**What is a strategy game?**

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Content

Introduction

1. The concept of a resource

2. Resource graph

3. Decision-making and resources conversion

4. Game description

**Introduction**

The purpose of this document is to clarify what is a strategy game.

We tried to find out what is common to a number of strategic games.

The analysis of existing strategic games allows us to believe that:

A strategy game is some virtual world, the evolution of which can be considered from the **resource-based** point of **view**.

**More specifically:**

Any changes in the world are the conversion of resources from one form to another.

Thus,

The model of a strategic game is a model of the resources conversion.

Let’s consider several types of the resources conversion:

1. Nonantagonistic conversion.

It is a conversion of resources, which is at the full disposal of the player (or robot-character) or the group of SapienZ.

From the standpoint of VWMT (Virtual World Modeling Technology) such conversions are performed by SapienZ and herewith do not have conflicts.

2. Antagonistic (competitive) conversion.

Here, the conversion occurs “in favor of” one or another player or a robot according to the state of the virtual world.

3. Spontaneous conversion.

It is a conversion, occurring out of the will of sentient beings inhabiting the virtual world. That’s mean “out of the will” of the players or robots with certain resources.

The general scheme of the evolution of the game world is:

Strategic game

Initialization of resources

Loop

Decision-making and

resources conversion

end

end

Initially resources have it’s owners: players, robots-characters. Then “in the loop” players make decisions and in accordance with those decisions the resources are converted and redistributed.

Besides, the transformation (conversion) of resources occurs due to what is happening in the world regardless of the made decisions (e.g. natural disaster).

The world can “live” indefinitely or the game finishes upon reaching (gaining) a certain target resource(s).

In any case, the aim of the game may be formulated in a resource language and can be precise or fuzzy.

In the first section, we will cite examples of resources.

In the second – we will coin a term resource structure – resource graph.

We will consider the concept of resources conversion in the third section.

In conclusion, in the fourth section we will briefly discuss wishes to create a gameplay.

**1. The concept of a resource**

The concept of a resource will be fundamental for us.

We will use term “tool” as a synonym for the term “resource”.

Virtually any entity can be regarded as a resource. We will focus on the examples that allow more precisely understanding of what we mean by this term.

Coal deposits, uranium, enriched uranium, ore, metal, people (human resources), car, home, knowledge, technologies, methodologies, faith, ... - all these are resources.

When we talk about resource, we mean its necessity, its use to attain one or another aim.

What is an aim?

We believe that the aim is the resource. Moreover, it concerns any aim.

For example.

1. Let’s consider the process of coal mining.

Initially, we can have the resource: “coal embedded at a certain depth”. This is some resource X, moreover we have a resource I – “mining infrastructure”, that is some compound resource.

Lifting the mined coal on the surface, we will get new resource X ':

“Mined coal” - this is the aim of the process of coal mining.

2. Now let’s consider the learning process.

The same as previous, initially having resources: teaching methods, teachers, ... as well as a resource “a group of students” as a result we will obtain a resource – aim: “a group of taught people. "

3. The production targets can always be regarded as resources conversion.

4. Let the paratroopers landing near one or another object, which attempt to capture the enemy.

“The advanced paratroopers” (or the army, already came up to the object)

is a certain resource, which is the intermediate aim. Moreover, this resource is different from the original resource: “a squad of paratroopers on the base”.

It becomes clear that the resource is a teleological concept, which lies in both the aim and the means to achieve it.

One more example.

In the game “Civilization” the final aim is a rocket, the resource on which the player leaves the planet. To create this rocket we need resources – interim targets.

So, in the virtual world of the game a resource structure will be the main data structure.

Herewith we will distinguish:

- original resources;

- resources – interim targets;

- resources – final aims.

Accordingly, we will talk about the initial situation (the initial state of the game), intermediate (interim) and final aims of the game.

Suppose, we have several resources. Each resource has its own name. For example, ore, lathes, planes, soldiers, beet, etc.

In this document, instead of resource names we will use natural numbers (we’ll need them later as indices).

So, we have “n” resources

1, 2, … , n.

If for resource “k” resources

, , … , ,

are needed, then we say that resources , … , are converted into a resource k.

The graph of convertibility ratio on the set of resources is a resource structure. This concept will be completed and **considered in a bit more detail** in section 2.

For example, let’s consider the graph below:

2

1

3

4

( 1 2 ) converts into 2

( 1 2 ) converts into 3

( 1 3 ) converts into 4

Here, 4 – target resource.

I.e. on the graph of convertibility we will mark the target resources.

Vectors ( 1 2 ) , ( 1 3 ) – we will call convertible vectors or compound resources.

In general case, this vector is:

( , , … , ) (\*)

We say that the vector (\*) is a resource (compound) for the resource k.

The process of conversion itself we will call activity.

**2. Resource graph**

The concept of a resource graph we’ll consider on the example of resource graph “Coal mining and conveying” (see pic.1).

1 2 3

CM

CB

CA

C

F

M

4

5

6

Pic.1. Resource graph “Coal mining and conveying”

The list of resources:

CM – coal mine (colliery) (inexhaustible resource);

F – fuel for coal conveying;

M – money;

C – mined coal;

CА – coal, delivered at point А;

CВ – coal, delivered at point B.

We have 3 resources conversions (or 3 processes, or 3 activities).

1. Coal mining

( M CM ) → C

or

( 2 3 ) → 4

I.е. mine and money are converted into the mined coal.

2. Coal haulage at point А

( C M F ) → CА

or

( 4 2 1 ) → 5

I.е. mined coal delivered at point А.

3. Coal haulage at point В

( C M F ) → CВ

or

( 4 2 1 ) → 6

I.е. mined coal delivered at point В.

Now we’ll consider the technological coefficients (see Leontief “input-output” model) (or otherwise conversion coefficients).

– the required amount of resource for getting a unit of resource 2.

Let's see how it looks in our example.

Firstly, we’ll consider the coal haulage, and then the mining.

* The delivery of coal at point А

1

**C**

**M**

2

**F**

5 4

**CА**

– the amount of fuel, for example, in liters, necessary for delivery of a unit of

resource 4 (mined coal) at point A for example, 1 ton of coal.

– the amount of money, necessary for delivery of a unit of resource 4 (mined coal)

at point A, for example, 1 ton of coal.

– the amount of coal, necessary for delivery of a unit of resource 4 (1 ton of coal)

at point A. Except for the loss during transportation, then = 1.

So, we have a conversion vector:

= ( , , ) ,

“the type” of this vector is:

( F M C ) .

This vector characterizes the delivery of coal at point A (conversion into resource CA).

Example 1.

Suppose, it is needed to transport 25 tons of mined coal at point A.

= ( , , ) .

Suppose:

= 100 l

= 1000 $

= 1,05 t

Then:

= ( 100 l 1000 $ 1,05 t ) .

To obtain the vector of the necessary resources you should multiply scalar =25t by :

= ∙ = ( 2500 l , 25000 $ , 26,25 t ) .

Example 2.

Suppose, initially we have:

resource F (or 1)

= 100000 l

resource M (or 2)

= 150000 $

resource C (or 4)

= 200 t

What is the maximum quantity of resource CA (or 5) we can get?

ton

In this example:

F, M, CM – original resources;

CА, CВ – target resources;

C – interim aim.

* The delivery of coal at point В

1

**C**

**M**

2

**F**

6 4

**CВ**

We think that the delivery of coal at point B is much harder than at point A by virtue of distance and losses in customs.

= 120 l

= 1100 $

= 1,07 t

Then, the conversion vector is:

= ( , , ) = ( 120 l 1100 $ 1,07 t ) .

* Coal mining

2 3

**CM**

**M**

4

**C**

In this case, we can assume that the resource CM (coal mine) is inexhaustible.

I.е. we believe that there is a large number of coal in the mine.

In this case:

= 1t

– the amount of money which should be spend on 1 ton of coal.

For example:

= 300 $

Then the conversion vector is:

= ( , ) = ( 300 $ , 1t )

The “type” of this vector is:

( M CM ),

where M – money;

CM – coal mine.

So, each node of the resource (conversion) graph is loaded with the name of resource, and the edges are loaded with technological coefficients.

Except for these loads, which are static loads, we have another one static load – the time of getting a unit of the target resource under conversion.

As we have seen before, the technological coefficients are the resources required to produce units of the target resource.

For example, for getting 1t of coal (resource CА) it is needed:

= 100 l of fuel

= 1000 $ other expenses

= 1,05 t of coal

Having these resources, we can obtain a unit of resource CA (1t of coal at point A).

It is important for us to know how much time it will take.

Thus, we’ll further load the nodes of the resource graph with time:

Node k → .

– time required to obtain a unit of resource k.

Note:

The time required to obtain x units of resource k is not always proportional to x.

In general case, this time is:

= ( x, )

Finally, except for static loads, the nodes of the resource graph are loaded with the current value of the resource at a time:

x (k, t) – the value of resource k of the resource graph at a time t.

**3. Decision-making and resources conversion**

Each player (possibly including robot) corresponds a dynamically changeable resource graph.

In other words,

graph “belongs to”

graph “belongs to”

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graph “belongs to”

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Let’s point out that the number of players can also change dynamically.

The player makes decisions “in the language of graph conversion”.

Below we consider various cases.

3.1. Nonantagonistic conversion.

For example: transportation of goods, the movement of the army, purchase of equipment, education, advertising, etc.

I.е. nonantagonistic conversion is a modification “of its own” graph.

For example, resources 1, 2, 3 are converted into resource 4.

1

2

4

3

Here,

, , – the value of resources 1, 2, 3.

– the value of the target resource for this conversion.

– time of getting a unit of resource 4.

, , – technological coefficients.

The conversion is as follows:

Suppose at a time we have resources (), , (), and we need to get units of resource 4.

Then:

() = () -

() = () -

() = () -

Onward:

() = + ,

где

= ( , )

Here,

– function, which allows us to calculate the required time for obtaining

units of resource 4, if for a unit of resource 4 units of time are needed.

If the dependence of the amount of time on the resource is linear, then

= .

Let’s illustrate the said above on the scheme:

+ t

Modification of the Modification of the

original resources target resource

Here, – conversion time.

Modification of the original resources – proportion .

Modification of the target resource – proportion .

Thus, the original graph will be different at the moment of decision-making (resource reservation), and the moment of conversion closure + .

3.2. Competitive (antagonistic) conversion.

In the virtual world there may exist special ways of resources conversion. What is meant here is that there are situations when one (or several) resource graph is modified with the help of another resource graph.

For example:

1. Hostility

2. Tender, auction

3. Totalizator

4. Economic competition

5. Trade, barter

In all these cases

resource graphs are modified one over another.

The situation is illustrated on the scheme.

+ t

Here,

Where,

a subgraph of the graph SapienZ\_1

a subgraph of the graph SapienZ\_2

At different instances of time

– a time of mutual conversion.

– conversion vector-function.

For example, the illustrated above scheme can be interpreted as a fragment of a battle or economic competition or as “one step” of the auction, etc.

**4. Game description**

It is desirable to describe the game (creation of the original document) “in the resource style”. Thus, minimizing the misunderstanding even between designer and developer.

On the other hand, we make an essential move to the creation of the model.

The scenario of the game should consist of:

1. The idea of the game, gameplay i.e. the description of the game “in the free style”.

2. The description of SapienZ, i.е. the description of the players and robots.

3. The description of the resource graphs, types of activity, and feasible solutions.

4. The description of the target resource(s).

5. The description of the antagonistic resource conversion.

6. What is the intrigue of the game? Qualitative resource management considerations.

7. The interface considerations.