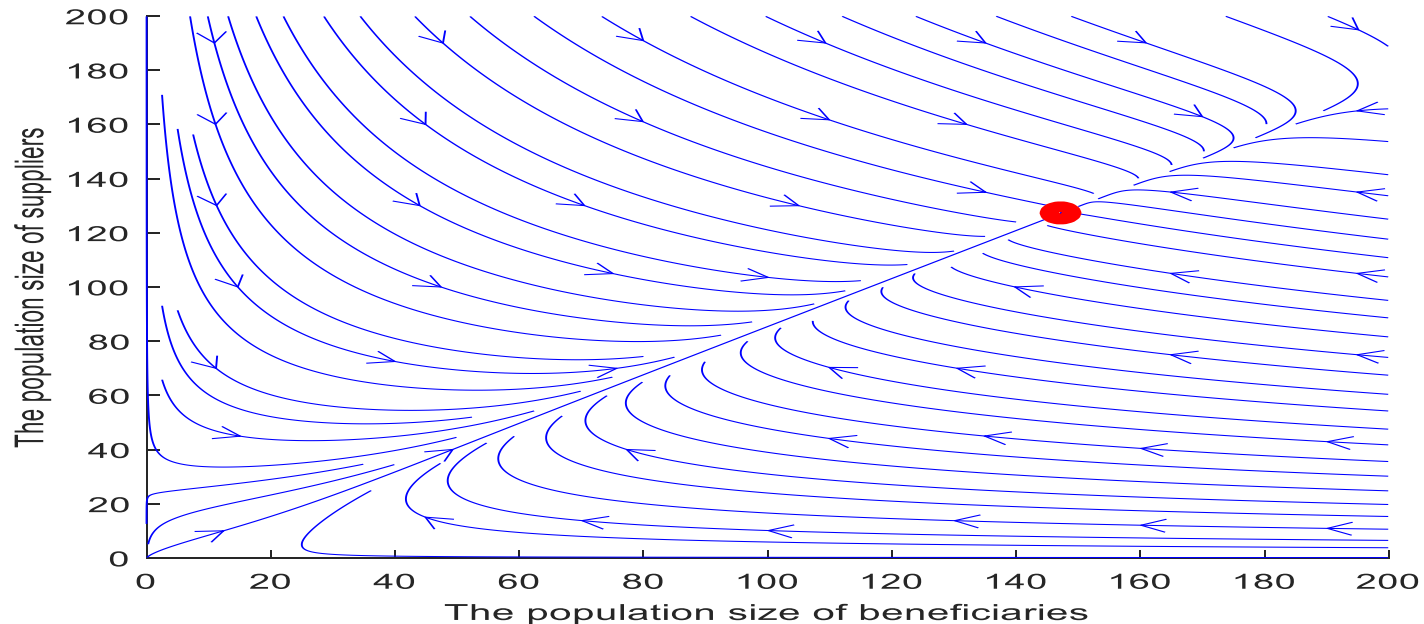
$$\hat{J} = \exp(i\gamma \hat{D} \otimes \hat{D} / 2) = \exp\left(i\gamma/2 \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \otimes \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\right) = \begin{pmatrix} \cos(\gamma/2) & 0 & 0 & i \sin(\gamma/2) \\ 0 & \cos(\gamma/2) & -i \sin(\gamma/2) & 0 \\ 0 & -i \sin(\gamma/2) & \cos(\gamma/2) & 0 \\ i \sin(\gamma/2) & 0 & 0 & \cos(\gamma/2) \end{pmatrix}$$

Source:

Li, S. and Huang, D., 2017. Hybrid Quantum Games. Working paper, the University of Westminster, London, UK. October 2017. Westminster Research Repository.

Huang, D., Delang, C.O., Wu, Y. and Li, S., 2021. An Improved Lotka–Volterra Model Using Quantum Game Theory. *Mathematics*, 9(18), p.2217.

Interactions and the equilibrium point

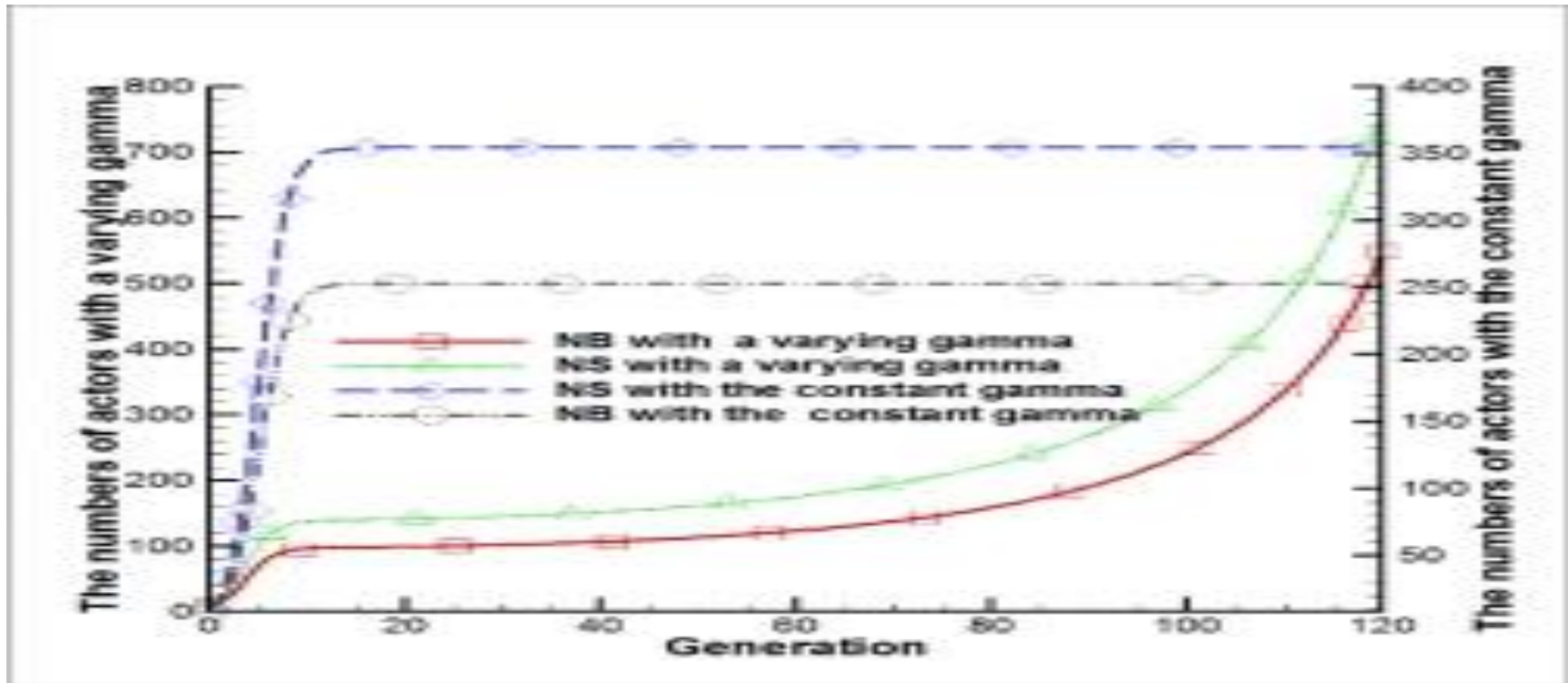


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The numbers of different actors in the scenario with a constant or varying gamma between the suppliers/vendors and the beneficiaries/digital avatars/customers



Source:

Li, S. and Huang, D., 2017. Hybrid Quantum Games. Working paper, the University of Westminster, London, UK. October 2017. Westminster Research Repository.

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Consumer behaviour across the worlds of the Metaverse

(By Shawkat Rahman & Shuliangn Li, U. Westminster)

For example:



**Multi-Agent-Based Modeling
of Deshopping Behavior
Considering Two or More
Shops or Web Sites or worlds**

Multi-Agent-Based Modeling of Deshopping Behavior Considering Two or More Shops or worlds of the Metaverse

By **Shawkat Rahman & Shuliang Li, U. Westminster**

Rahman, Shawkat & Li, Shuliang (2023). Multi-Agent-Based Modeling of Deshopping Behavior Considering Two or More Shops or Web Sites. *The 9th International Conference on Information Management (ICIM2023)*. The University of Oxford, Oxford, England, UK 17 - 19 Mar 2023 IEEE conference proceedings.

The screenshot displays a software interface for a multi-agent simulation. At the top, there is a menu bar with 'Interface', 'Info', and 'Code'. Below it is a toolbar with icons for 'Edit', 'Delete', 'Add', and a 'Button' dropdown. A speed control section shows 'normal speed' and a slider set to 'ticks: 0'. There are also checkboxes for 'view updates' and 'on ticks', and a 'Settings...' button.

The main area is divided into several sections:

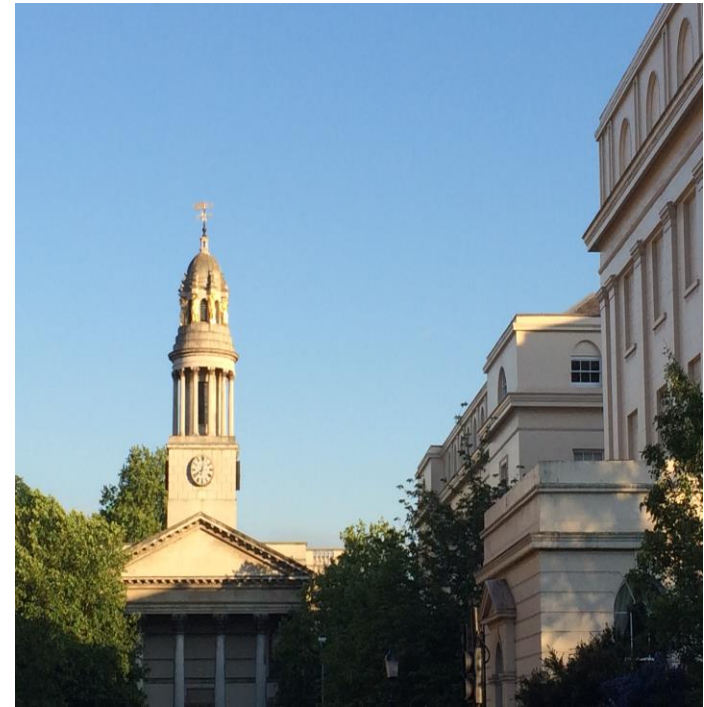
- Global Settings:** Includes 'Setup' and 'Go' buttons, and sliders for 'shopperz' (55), 'deshopperz' (9), and 'max-group-size' (12).
- Individual Shop Variables:** Sliders for 'recovery-value' (0.3) and 'return-ratio' (0.8).
- Return Parameters:** Text explaining 'return-leniency score' as a weighted score of return policy leniency, and 'return-ratio' as the percentage of items returned to the retailer. Below this are sliders for 'return-leniencyscore1' (3) and 'return-leniencyscore2' (3).
- Store Strategies:** Text explaining 'churn-limit' (amount of return-related loss to force a shopper away) and 'refuse-count' (deshop attempt rebuffed). Sliders for 'churn-limit' (3) and 'refuse-count' (7) are shown.

On the right side, there is a large visualization area. It features a network graph with blue nodes and red nodes connected by grey lines. The graph is overlaid on a background divided into two colored regions: a green region labeled 'Shop A' and an orange region labeled 'Shop B'. At the bottom right, a 'money' box shows a value of 1586.

Analytics

Shuliang Li (2022)'s definition on Metaverse: Aiming at analysing what occurred, what is occurring and what will or may occur or happen in the future, Metaverse Analytics is about the use of relevant strategies, procedures, methods and software tools for tracking, gathering, reporting, visualising, interpreting, mining, exploring and reviewing the users and digital avatars' behaviour, activities, interactions and associated data in a computer-generated and socially connected networking space of three-dimensional virtual-reality worlds, called Metaverse or meta universe. Metaverse analytics transforms data into information, knowledge, success and decisions. (Shuliang Li, University of Westminster, 2022). Copyright reserved ©

Metaverse analytics



Metaverse analytics for business (Extended by Shuliang Li)

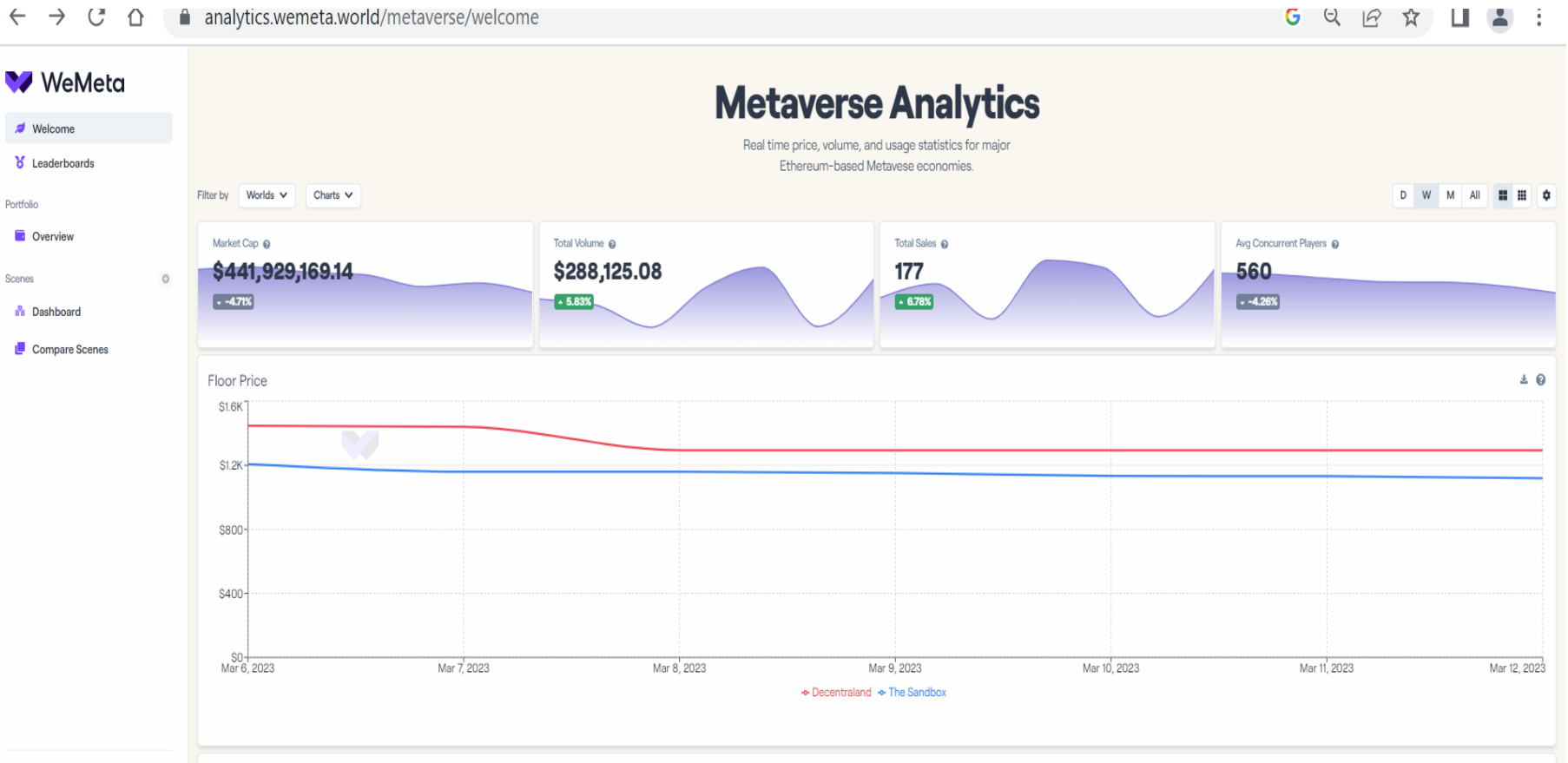
Element	Function	Software tools for Metaverse analytics
Metaverse SN space	Answers: reach, communication, interactions, engagement, etc.	Software tools, e.g. WeMeta, for Metaverse analytics for the elements; Artificial intelligence; Machine learning.
Avatar behaviour, clickstream or touch stream & metrics	Answers the what: Intelligent/smart digital avatars' behaviour, online visitor behaviour, traffic, bounce rate, referrals, conversions ...	
Multiple outcomes	Answers the how much: Sales, revenue, profit margin, costs, avatar/customer retention & loyalty, ...	
Customer churn; Digital avatar churn	Contribute to the why: comments, feedback from customers and intelligent or smart digital avatars	
Competitive intelligence	Answers the what else: Digital avatars' behaviour, monitoring competitors, ...	
Insights	Help achieve understanding, identifying, discovering new opportunities, useful patterns, hidden relationships ...	
Strategies, decisions, innovation, competition	Aims/goals to achieve; the means; courses of actions, different types & levels of decision making; digital innovation; open innovation; analysis of competitors	

Adapted, extended and modified by Shuliang Li on the basis of Avinash Kaul (2010)'s basic work

A very simple & basic example: WeMeta

Open Metaverse of multiple worlds,
dashboard, metrics (unique buyers, sales, etc.),
Comparison, and more

Source: <https://analytics.wemeta.world>



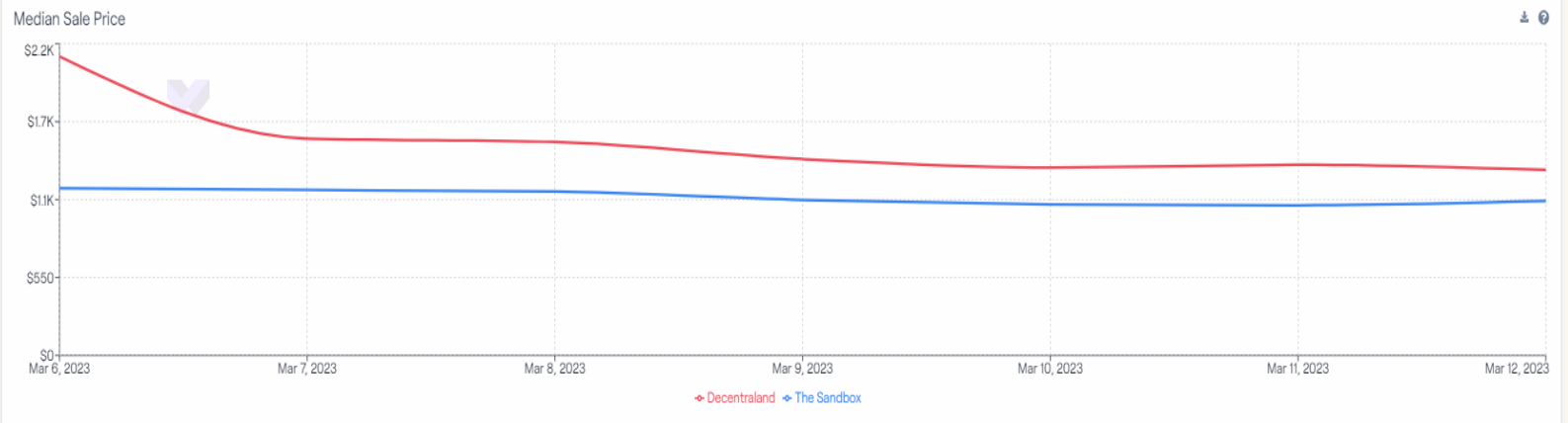
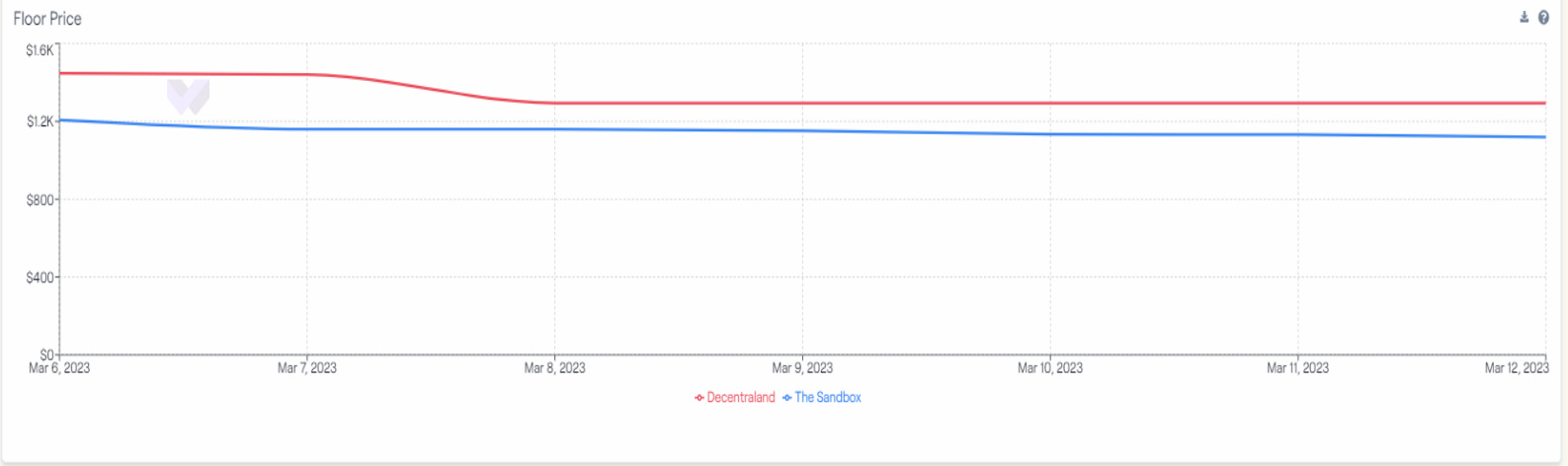
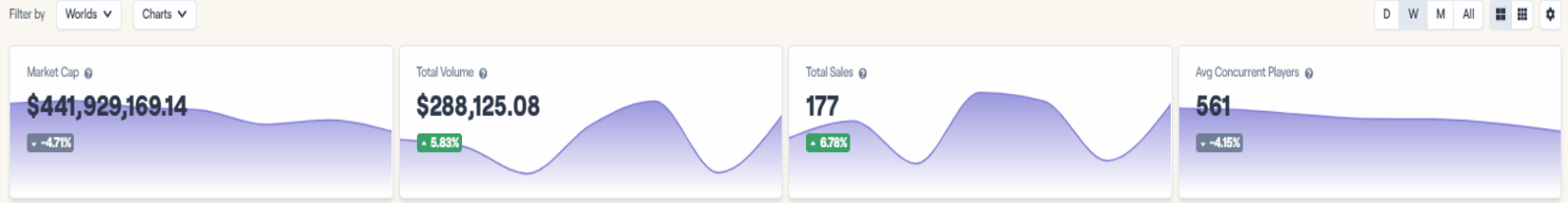


- Welcome
- Leaderboards
- Portfolio
- Overview
- Scenes
- Dashboard
- Compare Scenes

- API Docs
- Feedback
- Settings
- Light

Try WeMeta Premium!

Sign in

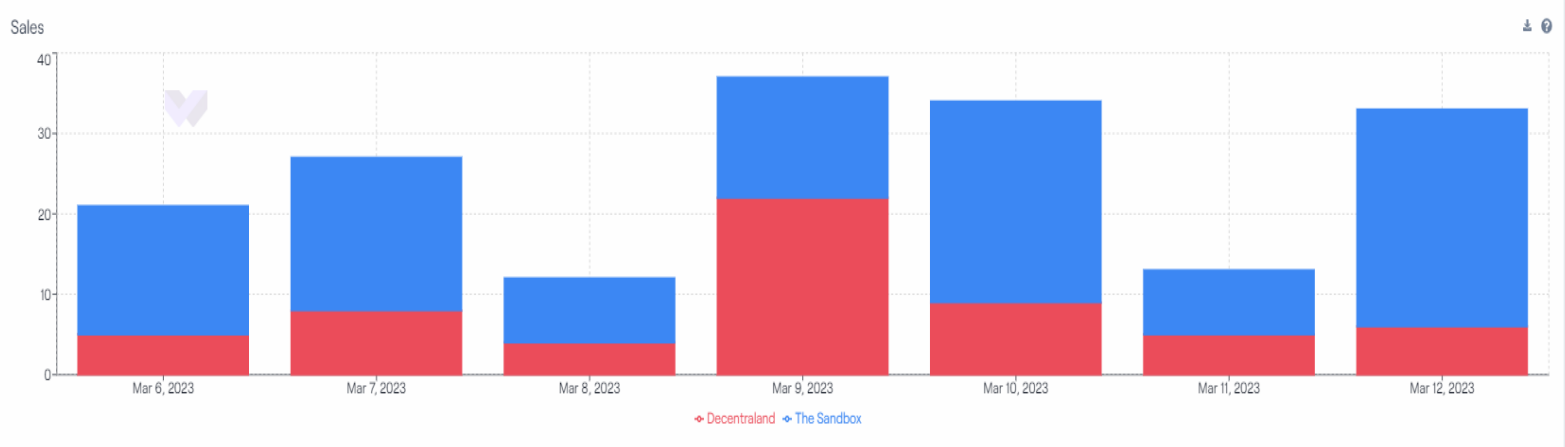
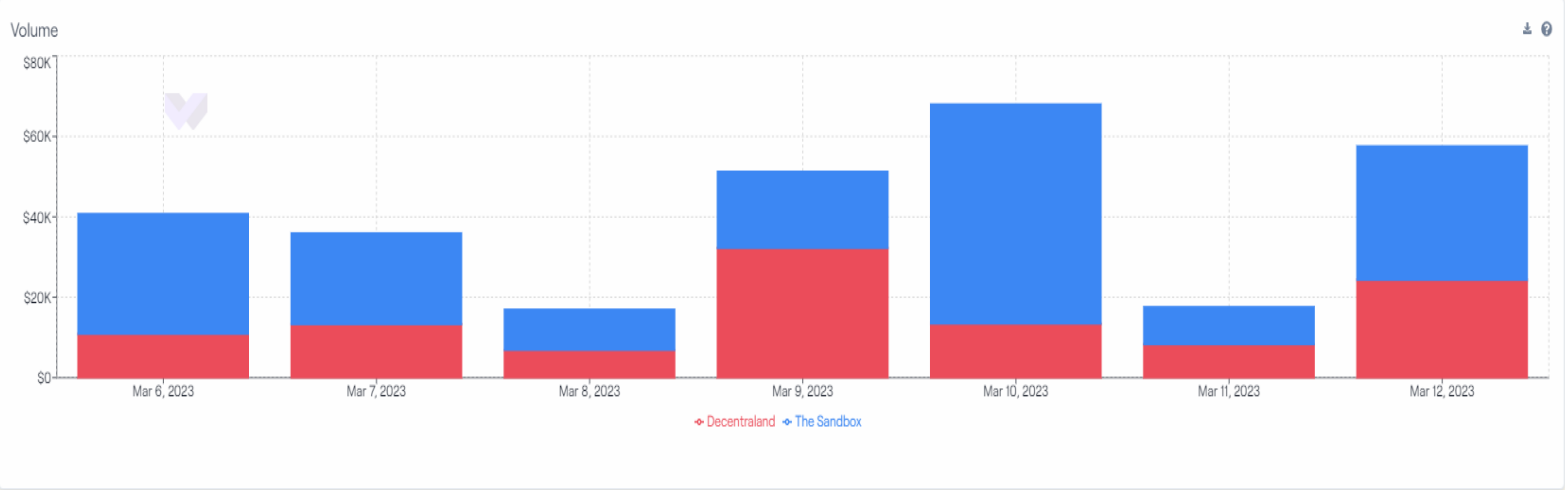
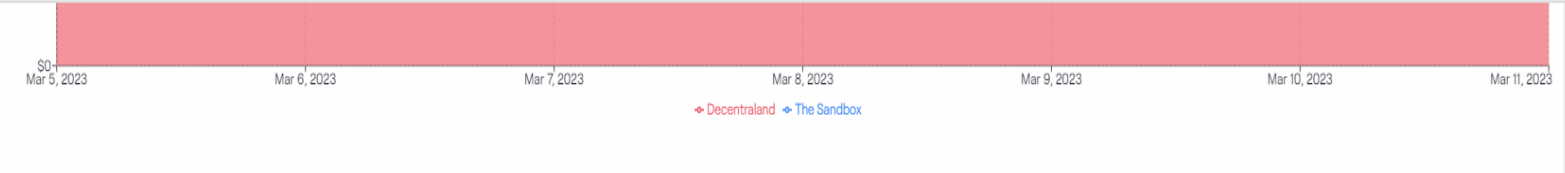


WeMeta

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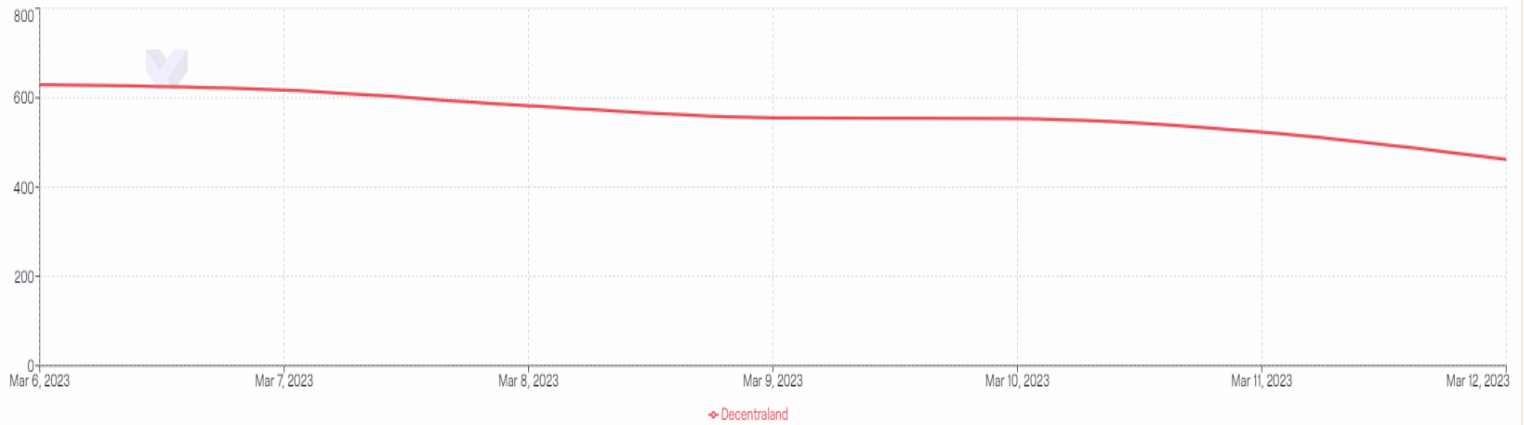


WeMeta

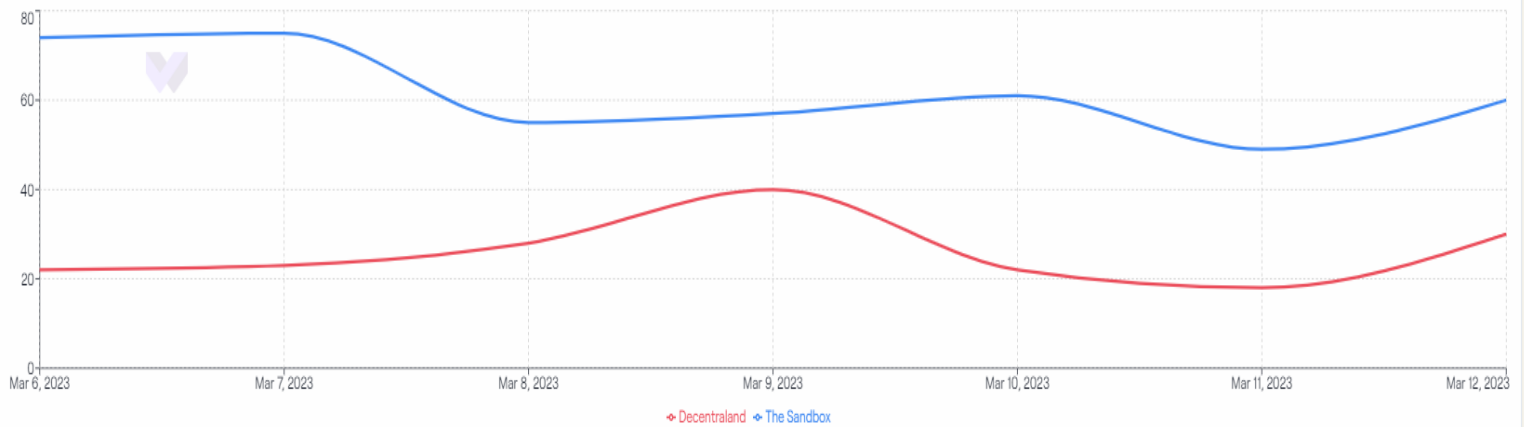
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Avg Concurrent Players



Active Traders



Scenes

Dashboard

Compare Scenes

API Docs

Feedback

Settings

Light

Try WeMeta Premium!

Top Selling Lands

	ASSET	FROM	TO	PURCHASED	PRICE
2	The Arcade Decentraland	0x1ea8...7c04	0xb7e8...cd49	Mar 12, 2023	34,200.00 \$17,765.57
3	Dragon City Decentraland	0x1393...6312	0xf0d6...579b	Mar 7, 2023	6,000.00 \$3,695.33
4	Parcel 146,-19 Decentraland	0x597e...19ef	0x739d...7651	Mar 6, 2023	2.10 \$3,282.77
5	Parcel -101,-80 Decentraland	0xe694...da30	0xa83b...4723	Mar 6, 2023	2.00 \$3,126.45

Coins

	COIN	PRICE	HOURLY DELTA	DAILY DELTA	WEEKLY DELTA	DAILY VOLUME	MARKET CAP
1	Bitcoin BTC	\$22,660.69	+2.46%	+10.62%	+0.55%	\$37,596,807,386.64	\$430,826,147,900.00
2	Ethereum ETH	\$1,624.22	+3.24%	+11.44%	+4.12%	\$20,570,654,400.45	\$192,896,782,826.00
3	Ape Coin APE	\$4.64	+5.38%	+25.33%	-2.08%	\$171,621,774.18	\$1,734,173,960.00
4	The Sandbox SAND	\$0.58	+4.00%	+15.87%	-0.73%	\$167,702,872.09	\$1,099,327,618.00

Source: <https://analytics.wemeta.world>

Thank you 谢谢 ! Questions?

