**Goo scripting language description:**

1. Adding a script to an object does nothing. In order to use it, first you need to prompt the Goo Interpreter to translate your script into events with “translate()” method like this:

objects.bob.scripts.new\_script.translate();

1. All instruction in the first level of the script are translated into events that will be executed every iteration – so called default events. Each if statement in the script creates a conditional/triggerable event – instructions placed inside the scope of these statements are executed only if all conditions in the if statement are fulfilled. Nested if and else statements, while also being translated into different events, are connected with each other and will be executed in the order given in the script – using interrupts if needed.

Using “**event [name]()”** statement you can create dormant events with a name set to a given string. Dormant events won’t be executed in every loop nor in a reaction to normal triggers. They are an equivalent of functions from normal programming languages and you can give them parameters by putting them in the parenthesis. There’s a major difference between these events and functions – events cannot return values, you must use variables belonging to the owner of the script if you want to save results of the event. Dormant events can be called manually in the terminal or in a different event using run() method. You can improve readability of your script by combining conditional events with dormant events. Examples:

event(“sleepy”){ print(“Zzz…\n”) }; //A line from a script of the object with “bob” id.

objects.bob.events.sleepy.run();

If you want to name a normal triggerable event, use “label [name]” statement like this:

label if\_1{

if(me.var.hp <= 0){ me.events.deathScreen.run(); }

}

Named triggerable events can also be manually called, but it’s not recommended since they can be simply ignored (if conditions are not met) or repeated too mant times.

1. Engine can halt the execution of an event if the infinite loop is detected. If needed it can also deactivate a dangerous event – deactivated event cannot be triggered by other events. In order to activate such event, use methods: “run()” or “elevated\_run()”. The second method forces the engine to ignore dangerous behavior.
2. Most methods or accessors need a context based on one of these templates:

[subject].[method/variable] – accessing methods and variables of the subjects: layers, cameras, mouse and env(environment);

cameras.[camera\_id].[method/variable];

layers.[layer\_id].[method/variable];

layers.[layer\_id].[object\_id].[method/variable];

layers.[layer\_id].[object\_id].[module].[method/variable];

layers.[layer\_id].[object\_id].[module].[element\_id].[method/variable];

For example:

layers.first.patrick.var.apples = 10; //In the “first” layer find an object with an id “patrick” and set its variable named “apples” to 10.

You can shorten “layers.[layer\_id].[object\_id]” using built-in variable **objects** like this:

objects.[object\_id].[method/variable];

objects.[object\_id].[module].[method/variable];

objects.[object\_id].[module].[element\_id].[method/variable];

When accessing the owner of the script, you can use built-in variable **me** like this:

me.var.money += 50;

Under the hood, accessing the context by id in this way uses aggregation command **first**:

cameras.[camera\_id] 🡸🡺 first(cameras.id == [camera\_id]);

layers.[layer\_id] 🡸🡺 first(layers.id == [layer\_id]);

objects.[object\_id] 🡸🡺 first(objects.id == [object\_id]).

1. Values or contexts can be assigned to a variable using **let** statement:

let number = 10;

let string = “hello Goo”;

let a = layers.background;

let bob = objects.bob;

let money = objects.bob.var.money;

1. In order to simultaneously access the context of a group of objects use aggregation methods: first, last, all, random. Aggregation templates:

[context].[aggregation]([…].[method/variable] [comparison] [value]);

[context]. [aggregation]([…].[method/variable] [comparison]… […].[method/variable]);

You can assign aggregated context to a variable using **let** statement.

Examples of aggregation:

objects.first(id == “bob”).var.money = 10; //This line does exactly the same thing as this line: “objects.bob.var.money = 10”;

objects.all(group == “tree”).events.spawn\_apples.run(); //For all objects in a group “tree” spawn apples.

let first\_bob = objects.first(group == “bob”);

let last\_bob = objects.last(group == “bob”);

let all\_bobs = objects.all(group == “bob”);

let all\_rich\_kids = objects.all(var.money >= 1000).

1. In order to repeat instructions or whole events use **while** loop. While loop repeats everything in its scope as long as its condition returns true. Examples:

while(objects.x.var.bool==”true”){ objects.x.events.doSomething(); }

let i = 0;

while(i < 10){ x.var.int+=2; i++; }

let x = all(group == “x”);

while(x.size > 0){ me.events.destroyRandomX(); }

Operands in the conditions of the while loop must return single values – groups of objects cannot be used without a special directives like **atomic**. Without directives every instuction on groups is treated like a SIMD instruction (Single Instruction Multiple Data).

1. Each if statement creates new conditional event. Nested statements, after being translated into separate events, are still connected to their parents. Examples of if statements:

if(objects.bob.var.int > 10){ objects.bob.events.doSomething(); }

let group\_a = all(group == “group\_a”);

if(group\_a.var.apples > 5){ group\_a.events.giveOrange(); }

Just like in while loops, operands in the conditions must return single values – groups of objects cannot be used without a special directive like **atomic.** Without directives every operation on groups is treated like a SIMD instruction (Single Instruction Multiple Data).

1. In order to use groups of objects with if statements and while loops, user must use special directives to control the flow of the groups. Available directives are:

* atomic() – iterates through all selected groups, takes one object from each and executes all instructions inside its scope in SISD mode (single instruction single data). In other words atomic directive is an equivalent of for loop iterating through a vector. Minimal complexity of atomic directive scope is a product of the multiplication of all selected groups’ sizes.
* unique() – takes one object from the beginning of each selected group, removes taken objects from these groups and executes instructions inside its scope in SSID mode – then repeats the process until it cannot form a full tuple of objects. Minimal complexity of unique directive scope is a size of the smallest selected group.
* random() - takes one random object from each selected group, removes taken objects from these groups and executes instructions inside its scope in SSID mode – then repeats the process until it cannot form a full tuple of objects. Minimal complexity of random directive scope is a size of the smallest selected group.

Example:

let guy = objects.all(group==”a”);

let thug = objects.all(group==”b”);

atomic(guy, thug){

if(guy.var.money > 0){

let payment = rand(0, guy.var.money);

thug.var.money += payment;

guy.var.money -= payment;

}

else{

guy.var.hp -= 1;

}

}

Description of the example: Every guy is visited by every thug, but only one guy can be mugged by one thug at a time – in this way money won’t be duplicated.

1. After being triggered, conditional events execute all instructions placed inside them. These are sources of all triggers:
   1. Terminal – “run()” command;
   2. Events – “run()” command;
   3. Time – based on main loop iterations. Passing of seconds and minutes can be detected by using built-in variables **second\_passed** and **minute\_passed** – they are set to true if the stated time has passed in the current iteration;
   4. Camera – based on its state, position and **collision\_with** method.
   5. Keyboard – with variables: **key\_down**, **key\_pressed** and **key\_released**;
   6. Mouse – with variables: **mouse\_moving**, **mouse\_down, mouse\_pressed**, **mouse\_released**. Mouse can also select a group of objects based on their position and approximated size – selected group is saved in a built-in context variable **mouse\_selection**;
   7. Objects – current state;
   8. Variables – current state;
   9. Collision – collisions of objects from the same layer detected in the current main loop iteration;
   10. Editable Text Fields – with **content** variable;
   11. Movement – based on current state and **is\_moving** variable.
2. To create a new object you can use clone() method after choosing an existing object or function new() to create a blank object. Remember that you can use objects from another layers as templates. Examples:

Objects.FirstStar.clone(“SecondStar”);

Objects.SecondStar.var.brightness+=10;

Objects.new(“BlankObject”);

Objects.BlankObject.var.newVariable = 42;

Action of creating new objects can return a handle to an object if **let** statement is used:

let newBob = Layer.bobTemplates.bob123.clone(“newBob”);

newBob.var.type = 10;

newBob.event.prepareBasedOnType();

let newPatrick = Objects.new(“newPatrick”);

1. Accesing and creating new variables inside all objects is done by using **.var** accessor on a selected object and giving an id of a user defined variable. Example:

Objects.MrVariable.var.newVariable = 12;

1. In order to create and destroy elements of every other module in the object use methods **new(string id)** and **destroy(string id)**, for example:

Objects.walter.particles.new(“snow”);

Objects.walter.particles.destroy(“rain”);

1. The list of engine instructions:
   1. break – interrupts the execution of the current scope.
   2. return – interrupts the execution of all events from the object.
   3. <aggregaton> <source> [contextIDs] [expression] [cameraID] [layerID] [objectID] [moduleType] [moduleID] [attribute] [newContextID] – returns a context that fulfils the boolean expression and optional parameters.

Parameters:

* + aggregation (string): “all” – returns whole context, “first” – returns the first context, “last” – returns the last context, “random” – returns one random context;
  + source (string): “camera” or “layer” – if a context is not provided, choose one of the highest types of abstractions. Each camera contains its attributes and a bitmap (screen/window), while each layer contains its attributes and objects;
  + [optional] contextIDs (vector<string>) - if you provide a list of context ids, the source parameter will be ignored even if not empty. Each context can have one of these types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”. Type of the context affects other parameters;
  + [optional] expression (vector<ConditionClass>) – the list of locations of values and the list of operators that create a relationship between those values, which in turn results in a single boolean value. This whole expression is calculated for each entity separately and if it returns truth, entity is aggregated into the new context. But if expression is empty, this boolean is equal to true by default;
  + [optional] cameraID (string) – if source is equal to “camera” or provided context is of a camera type, only the camera with this id can be aggregated;
  + [optional] layerID (string) – if source is equal to “layer” or provided context is of a layer type, only the layer with this id can be aggregated;
  + [optional] objectID (string) – if source is equal to “layer” or provided context is of a layer or object type, only the object with this id can be aggregated;
  + [optional] moduleType (string) – if source is equal to “layer”, or provided context contains layers, objects or modules; only the module of this type can be aggregated;
  + [optional] moduleID (string) – if source is equal to “layer”, or provided context contains layers, objects or modules; only the module with this id can be aggregated;
  + [optional] attribute (string) – if provided, aggregate this attribute from selected entities;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. index [source] [indexes] [contextIDs] [attribute] [newContextID] - takes a list of indexes and returns a context with entities found by indexes.

Parameters:

* + [optional] source (string): “camera”, “layer” – if provided, contexts from contextIDs are treated as indexes.
  + [optional] indexes (vector<int/unsigned>) – the list of indexes used to find entities in vectors;
  + [optional] contextIDs (vector<string>): “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value” – if source is not provided, the first id serves as the container for index search. The rest of ids, no matter the source, are treated as indexes – they have to be of “pointer” or “value” type.
  + [optional] attribute (string) - if provided, aggregate this attribute from selected entities;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. sum <contextID> <contextID> [newContextID] - takes a pair of contexts and returns the sum of these sets.

Parameters:

* + contextID (string) – id of the selected context. This instruction accepts all types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. intersection <contextID> <contextID> [newContextID] - takes a pair of contexts and returns the intersection of these sets.

Parameters:

* + contextID (string) – id of the selected context. This instruction accepts all types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. difference <contextID> <contextID> [newContextID] - takes a pair of contexts and returns the difference of these sets.

Parameters:

* + contextID (string) – id of the selected context. This instruction accepts all types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. value <source> [locations] [literal] [newContextID] – returns a context made out of given literals or values found in different sources.

Parameters:

* + source (string): “context”, “camera”, “layer”, “object”, “variable”, “literal”, “second\_passed”, “key\_pressed”, “key\_pressing”, “key\_released”, “any\_key\_pressed”, “any\_key\_pressing”, “any\_key\_released”, “mouse\_moved”, “mouse\_pressed”, “mouse\_pressing”, “mouse\_released”;
  + [optional] locations (vector<ValueLocation>) – each location contains these parameters: cameraID, layerID, objectID, moduleType, moduleID, attribute. Some of them will be ignored based on the provided source and only entities with the right ID or (module type) will be taken into consideration;
  + [optional] literals (vector<VariableModule>): bool, int, double, string – literals will be used only if the source is equal to “literal”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. literal <literals> [newContextID] – returns a context filled with provided literals.

Parameters:

* + literals (vector<VariableModule>): bool, int, double, string;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. random\_int <literal> <literal> [newContextID] – returns a random integer from the range provided in the pair of literals.

Parameters:

* + literal (vector<VariableModule>): bool, int, double, string;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. random\_int <contextID> <contextID> [newContextID] – returns a list of random integers from the ranges provided in the pair of contexts.

Parameters:

* + contextID (string) – id of the choosen context. Context types allowed by this instruction are: “value” and “pointer”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. find\_by\_id <source/contextIDs> [expression] [cameraID] [layerID] [objectID] [moduleType] [moduleID] [attribute] [newContextID] – returns a context filled with entities which ids are equal to ones provided in parameters. If no ids are provided, aggregates all possible entities.

Parameters:

* + source (string): “camera” or “layer” – if a context is not provided, choose one of the highest types of abstractions. Each camera contains its attributes and a bitmap (screen/window), while each layer contains its attributes and objects;
  + contextIDs (vector<string>) - if you provide a list of context ids, the source parameter will be ignored even if it isn’t empty. Each context can have one of these types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”. Type of the context affects other parameters;
  + [optional] cameraID (string) – if source is equal to “camera” or provided context is of a camera type, only the camera with this id can be aggregated;
  + [optional] layerID (string) – if source is equal to “layer” or provided context is of a layer type, only the layer with this id can be aggregated;
  + [optional] objectID (string) – if source is equal to “layer” or provided context is of a layer or object type, only the object with this id can be aggregated;
  + [optional] moduleType (string) – if source is equal to “layer”, or provided context contains layers, objects or modules; only the module of this type can be aggregated;
  + [optional] moduleID (string) – if source is equal to “layer”, or provided context contains layers, objects or modules; only the module with this id can be aggregated;
  + [optional] attribute (string) – if provided, aggregate this this attribute from selected entities;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. let <contextID> <newContextID> - creates a variable with provided id from the selected or last existing context or overwrites the context of the existing variable with the same id. New variables will exist only in the current scope.

Parameters:

* + contextID (string) – id of the context. Context can have one of these types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”;
  + newContextID (string) – id of the new variable or the id of existing variable intended for a context overwrite.
  1. clone <contextID> <contextID> [changeOldID**]** - clones the values and structure of the right context to the left context.

Parameters:

* + contextID (string) – id of the context. Context can have one of these types: “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar", “pointer”, “value”;
  + [optional] changeOldID (bool) – if true, the left context will inherit the id of the right context (with the last number incrementation). True by default.
  1. <operator> <contextID> <contextID> [newContextID] – returns a context with a result of an arithmetic operation on the pair of contexts (with numeric values).

Parameters:

* + operator (string): "+", "-", "\*", "/";
  + contextID (string) – id of the context. This instruction accepts these two context types: “pointer” and “value”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. <operator> <contextID> – increments or decrements the numeric value found in the context by 1.

Parameters:

* + operator (string): "++" – increment by 1, "--" – decrement by 1;
  + contextID (string) – id of the context. This instruction accepts these two context types: “pointer” and “value”.
  1. <operator> <contextID> <contextID> – moves a numeric value from the right context to the left context based on the choosen operator.

Parameters:

* + operator (string): "=", "+=", "-=", "\*=", "/=" – these work exactly like in c++;
  + contextID (string) – id of the context. This instruction accepts these two context types: “pointer” and “value”.
  1. in <contextID> <contextID> [newContextID] - returns true if any entity from the left context occurs in the right context. In case of numeric values, instruction compares their values. For other entities like layers, instruction compares their ids, but only if both entities are of the same type.

Parameters:

* + contextID (string) – id of the context. This instruction accepts these two context types: “pointer” and “value”;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. new <number> <type> [newIDs] [layerID] [newContextID] - creates new entities and returns a context with their pointers.

Parameters:

* + number (int/string) – integer value or an id of the context of the type “pointer” or “value”. This is the number of new entities that will be created;
  + type/source (string): “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar" – the type of the new entities;
  + [optional] newIDs/contextID (string) – the id of the context with the type “pointer” or “value”. This context provides the list of strings that will become the new identificators for new objects. You can provide any number of ids and if the number is too low, the last id will be repeated. Although, to ensure the uniqueness in the given container, indexing numbers will be automatically added to the ends of repeated ids and incremented by one for every next repetition. The same automatic action will be taken if no new ids are provided;
  + [semi-optional] layerID (string) – the id of the layer with the role of a container for new objects. Usefull only if the new entities’ are objects;
  + [semi-optional] objectID (string) – the id of the object with the role of a container for new modules. Usefull only if the new entities are modules;
  + [optional] newContextID (string) – giving an id to a new context creates a variable in the current scope or overwrites the context of an existing variable with the same id.
  1. delete <contextID> - deletes all entities provided in the context.

Parameters:

* + contextID (string): “camera”, “layer”, “object”, “text”, "editable\_text", "image", "movement", "collision", "particles", "event", "variable", "scrollbar" – id of the context with entities selected for deletion.

**[script].****translate(string event\_id=”[script]”):**

Description: Method prompts the interpreter to translate selected script into an event named **event\_id** by creating a new event or updating existing one in the selected object. Default value of **event\_id** is the name/id of translated script.

Example: me.scripts.recursion.translate()

**[event].run(int n=1):**

Description: Method executes a chosen event **n** times, which is limited by the environmental variable **stack\_size**. Run() dynamically adds an object to the end of the **TriggeredObjects** list.

Example: me.events.recursion.run().

**[event].elevated\_run(int n=1):**

Description: Method executes a chosen event **n** times without any limitation and by ignoring all dangers like infinite loops, modification of system files or having sex with your mom.

Example: me.events.recursion.elevated\_run().

**[event].stop():**

Description: Method deactivates the event, making it indifferent to any triggers.

Example: me.events.eat\_bananas.stop().

**print(string text):**

Description: Command prints a provided text in the terminal. It’s the best tool for debugging!

Example: print(“Hello Goo!\n”);

**let [name] = [value]:**

Description: This statement assigns a literal or context to a new variable created in the script owner. Examples:

let banana = “”

**each\_second:**

Description: Simple condition check triggered every second. You can simulate it by incrementing a variable every iteration and checking its value in a simple if statement.

Result: bool

Example:

   each\_second{ me.var.money ++; }

**isolated\_if:**

Description: this if statement checks only the state of the currently analyzed object.

Result: bool

Example:

isolated\_if( me.var.money > 64 ) {

me.var.money --;

}

**half\_if:**

Description: this if statement inherits functionality of **isolated\_if** and compares currently analyzed object’s state (including constants) to a one specific object at the time.

Result: bool

Examples:

half\_if( me.var.money > you.var.money ) { … }

half\_if( you.var.money == 90 && bob.var.gold < 45 ) { … }

**full\_if:**

Description: this if statement compares constants, currently analyzed object’s state, one specific object or even two different objects in every comparison.

Result: bool

Examples:

full\_if( you.var.money > bob.var.money) { … }

full\_if( me.var.money == 90 && bob.var.gold < jeff.var.diamonds

|| steve.var.cash < patrick.var.bread ) { … }

**first:**

Description: this conditional statement returns the first object

Result: bool

Examples:

half\_if( me.var.money > you.var.money ) { … }

half\_if( you.var.money == 90 && bob.var.gold < 45 ) { … }