

# **PRACTICAL USE OF ARTBOTS IN VIRTUAL WORLDS**

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## **ABSTRACT**

For 17 years the estimated number of bots in the virtual world of Second Life (SL) is less than 1% and only about 15% of them are active. They deal with simple matters asked by their creators, e.g. managing a region, a group, working as a language translator, an avatar welcoming other avatars appearing in a given area, a catwalk model, etc. On average, for so many years various artists have tried to create bots in the field artistic, either using available programming libraries that support the Second Life protocol or using objects to create advanced choreographies in which they later embed their bots. In this article, a brief history of the creation of bots on the Internet will be discussed, examples of created artistic bots in Second Life will be given and the operation of the artbot created by me will be presented. People interested the bot have the opportunity to interact with it personally, e.g. by requesting the creation of a given work,

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with which they could later photograph and put on a joint exhibition.

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## **PRACTICAL USE OF ARTBOTS IN VIRTUAL WORLDS**

The virtual world Second Life allows to meet real people from around the world in 3D graphic environment over the Internet. In this environment they can gather in common thematic groups, discuss, spend free time together, e.g. listening music, create virtual conferences, workshops, interactive works of art available to a wider audience. In addition to people living their virtual, ordinary lives, there are characters for whom the presence of people in the same area is completely indifferent - they are bots which take various forms - human, animal, fictitious. They may not be aware that they have a limited consciousness imposed by their creator to exist in the world of Second Life. There is no exact data regarding the number of bots. We can try to estimate the number of bots in Second Life. There are approx. 62 million registered accounts, approx. 41 thousand residents log in to Second Life daily (Second Life Grid Survey, n.d.). Let's say bots can be between 10-20%. It is easy to count that there are approx. 6 - 12 million bots in the virtual world and approx. 4 - 8 thousand can be active.

Bots in the virtual world are assigned various tasks, e.g. they can simulate air traffic control (ATC), manage the region (bodyguard, manager), group, welcome in the region, moderator in group chat, model showing clothes and other things to sell, a character playing a specific role in interactive mini games with other avatars (e.g. deadly zombies in a post-apocalyptic city), etc.

The Second Life policy regarding bots is clear. Bot can manage group notifications, manage a group, be a translator in a group, be anti-spam monitor, mannequin, free range model, participate in minigames as an NPC. Bot can't generate a lot of artificially traffic,

copy things without looking at copyrights, sending more than 5000 messages per day, group messages are counted as 1 message per 1 recipient, buying the Mainland region, other things prohibited in Terms of Service, so the bot can do everything according to the principle: "what is not prohibited is allowed".

## **WHAT IS A BOT?**

Bot (other names are: web robot, internet robot, agent, scripted agent, NPC (Non-Player Character), softbot) is computer program which performs tasks usually simpler and faster than a human, don't have physics body, can have virtual body, emulates human activity in the Internet, e.g. conversation with a human. In the Internet we have examples various bots: spam bots - they send unwanted messages e.g. to email boxes; Copy Bot - this program has a bad famous in Second Life because in the past it stole the works of other users regardless of copyright, in Second Life its use is prohibited; DDoS bot (paralyzing networks and servers by sending too much data that cannot be handled quickly, exhausting memory and processor limits, which causes servers to hang up and refuse to provide services); spider bot, which is indexing websites - you see them on search website; service bots which are using on social platforms e.g. Facebook, Twitter, Instagram, where companies are sharing their services, e.g. delivery company can via bot give information about specific package for asking person via Messenger, etc.

We have different bots on the Internet. The list is opened by chatbot Eliza created in 1966 by Joseph Weizenbaum from the MIT Artificial Intelligence Laboratory (Landsteiner, 2005), which pretended to be a psychotherapist and was the first to pass the Turing test. Eliza simulated the conversation using "pattern matching" and a replacement methodology that gave users the illusion of understanding from the program but had no built-in framework for contextualizing events.

A good patient for Eliza would be another bot named Parry, which was created in 1972 by psychiatrist Kenneth Colby and was supposed to simulate a person suffering from paranoid schizophrenia. Eliza and Parry's meeting took place during an international computer conference, the ARPANET network was used, Eliza was launched at the headquarters of MIT and Parry at Stanford University. A record of their conversation can be seen in RFC 439 (Network Working Group, 1973).

It is interesting to note that in the 1970s a group of experienced psychiatrists analyzed a mix of real patients and computers on which Parry was running by teleprinters. Another group of 33 psychiatrists were shown transcripts of conversations. In both groups, they were then asked to indicate which patients were human and which were computer programs. Psychiatrists were able to identify only in 48% of cases (Saygin, Cicekli, & Akman, 2000).

If Eliza did not help Parry, then maybe help it other the chatbot created by Rollo Carpenter in 1988, named Jabberwacky (Carpenter, 1997), would simulate human speech in an interesting, funny and humorous way.

In 1991 Dr. Sbaitso (Sound Blaster Artificial Intelligent Text to Speech Operator) by Creative Labs for computers with MS-DOS (Mann, n.d.). It was an artificial intelligence speech synthesis program distributed with Sound Blaster cards. It talked to the user simulating a psychologist, most of the lines answered "WHY DO YOU FEEL THAT WAY?", If he did not understand something, it answered "THAT'S NOT MY PROBLEM" and after typing "SAY" it repeated the last sentence louder.

In 1995, A.L.I.C.E. (Artificial Linguistic Internet Computer Entity) was created Eliza's cousin thanks to Richard Wallace. It uses AIML, an XML-based language to match certain heuristic pattern rules to input data.

In 2006, Watson was shown - the first supercomputer whose purpose was to process questions asked in natural language. Watson appeared in the American program Jeopardy!, in which in 2011 it won the main prize of 1 million USD, which was allocated to charities (IBM, 2011).

ChatBot using Watson was implemented by one of IBM's partner companies - Elemental Path in crocodile look toys - CogniToys (Takahashi, 2015), where after pressing the button the child can talk to the toy - questions are directed via WiFi to AI network operated by Watson supercomputer.

Since 2010, we have a rash of voice bots called voice assistants - at first it was Siri from Apple, then in 2012 Google Now from Google, then in 2015 Alexa (Amazon) and Cortana (Microsoft) appeared.

From 2016, bots on Facebook private messages portal - Messenger are gaining popularity.

In the same year, Tay - a chatbot pretending to be a 19-year-old American girl and interacting with other Twitter users is published on Twitter. Tay answered questions, sent photos in the form of memes, but under the influence of tweets reflecting incorrect political expressions sent by users, the bot began to raise controversial topics, e.g. Eric Garner, praising Adolf Hitler or the emigration policy of Donald Trump. After 16 hours Tay was turned off and Microsoft published an apology.

## **EXAMPLE BOTS IN SECOND LIFE**

In Second Life, bots can be divided into two types:

- prim-mesh - the bot is made of prims and/or mesh objects, bot describing is done using Linden Scripting Language (Linden Scripting Language, n.d.), which is a simple programming language similar to C # and Java.

- avatar - the bot is launched as a regular avatar from an external computer, communication with it takes place through its programming interface, which can be mixed with LSL.

As mentioned earlier, there are many bots in Second Life.

Three interactive bots can be found on the virtual campus of the Jagiellonian University - Academia Electronica (Figure 1). Kocio is a cat-bot that reacts when you type its name in the general chat, then it comes up and coaxes to the person who called it.

The Nightingale is a bird surveyor, with whom you can complete a survey about your participation in the virtual world of Second Life. The survey results are later presented on the virtual campus page (Academia Electronica Survey, n.d.).

The owl is an examiner, at which a student can pass one of the subjects taught by Sidey Myoo (He is patron of Academia Electronica, in Real Life known as Michał Ostrowicki, associate professor at the Faculty of Philosophy of the Jagiellonian University in Kraków, Poland).



Figure 1. Examples of bots in Academia Electronica - nightingale (interviewer), Kocio (mascot), owl (lecturer examiner)

Another example of working bots in Second Life are Air Traffic Control Bots (ATC Bots), which can be found in control towers at airports, among others at Second Norway Lufthavn (Figure 2), Aleksandr International Airport, St Martin Airfield, Arimto Airport, East River Intercontinental Airport.

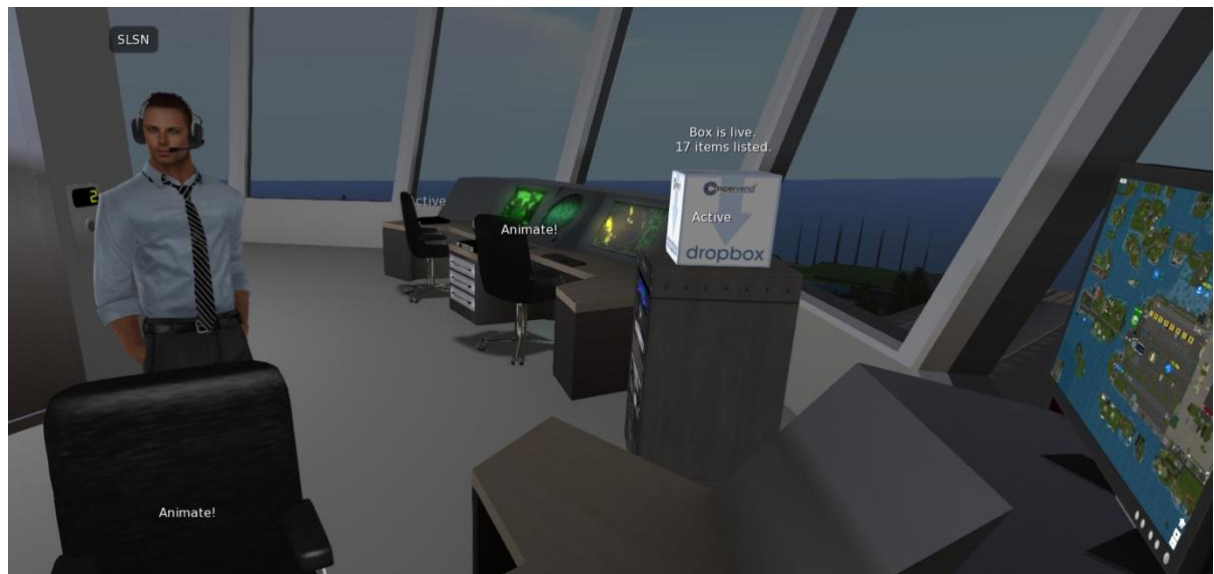


Figure 2. Air Traffic Control bot (ATC) in the Second Norway region at SLSN airport in Second Life

These bots are connected in different groups 119.200 MHz (for continents connected to the Blake Sea) and 17.900 MHz (for Sansara and Heterocera Atoll).

ATC bot reacts to specific words (e.g. takeoff, landing, etc.) in pilots' messages sent via group chat or GridTalkie. In the statement of the pilot communicating with the bot data must appear the name of the bot, the character calls the pilot and request. On a properly formulated request, the bot sends a reply via a reverse communication channel, e.g.

request from pilot:

*SLSN tower, ABC1234, request permission for taxi to runway 36L.*

response into bot:

*ABC1234, SLSN TOWER, TAXI APPROVED. HOLD SHORT RUNWAY 36L. CONTACT TOWER FOR DEPARTURE.*



Other examples of communicating with ATC Bot can be found in the Wikipedia Second Life Aviation (Second Life Aviation Wiki, n.d.).

This communication between the avatar-pilot of the aircraft and the ATC bot is to simulate the aircraft traffic environment in Second Life, similar to the environment in the real world.

In Second Life, we will meet bots that can take the form of dinosaurs (Figure 3), but are not interested in the presence of avatars visiting them or talking to them. Such bots can be found in Jurassic Park "Prehistorica: The Dawn Kingdoms", which are an integral part of a region from different periods of the Earth.



*Figure 3. Triceratops - a dinosaur-bot living in Jurassic Park entitled "Prehistoric: The Dawn Kingdoms"*

In 2009 other autonomous bot came to Second Life called Hal Cybertar (Zabaware, n.d.) presented on *Figure 4*, which was based on AI technology created by Zabaware - owner of this bot. Hal itself explored the virtual world, looking for people to talk together. When it was not welcome by certain people, it continued its journey through Second Life. If someone wanted to interact with Hal, it had to write "Hello Hal" in the chat, and if it wanted to end the conversation with



"Bye Hal". An attempt to talk Hal with other avatars can see in a YouTube video (Zabaware, 2009).



Figure 4. Hal Cybertar

## **SAMPLE ARTBOTS CREATED IN SECOND LIFE**

Over the life of Second Life, attempts have been made to create various artistic bots. This was done in two ways: either the free libsecondlife/libopenmetaverse (libopenmetaverse, n.d.) programming library was used, which allowed the avatar to connect to Second Life via the one described by Linden Research Inc. protocol or Second Life programmed the behavior of an ordinary avatar using LSL and functional objects, e.g. machines for making advanced various positions for various avatars.

The first example would like to present is the work of Gazira Babela - Don't Say (Babela, 2006). This work depicts an avatar with an automated, semi-anthropomorphic, scripted tornado connected to it, which provides the illusion of acting as an isolated force of nature suggesting autonomy. The tornado acts as the force punishing the avatar for its vulgar, offensive attitude towards the interlocutor - after detecting the forbidden word, it orders the avatar to apologize to the

other party and then moves it to another place using its natural force (Figure 5; Figure 6).



Figure 5. Tornado moves bot to another location for using the forbidden word (Babela, 2006)

```
TheEnd Bishop: hello, stupid bitch  
Gazira Babeli: ?!  
Gazira Babeli: dont say stupid  
TheEnd Bishop: stupid puppet!  
TORNADO says: TheEnd Bishop, dont say STUPID... say sorry!  
TheEnd Bishop: WHAT IS THIS!!!  
TheEnd Bishop: AHhh  
TheEnd Bishop: IM SORRY  
TORNADO says: TheEnd Bishop, dont say STUPID... Nevermore
```

Figure 6. Conversation between the creator and the bot

Another example is LPDT2 (fr. La Plissure du Texte) created by: Ayiter, Glasauer, Moswitzer (Ayiter, 2006), which perfectly shows the combination of cooperation between bots in the production of a character string. The work refers to the telematics work of Roy Ascott from 1983 under the same title (Ascott, 1983), which explored the potential of a computer network in interactive, remote, joint creation of a work of art that would undermine the artist's conventional aesthetic categories, works of art and the recipient and traditional object and objection. 11 locations, among others in the USA, Canada,

Europe and Australia participated in the diffuse authorship of a "planetary fairy tale" (each location represented a character, such as a magician, princess, beast, etc.) by jointly creating and sharing texts and ASCII images that contained a developing narrative. Collective work was active for 12 days, the full picture of the work has not been preserved, only the fragment found on Norman White's disc from Toronto (White, n.d.).

Returning to the very work of LPDT2 in Second Life, it was founded in 2006 and shows how bots (Figure 7) act as communication nodes between narrators, disseminating collective authorship of text strings from many literary sources, e.g. Gutenberg project (Project Gutenberg, n.d.), chat avatar text entries public, SMS, Twitter.



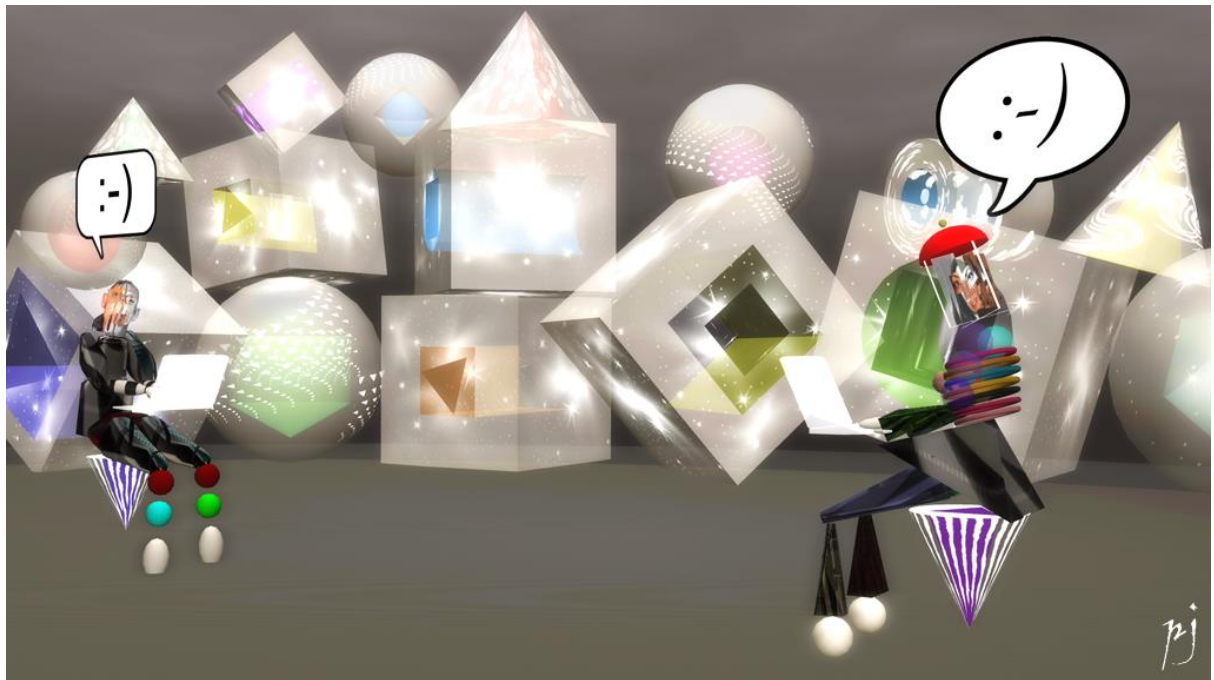
*Figure 7. One of bots of LPDT2 exhibition*

The algorithm of operation is very simple:

- Choose random text from the Gutenberg project and then choose a random sentence from this text, which will be the starting point.
- Choose the longest word in this sentence and search for that word in another text from the Gutenberg project.
- Take a sentence from this text that contains the word found.
- Add the found sentence to the generated text.

- Continue the algorithm indefinitely.

An example of how this work works can be seen in many movies on the Internet (Mab MacMoragh, 2010; Mab MacMoragh, 2011).



*Figure 8. Ellsmere & Kazyanenko - Pardon our Zeitgeist (2012)*

Another interesting work is Pardon our Zeitgeist in 2012 (Pyewacket, 2013) created by Ellsmere & Kazyanenko, where a non-verbal dialogue is conducted between two geometrically abstract bots (Figure 8). These bots, in addition to talking in silence, also move, the only sounds can come only from items that they use, e.g. a laptop.



Figure 9. Iaconesi - Dead on Second Life (2007)

The last interesting example in my opinion is the work of Iaconesi - Dead on Second Life from 2007 (oriana persico, 2008) [shown in Figure 9], where Karl Marx - philosopher, Franz Kafka - writer, Coco Chanel - fashion designer came to the electronic world from the beyond. Each of them is a separate, autonomous bot operating in the virtual world - they can walk, fly, look for companionship to talk. And so it happens - a given bot teleports to a randomly selected place in Second Life, where around it looks for other avatars with which it could talk and if it finds it writes answers collected from works characteristic of the specific character it represents. Conversations between bots and other avatars are recorded - this allows bot's author to manually enter new answers to frequently asked questions.

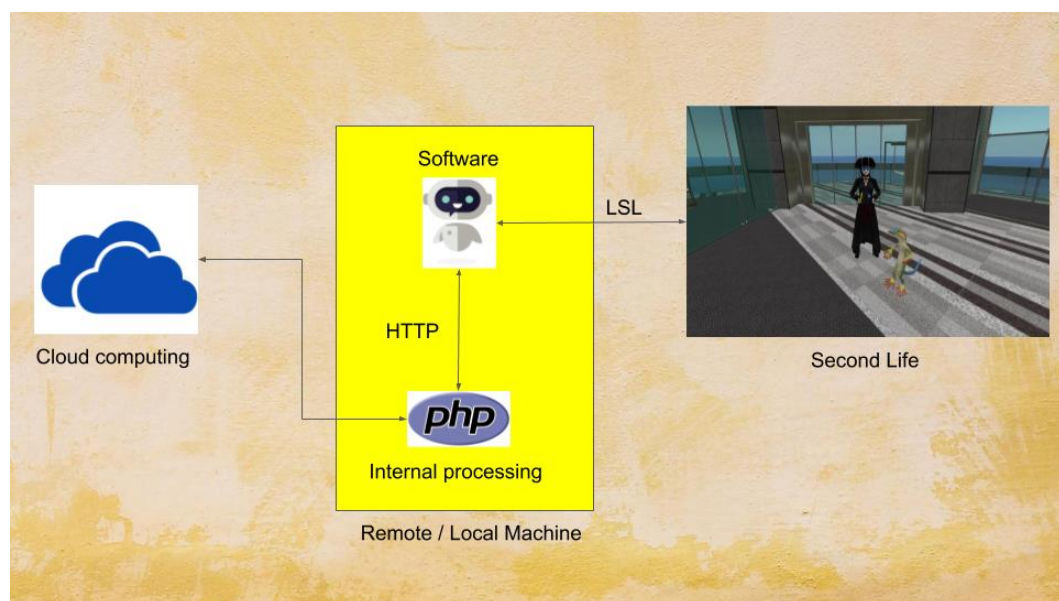
## ARTBOT CREATED FOR PRESENTATION

Most artists in Second Life are artists into flesh and blood living in parallel in SL and RL world. Bots live only in Second Life, there are few artistic bots, the majority deals with the management of plots, keeping order in group chats, sending group announcements. Leonardo de ArtBot is a bot - an artist which, in addition to acting in the artistic field, allows basic interaction with the user.

— Jarosław Maciejewski, Leonardo's creator



I decided to create and launch in this year an artistic bot named Leonardo De ArtBot which is to operate in Second Life in the period from 04/14/2020 to 06/01/2020. The bot will offer to create some sample art works from primitives (it's basic three-dimensional building object, taking various forms) and mesh objects (it's 3D object created in external software, loaded to Second Life). Let's first discuss Leonard's brain and heart which is shown on Figure 10.



*Figure 10. Flowchart of Leonardo*

Leonardo de ArtBot (Maciejewski, 2020) works on the free Corrade software (Corrade, n.d.), which has very extensive documentation and the implementation of the bot using this software is not a problem. Leonardo connects to the electronic world of Second Life in the same way as a regular avatar, but without a graphical interface, because it does not need anything in this situation.

To make communication between the bot and Second Life possible, put the LSL script inside the prim. In this script you may use one of listed commands: `llInstantMessage()`, `llOwnerSay()` or `llRegionSayTo()`.

The `llSendMessage()` command (`llSendMessage`, n.d.) allows to send private messages from an object to a given avatar - in the context of the bot these will be sent to it.

This command may be used when programmer will put prim "box" on the region, which allows direct script management, but if the region is restarted, access to them is temporarily lost. This function allows prim to send max. 2,500 messages for 30 minutes through all objects belonging to the owner in the region. A single message can have max. 1,023 characters.

Rest of listed commands may be used when programmer will put prim "box" as part of the bot's clothing (bot must be owner of this prim), they send private messages directly to bot without delays, limitations of number sending messages in specific time, one limitation is max. number of characters in single message. If programmer will edit prim, he must log in to the bot account using a browser to browse virtual worlds.

A single script can have max. 64 KB in size, it is compiled using a Mono compiler and has 16 KB of memory available to: bytecode, heap, stack. The advantage of such script limitation is the limitation of programming of resource-consuming scripts that would burden the server on which they are run. The downside, however is the inability to create scripts that would do advanced things in the virtual world. You can either break a large script into further smaller scripts and try to connect them with each other, which in Second Life would be a breakneck task or transfer a large part of the bot's functionality outside of Second Life and only in the virtual world receive the status of completed parts of functionality. This also has the advantages of smaller LSL files in the object - prime and a lower risk of error associated with exceeding the memory limit for compiled code (e.g. "Script run-time error: Stack-Heap Collision", "ERROR: Byte code assembly failed - out of memory").



Regardless of which option we choose, remember that the prime does not contain many LSL scripts - they will cause a very heavy load on the server and when the region manager sees it, it may tell us to slim down the prim scripts or order to leave the region.

In Leonardo, commands are sent outside of SL with the aforementioned `lOwnerSay()` command and the "execute" command from the bot API, which allows prim to execute any command on the system on which the bot is running. "Box" prim which is primary command center is part of bot's clothes, because the bot has no permanent headquarters, where we could permanently put a "box" with scripts supporting the bot and logging in using the bot account is not a challenge for me either.

Bot in the prim, which is its primary command center, currently has the following LSL scripts; the \* symbol indicates scripts that are run independently of other scripts (may be dependent initially on the Bootup script):

- Bootup - is the first script to run other scripts and to send a command instructing the bot to load the basic configuration (e.g. putting on clothes).
- IM\* - script that supports private messages between a bot and a given avatar.
- Debug\* - a script that handles the order to restart the script in which the error was reported that such script was not found.
- CheckVersion\* - sending a notification to the bot administrator when he finds a new version of the software.
- ExhibitionWorks - a script that supports the ability to receive textures from avatars and place them in a joint exhibition.
- ListenMath\* - script supporting mathematical functions.
- PlatformMonitor - a script that monitors whether the artistic platform with its accompanying objects exists, if any of the objects is not in the region, it orders the creation again.

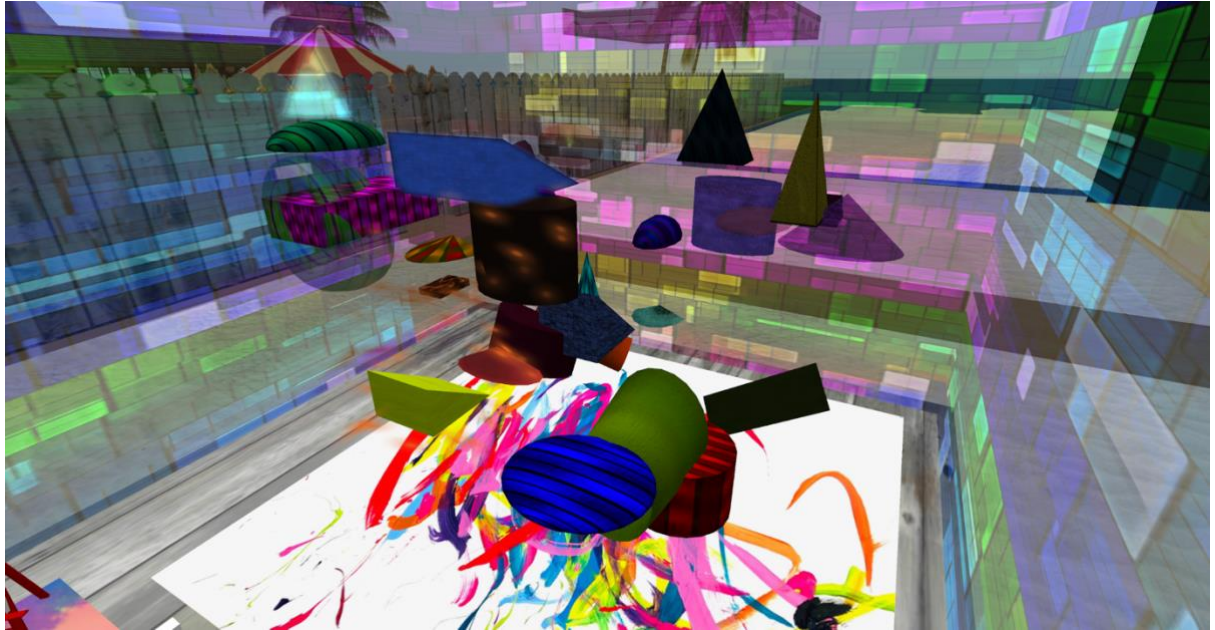
- ReturnToHome - in the case of restarting the region and teleporting the bot into the hub region (open region for all avatars, also when restarting regions) checks if the desired region is already available, if so, it teleports back to it.
- RegionAlert\* - receive informations about restart region and send notice to group, social portals that region where is bot will be restarted.

Returning to Leonard's heart and brain, all the service comes down to the `servebot.php` file processed by PHP. This file is where Second Life's requests run by the "execute" command. It does not matter what language in the programming of the bot brain the programmer chooses, it can be well Python, Java, C#, C ++, etc., may the service run in the console version and the language support sending and receiving requests via the HTTP protocol. Yes, the Corrade software itself allows you to send commands via HTTP, MQTT, websockets or TCP, however HTTP will be used most often here. All PHP support is in the bot's directory. I chose PHP as the language for programming functionality, because this language is well known for me, the script can specify max. memory usage limit (and we can definitely go beyond 16 kB available in Second Life). PHP uses HTTP when sending commands to the bot and receiving data from it. This also has its advantages - you can delegate tasks to cloud computing, AI processing, etc.

I dream that the bot can create simple things composed of prims based on the data sent by AI, which based on the data: how many primes can be used, which primes, what is to be created sends feedback on the used primes, sizes, colors, angles, etc. in order to achieve the intended goal.

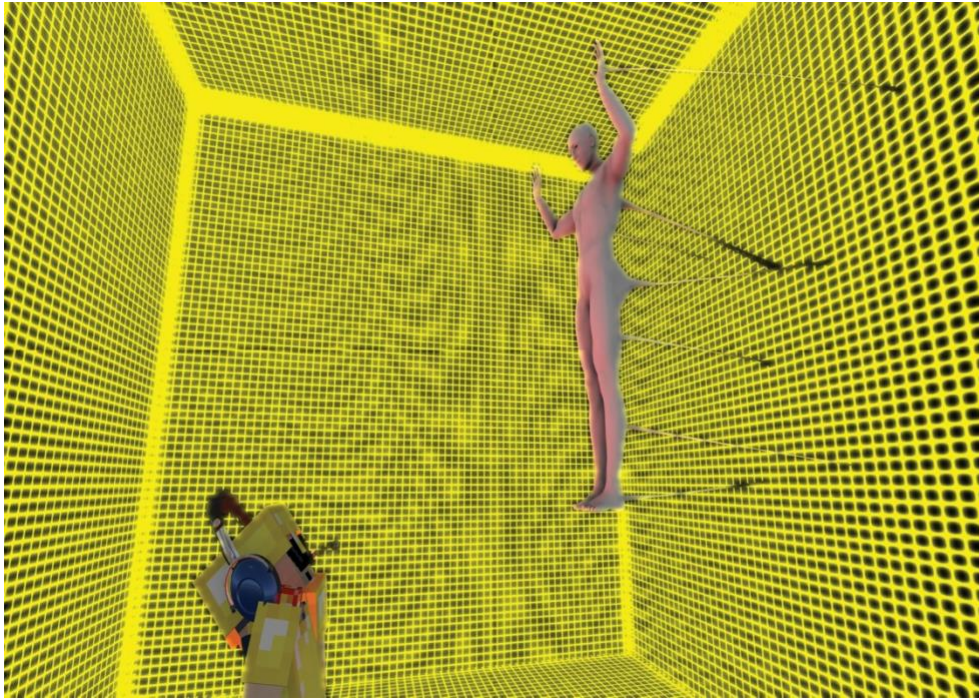
Let's get to the works created by Leonardo.

The first example type of work created by ArtBot was RandomArt (Figure 11), i.e. a work created from random elements, e.g. primitive type, its color, texture, etc.



*Figure 11. RandomArt - work art created from random elements*

The second work created by ArtBot is an artistic installation called Hemmed (Figure 12). The bot creates a black box with internal yellow grid walls, in which there is a figure glued to one of the walls and at random intervals can hear voices ordering compliance. When the avatar moves inside the box, can see random letters flying up, which may indicate the inability to assemble a logical word or even a sentence - blocking of thinking or speaking by the sticky figure.



*Figure 12. Hemmed - mysterious figure inside box*

The recipient of the work can release the sticky character by issuing the command 'free him' in general chat. When this happens, the character disappears and instead appears a mysterious, hooded, sitting figure with a sword in his hand and an eagle on his shoulder. The figure thank him for release and after a short time turns into an eagle and flies away. However, this has its consequences in the form of closing the recipient in this work - he can not go through the walls. Now he is cornered. It can be released by typing in the general chat 'free me' - he can go through the walls again, but the consequence of this action is the return of the sticky character. So either sticky character or recipient can be free at the same time.

Another form of interaction proposed by artbot involves the user creating a work of voxels (Figure 13), i.e. the smallest elements of space in 3D graphics. The user receives a convenient editor via the website, where it can create its work, which it will later send to the bot. The bot itself only imposes the maximum number of voxels, i.e. primas, which can be used in construction.



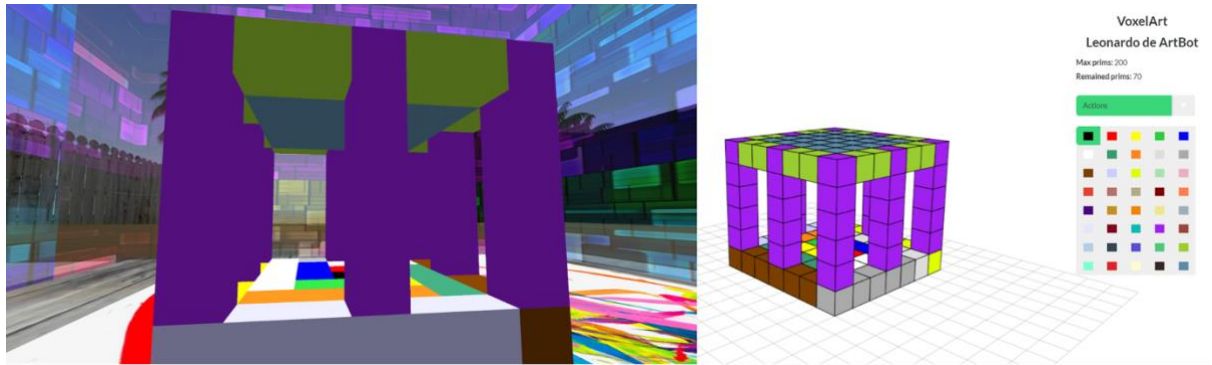


Figure 13. VoxelArt - user on special website can create own work itself

## SUMMARY

This article describes the operation of an artistic bot operating in Second Life, presents a brief history of bots on the Internet, shows examples of other artistic bots from Second Life that worked much earlier.

Regardless of the bot type, you have tried or created a bot that connects as a simple avatar to the Second Life virtual world through external programming libraries that support the Second Life protocol, e.g. libopenmetaverse or attempted to shape, move and animate using various objects to build advanced choreography.

Can we say then, that bots in Second Life are autonomous, regardless of what tasks were assigned to them? I would like to quote here in the full version (Tuner, Nixon, & Bizzocchi, 2015, p. 23):

Currently, SL-Bots's finite-state architecture implements a narrow or weak category of single-purpose Artificial Intelligence. At best, single purpose agents such as SL-Bots are only minimally "intelligent" within the context of pre-determined roles that depend on persistent social interactions with external forces for its perceived personality-development and unique characterization. In other words, SL-bots have a strictly reactive personality and are directly shaped by an avatar, another bot or the environment. This is why SL-Bots are ideally suited for subordinate social roles such as a "greeter" or a "tour guide". This is also why SL-Bots are seen as automated rather than autonomous characters. (Tuner, Nixon, & Bizzocchi, 2015, p. 23)

Based on my own five-year participation in the electronic world of Second Life, I can agree with the above quote that bots in Second Life are automated and not autonomous, because their software does not allow for independent existence in the world, their developers have programmed them the simplest, useful for them functions (e.g. group management, parcel management, etc.). This has been happening since the creation of Second Life and the possibility of creating bots in this virtual environment.

Leonardo de ArtBot is also not an autonomous bot - it can't make decisions alone based on the collected live data. Its programmed functions are: processing commands by private messages, creating a platform for creating works, creating works, animating "artificial" painting on canvas, etc. It does not work alone outside the artistic platform.

Finally, in Second Life, one big boom in the form of a semantic bot would be needed, which would respond with natural responses to voice chat statements by using the semantic web. But will this happen? I am a skeptic at the moment because for 17 years I have not heard on the Internet that anyone would work on creating such a bot for Second Life world.

## **BIBLIOGRAPHY**

Academia Electronica Survey. (n.d.). Retrieved February 03, 2020, from

[http://www.academia-electronica.net/?page\\_id=7094&lang=en](http://www.academia-electronica.net/?page_id=7094&lang=en).

Ascott, R. (1983). *La Plissure du Texte*. Retrieved February 03, 2020, from

<http://alien.mur.at/rax/ARTEX/PLISSURE/plissure.html>.

Ayiter, E. (2006). LPDT2/3. Retrieved February 03, 2020, from

<http://lpdt2.blogspot.com/>.

Carpenter, R. (1997). *jabberwacky*. Retrieved February 03, 2020, from

<http://www.jabberwacky.com/>.

Corrade. (n.d.). Retrieved February 03, 2020, from [http://grimore.org/secondlife/scripted\\_agents/corrade](http://grimore.org/secondlife/scripted_agents/corrade).

Babela, G. (2006). *Gazira Babela - Don't Say*. Retrieved February 03, 2020, from <http://www.gazirababeli.com/dontsay.php>.

libopenmetaverse. (n.d.). Retrieved February 03, 2020, from <https://github.com/openmetaversefoundation/libopenmetaverse>.

IBM. (2011, February 16). *IBM Watson: Final Jeopardy! and the Future of Watson* [Video].

YouTube. [https://www.youtube.com/watch?v=II-M7O\\_bRNq](https://www.youtube.com/watch?v=II-M7O_bRNq).

Linden Scripting Language. (n.d.). Retrieved February 03, 2020, from [http://wiki.secondlife.com/wiki/Getting\\_started\\_with\\_LSL](http://wiki.secondlife.com/wiki/Getting_started_with_LSL).

Mab MacMoragh. (2010, August 22). *Roy Ascott's LPDT2* [Video].

YouTube. <https://www.youtube.com/watch?v=kTSaOTh3Hz0>.

Mab MacMoragh. (2011, September 14). *Roy Ascott's LPDT2: Telematic Embrace* [Video].

YouTube. <https://www.youtube.com/watch?v=2Oe9x73HcFw>.

Maciejewski, J. (2020, January 1). *Leonardo de ArtBot website*. Retrieved February 03, 2020, from <https://webnitro.eu/en/leonardo-de-artbot-en/>.

Mann, D. (n.d.). *Dr. Sbaitso Online*. Retrieved February 03, 2020, from <https://oneweakness.com/dr-sbaitso-online>.

Landsteiner, N. (2005). *Eliza (elizabot.js)*. Retrieved February 03, 2020, from <https://www.masswerk.at/elizabot/>.

LIInstantMessage. (n.d.). In *Second Life Wiki*. Retrieved February 03, 2020, from <http://wiki.secondlife.com/wiki/LIInstantMessage>.

Network Working Group. (1973, January 21). *PARRY encounters the DOCTOR*. Retrieved from <https://tools.ietf.org/html/rfc439>.

oriana persico. (2008, March 10). *Dead on Second Life* [Video]. YouTube. [https://www.youtube.com/watch?v=BPJA\\_xjPsh0](https://www.youtube.com/watch?v=BPJA_xjPsh0).



- Project Gutenberg. (n.d.). Retrieved February 03, 2020, from <https://www.gutenberg.org/>.
- Pyewacket. (2013, July 4). *Pardon my Zeitgeist (3d rough cut , use 3d red/blue glasses)* [Video]. Vimeo. <https://vimeo.com/69726707>.
- Saygin, A. P., Cicekli, I., & Akman, V. (2000). Turing Test: 50 Years Later. *Minds and Machines*, 10(4), 463–518. doi: <https://doi.org/10.1023/A:1011288000451>.
- Second Life Aviation Wiki. (n.d.). Retrieved February 03, 2020, from [https://sl-aviation.fandom.com/wiki/ATC\\_Bot](https://sl-aviation.fandom.com/wiki/ATC_Bot).
- Second Life Grid Survey. (n.d.). Retrieved February 03, 2020, from <http://www.gridsurvey.com/>.
- Składanek, M. (2017). *Sztuka generatywna: metoda i praktyki*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.
- Takahashi, D. (2015, February 23). *Elemental's smart connected toy CogniToys taps IBM's Watson supercomputer for its brains*. Retrieved from <https://venturebeat.com/2015/02/23/elementals-smart-connected-toy-cognitoys-taps-ibms-watson-supercomputer-for-its-brains/>.
- Turner, J. O., Nixon, M., & Bizzocchi, J. (2015). SL-Bots: Automated and Autonomous Performance Art in Second Life. In *New Opportunities for Artistic Practice in Virtual Worlds* (1st ed., pp. 263–289). IGI Global. doi: 10.4018/978-1-4666-8384-6.
- White, N. (n.d.). *Text notation of La Plissure du Texte*. Retrieved February 03, 2020, from [http://telematic.walkerart.org/timeline/timeline\\_ascott.html](http://telematic.walkerart.org/timeline/timeline_ascott.html).
- Wójtowicz, E. (2008). *Net art*. Kraków: Wydawnictwo RABID.
- Zabaware. (n.d.). Retrieved February 03, 2020, from <http://www.zabaware.com/sl.asp>.
- Zabaware. (2009, October 21). *AI Bot Lives Among and Interacts with Real People in Second Life* [Video]. Youtube. <https://www.youtube.com/watch?v=DwsK3ckMdFs>.