The Shin-Life Career Game: Pursuing Your New Life Style through Gaming Simulation

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***Abstract*— The purpose of this study is to propose a serious game: the Shin-Life Career Game, which allows players to construct various careers. The name of this game is come from the most famous classic game: the Life Career Game developed by Boocock. In the field of career education, various serious games have been developed as a means for students to learn about career planning and development in a practical way. However, in conventional serious games for career education, the diversity of careers constructed by the players is low compared to the reality of today's working society. We propose a new serious game: the Shin-Life Career Game which eliminates the restriction on the number of occupations a player is able to take at the same time. We plan to use this game to explore the possibilities of various lifestyles for people.**

***Keywords*—Serious game; career education; gaming simulation; resource allocation.**

I. Introduction

The purpose of this research is to propose a gaming simulation: the Shin-Life Career Game, which provides players with the experience of constructing various careers. Gaming simulation is a simulation in which humans participate as players in the context of the simulation, and which is operated through the decisions of those players [1].

In the field of career education, serious games have been developed to help school students learn about career planning and development [2] [3]. It has been reported that students who learn through serious games are motivated to learn, acquire factual knowledge, and gain confidence in the real-world application of what they have learned [2].

A variety of serious games have been developed in the field of career education [2]-[4]. However, these games are not designed to take into account the diversification of careers faced by today's working society [5]. Specifically, in conventional career education games, players cannot work in more than one occupation at the same time. In addition, players is not able to choose the type of work when they enter a certain occupation. If there were a realistic career simulator that reflected the diversity of careers, it would be of use in revealing the lifestyles of various people. Therefore, we developed a new serious game: the Shin-Life Career Game in which players are able to work in multiple occupations at the same time and to choose the type of work (employed or independent). This game inherits the features of the original life game [6], as well as the Life Career Game, an early serious game for career education.

Therefore, we developed a new serious game: the Shin-Life Career Game in which players are able to work in multiple occupations at the same time and to choose the type of work (employed or independent). This game inherits the features of the original life game [6], as well as the Life Career Game, an early serious game for career education. Boocock's the Life Career Game has been played by students of all ages, from elementary school to university. Of course, our game can be used to educate students of all ages as well. On the other hand, we are considering having adults who have a lot of life experience play our games. This is because analyzing the games played by adults who have worked in the society and gained various experiences may help us to find their unique wisdom and perspectives on worldly affairs.

In this study, we conducted an experiment to verify the behavior of the Shin-Life Career Game. The goal of this experiment is to confirm that the game players experience

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a significant reduction in income when they experience an economic recession. To achieve this goal, we first prepared a scenario in which game players experience an economic recession. Next, we created four software agents with decision-making rules and made them participate in gaming. As a result of the experiment, we found that (1) the income of the players temporarily dropped when they experienced an economic recession in all the strategies, and (2) the strategy of devoting resources only to the core business (permanent work) may result in less money resources acquired through gaming than the strategy of distributing resources to the core business and other activities.

II. Related Work

To overcome the contradiction between the way secondary school youth see the career world and the way adults see it, Boocock developed a life career game that plays much like the original life game [2]. In the game, players experience a hypothetical life, playing various roles and spending their resources (money, time, etc.) on various activities with the goal of maximizing their present satisfaction and the possibility of a good life in the future. As a result, they acquire knowledge related to career development and develop understanding and confidence. These characteristics have been partially inherited by other serious games for career education that have been developed since then (e.g. [3], [4]).

In today's world, many workers have the opportunity to build a variety of careers [5]. There is a growing population of workers worldwide who choose non-traditional ways of earning a living, such as those who work more than one occupation at the same time, those who are independent of organizations and earn a living through contract work using highly specialized skills, and those who earn efficient rewards from simple labor online [5]. However, in traditional games, players are expected to make a living from only one job. In addition, players is not able to choose the type of work (Players should have a variety of options, such as working as an employee or as an independent contractor) when they take a certain occupation. Therefore, we have developed a new game that takes into account these modern workers' circumstances. The features of the game are shown in Table 1. A career simulator that reflects the realities faced by today's workers could be applicated to reveal the lifestyles of different people.

III. The Shin-Life Career Game

In this section, we describe the features of the Shin-Life Career Game in detail.

A. Overview

The Shin-Life Career Game is a kind of turn-based life game. Players experience a virtual worker's life in the game. The players are given several kinds of resources by the game system, and allocate them to various activities according to the game rules, restrictions, and their own will, resulting in the gaining or losing of new resources.

INPUT / OUTPUT	Money	Ability	Time	Health
Money			Simple work	
Ability		Permanent work Freelance work Learning		
Time				
Health				

Fig. 1. MATH model for agents in the game.

B. Agent model

1) Resource variables: We used MATH model [7] to represent the activities of agents that gain and lose resources by allocating resources to various activities (See Figure 1). Our agent model contains three types of resource variables: money resources, ability resources, and time resources. The following sections describe the resource variables and activities that make up the model.

The variable of money resource corresponds to an asset in the real life. Human beings use monetary assets to support their lives. The variable of money resource has extensive property and does not have an upper limit.

The variable of ability resource corresponds to knowledge and skills for work in the real life. Human beings use their skills and knowledge to engage in labor and get paid for it. The variable of ability resource has intensive property and does not have an upper limit.

The variable of time resource corresponds to time for real life. Human beings live their lives by spending their time in a variety of activities. The variable of time resource has extensive property and an upper limit.

2) Activity: Next, we describe the agents' activities. In this game, agents allocate their resources to several activities, "Permanent work (PW)," "Freelance work (FW)," "Simple work (SW)," and "Learning (LN)," in each turn according to the constraints of the game and their own will. The features of each activity are summarized in Table II, and the details are described below.

PW is a work style in which workers are employed by an organization until they reach retirement age and receive remuneration for their labor. The characteristics of PW are described below. First, the remuneration for PW is stable. In reality, full-time workers are less likely to experience unemployment due to the effects of the economy than part-time workers [8]. Second, the remuneration for PW is higher than that for SW. In reality, the income of full-time workers is much higher than that of part-time workers [9]. Third, if a player's ability resources increase, the reward for PW will be higher. In the personnel evaluation system in companies, it is customary to reflect the medium- to long-term accumulation of capabilities by regular workers in the increase of their basic salary and the promotion of their qualification grade [10]. Fourth, engaging in PW increases the ability resources

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TABLE I
COMPARISON OF FEATURES BETWEEN THE SHIN-LIFE CAREER GAME AND TRADITIONAL GAMES FOR CAREER EDUCATION

Feature	Conventional Games[a]	The Shin-Life Career Game
Nomber of occupations a player can have at the same time.	One	Multiple
Diversity of labor forms.[b]	Low	High

[a] The target games are "the Life Career Game [2]," "the Real Game [3]," and "MeTycoon [4]".
[b] In the real world of labor, workers earn their living not only through traditional full-time employment, but also through freelance work, part-timejobs, gig work, and many other forms of work. Conventional games do not make a clear distinction between these forms of work.

TABLE II
FEATURES OF EACH ACTIVITY

Feature	Activity			
	PW	FW	SW	LN
Type of activity[a]	W	W	W	L
Income level[b]	M	H	L	-
Positive impact of ability level on income level[c]	P	P	N	-
Stability of income[b]	H	L	L	-
Ability growth[c]	P	N	N	P

[a] W and LN stand for "Work" and "Learning," respectively.
[b] H, M, and L stand for "High level," "Middle level," and "Low level," respectively.
[c] P and N stand for "Positive" and "Negative," respectively.

of players. Firms provide regular workers with education and special jobs that encourage their growth [11]. Fifth, a player has to provide a certain amount of time resources for PW. In general, the law sets minimum and maximum working hours for regular employees. Sixth, a player is not able to decide the amount of time resources to be allocated to PW at will. In general, in regular employment, workers are obligated to engage in overtime and holiday work according to the orders of their supervisors.

FW is a way of working that is independent of a particular organization and is paid by providing expertise and skills to a contracted party. FW has the following characteristics. First, the income of workers who engage in FW is unstable. The income of real freelancers is also unstable [12]. Second, as a player's ability resources increase, the reward for FW increases. In online job brokerage services used by real freelancers, workers with high value-added skills have a chance to get high-paying jobs [13]. Third, a player's ability resources do not increase when the player engages in FW. Employers spend less time training the self-employed than do employees [14]. Fourth, a player is free to decide the amount of time resources to be allocated to FW. Since freelancers do not have an employment contract, they have no obligation or responsibility to have their working hours controlled by others [15].

SW is a form of work in which workers provide their time to their employers or contractors and are paid for it. In this game, SW is the kind of work that manual workers do in the real world, such as part-time jobs, day labor, and gig work, which do not require any special skills or qualifications. SW has the following characteristics. First, the money resource, which is the reward for labor, increases in proportion to the amount of time resource the player allocates to SW. In general, the wages of part-timers are determined by the length of time they work. The wages of day laborers and gig workers are determined by the unit cost and number of jobs that can be completed in a short period of time. Regardless of the type of labor engaged in, the longer the time spent in labor, the more the worker's income is expected to increase roughly proportionally. Second, the amount of a player's ability resource do not affect the amount of compensation for SW. In fact, many managers do not require part-time workers to have special job performance skills [16]. Third, the income of a player who engages in SW is unstable. If the economy is strong, the reward of simple workers' will be stable, but if the economy worsens, simple workers' jobs will be reduced or they will be laid off [17]. Fourth, a player's ability resource does not increase when the player engages in SW. Many companies keep the training costs they pay for part-timers to a minimum [16]. Finally, a player has the flexibility to adjust his/her working hours to engage in SW. Workers who earn money from one-time jobs, such as on-call work or gig work, and part-time workers can flexibly manage their working hours [18].

LN is the act of taking extra time to develop competencies in order to nurture one's work capacity. People who hold core positions in organizations or who do business with their expertise as freelancers engage in lifelong learning to develop professional competencies that will keep them eligible for work [19]. Self-employed individuals with unstable incomes spend more time on work-related learning than employees of firms [14].

Based on each of the above characteristics, we examined the structure of resource acquisition by each activity. The amount of remuneration for regular employment labor is thought to increase monotonically in proportion to the product of working hours and the worker's ability. The amount of remuneration for freelance labor increases monotonically in proportion to the product of working hours and ability, but there is uncertainty in terms of income. The amount of compensation for simple labor is expected to increase monotonically with the number of hours worked. The more time a worker spends in formal labor, the more work experience he or she will gain and the more education he or she will benefit from. Therefore, the ability acquired through formal employment is expected to increase monotonically as total hours worked increase. However, if a worker works for a particular company for a long time, the growth potential will gradually decrease. Finally, the ability of a worker is expected to increase monotonically in proportion to the product of

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TABLE III
VARIABLES AND CONSTANTS IN EQUATIONS

Variable/Const	Name
$I_{PW}(t)$	Reward for PW in turn t (money resources))
$I_{FW}(t)$	Reward for FW in turn t (money resources)
$I_{SW}(t)$	Reward for SW in turn t (money resources)
$G_{LN}(t)$	Reward for LN in turn t (ability resource)
$A(t)$	Agent's ability resources as of turn t
$A_{PW}(t)$	Ability resources that an agent has developed in PW by turn t
$M_{LN}(t)$	Money resources allocated to LN in turn t
$T_{PW}(t)$	Time resources allocated to PW in turn t
$T_{FW}(t)$	Time resources allocated to FW in turn t
$T_{SW}(t)$	Time resources allocated to SW in turn t
$T_{LN}(t)$	Time resources allocated to LN in turn t
c_{PW}	Reward per unit time for PW (constant)
c_{FW}	Reward per unit time for FW (constant)
c_{SW}	Reward per unit time for SW (constant)
c_{LN}	Reward per unit time for LN (constant)
a_0	Intercept of equation (2) (constant)
$\epsilon_{FW}(t)$	A random number generated according to a continuous distribution whose probability density function is constant on a finite interval [α,β] and zero outside the interval.
$T_{PW\_TOTAL}(t)$	Total time resources allocated to PW by turn t

working hours, learning fees to the power of 0.5 , and working capacity. Based on the above, we have prepared equations (1) through (5). See Table 2 for the variables and constants that make up each equation.

$$I_{PW}(t) = C_{PW} \times A(t-1) \times T_{PW}(t) \quad (1)$$

$$A_{PW}(t) = a_0 + \frac{1}{1+\exp(r \times (T_{PW\_TOTAL} - d))} \quad (2)$$

$$I_{FW}(t) = \epsilon_{FW} \times C_{FW} \times A(t-1) \times T_{FW}(t) \quad (3)$$

$$I_{SW}(t) = C_{SW} \times T_{SW}(t) \quad (4)$$

$$G_{LN}(t) = (C_{LN} \times T_{LN}(t) \times \sqrt{M_{LN}(t)}) \times A(t-1) \quad (5)$$

Equations (1) and (2) are used to determine the money resources and ability resources that are the rewards of PW, respectively. Because of the sixth characteristic of PW, players cannot determine the value of T_{PW} by themselves. The value of T_{PW} is determined by the system using a random number generator according to given conditions. The given condition is the range of values that T_{PW} can take. This condition reflects the fifth characteristic of PW. Next, equations (3) and (4) are the equations for calculating the money resource, the reward for FW, and the money resource, the reward for SW, respectively. Finally, equation (5) is an equation for calculating the ability resources gained from LN.

C. Happening

In the real world, events that cannot be avoided by individuals, such as natural disasters and economic recessions, can occur. Whenever people experience such events, they try to rebuild their lives by making various decisions. In this game, an "economic depression" is implemented, which temporarily reduces the amount of resources acquired by each activity. When an economic depression occurs in a given turn, the rewards for various types of labor are forcibly reduced. At this time, once a player has allocated resources to labor, he will eventually only receive the amount of reward he would have received if he had invested the least amount of resources in labor. In this game, a player who engages in PW are not laid off, so he/she is able to secure some income even if an economic recession occurs. However, workers who engage in FW and SW experience a significant temporary decrease in income.

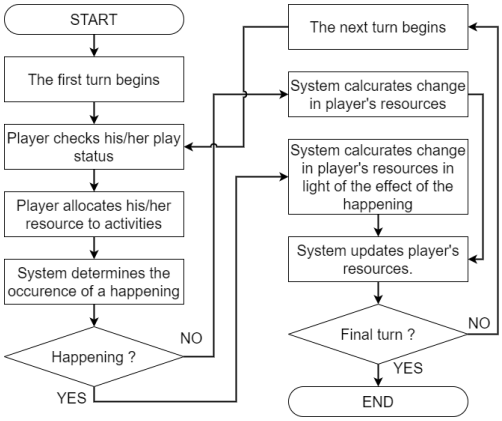

Fig. 2. Flowchart for gameplay

D. Instructions for Gameplay

In this section, we describe the procedure for playing the game. Figure 2 illustrates the procedure for playing the game. The player has to make a decision about resource allocation at each turn. First, when his turn comes, the player gets a chance to check the game information. Here, the player is allowed to check the amount of resources he currently has, the history of his past resource allocation activities, and information about the game environment. The player decides the policy of resource allocation based on the information obtained in this stage. Next, the player allocates resources to each activity. After the resource allocation is completed, the game system updates the player's resource variables. At this time, if the game system considers that a financial crisis event has occurred, the effect is reflected in the calculation results. Finally, the calculation results are fed back to the player, and the turn ends. When a turn ends, a new turn begins. The game is repeated for a predetermined number of turns.

IV. METHOD

In this section, we describe in detail the methodology of the experiment.

A. Agent

A software agent has a policy for resource allocation, and allocates resources to various activities according to the contents of that policy. Software agents allocate resources to various activities. Each software agent has one policy for resource allocation. This policy consists of three components

TABLE IV
CORRESPONDENCE BETWEEN POLICY AND RESOURCE ALLOCATION BEHAVIOR

Policy	Explanation of policy about resource allocation by agents	Policy[a]			Resource allocation behaviour[bc]			
		SI	HI	AG	PW	FW	SW	LN
A	Agents with Policy A hope to work in a way that allows them to earn a stable and high income and to grow in their abilities.	○	○	○	Rand.	-	Rest/2	Rest/2
B	Agents with Policy B hope to work in a way that allows them to earn a stable and high income.	○	○		Rand.	-	Rest	-
C	Agents with Policy C hope to work in a way that allows them to earn a stable income and to grow in ther abilities.	○		○	Rand.	-	-	Rest
D	Agents with Policy D are satisfied as long as they have a stable income.	○			Rand.	-	-	-

[a] SI, HI, and AG stand for "Stability of income," "Higher income," and "Ability growth," respectively.
[b] Rand represents the amount of resources determined by the random number generator.
[c] Rest is the amount of resources of time held at the beginning of each turn minus Rand.

TABLE V
VALUES OF THE PARAMETERS OF THE MATH MODEL IN THIS EXPERIMENT

Parameter	Value	Parameter	Value
C_{PW}	5.5	r	-2.5×10^{-3}
C_{FW}	5.5	d	1.5×10^{3}
C_{SW}	3.0	α	-1.0
C_{LN}	2.0×10^{-4}	β	3.0
a_0	1.0		

("stable income," "high income," and "growth"), each of which can be either "important" or "unimportant" (there are eight policies in total). Each policy is associated with a strategy and action rules for resource allocation. Each software agent allocates resources according to the action rule corresponding to its policy. In this study, we tested the behavior of the gaming system using only the software agent with the policy that emphasizes stable income. The test evaluation using the software agent with the remaining four policies is a future work. In this study, we tested the behavior of the gaming system using only the software agent with the policy that emphasizes stable income. The correspondence between each policy and the resource allocation behavior is summarized in Table IV. The following is a description of the behavior of the software agent with each policy. A software agent with Policy A allocates resources to PW, FW (or SW), and LN, because he considers stable income, high income, and ability growth to be all important. A software agent with Policy B allocates resources to PW and FW (or SW) because they consider stable income and high income to be important. A software agent with Policy D allocates resources to PW only, because it considers only stable income to be important. A software agent with Policy A or Policy C is subject to special rules that do not apply to a software agent with other policies. Because these policies emphasize ability growth, they allow software agents to allocate additional time resources to LN that were not allocated to labor due to the economic recession. In addition, the money resources spent on LN by a software agent with Policy A and a software agent with Policy C are fixed at 50.

B. System

The software for simulation is written in C#. The simulation was carried out using Intel(R) core(TM) 4600U CPU @ 2.10GHz PC with 16GB RAM, Windows10 Pro, 64bit OS.

C. Game scenario

In this experiment, we checked the behavior of the system and the changes in the resources of the software agents when an economic recession occurs. In our scenario, each software-agent experiences just one economic recession in a gaming. The recession occurs on turn 30 (the worker is in his/her 50s).

D. Procedures

We prepared four software agents, each with a different policy. Each software agent was ordered to play 40 turns per gaming session. We assumed that one turn of the game corresponds to one year in the real world. Therefore, 40 turns corresponds to the period from entry to retirement for a standard permanent worker. Each software agent played the game under the aforementioned scenario.

V. RESULTS AND DISCUSSION

In this section, we describe and discuss the results of our experiments.

A. Results

As a result of the experiment, it was observed that the money resources of each agent gradually increased as the game progressed (See Figure 3). It was also observed that the income level of each agent gradually increased as the game progressed (See Figure 4). Finally, the pace at which the ability resources of the software agent with Policy B and the software agent with Policy D increased, gradually accelerated in the first half of the game and gradually decelerated in the second half of the game (None of the agents allocated any resources to the LNs, so their lines overlap on the graph.). While the ability resources of software agents with the other policies increased software agents with the other policies did not decelerate in the second half of the game (See Figure 5).

B. Impact of economic recession on agents' income

When we check the income of each agent in turns 30 in Fig.4, we can see that the income of all software agents has fallen uniformly. The impact on software agents with Policy

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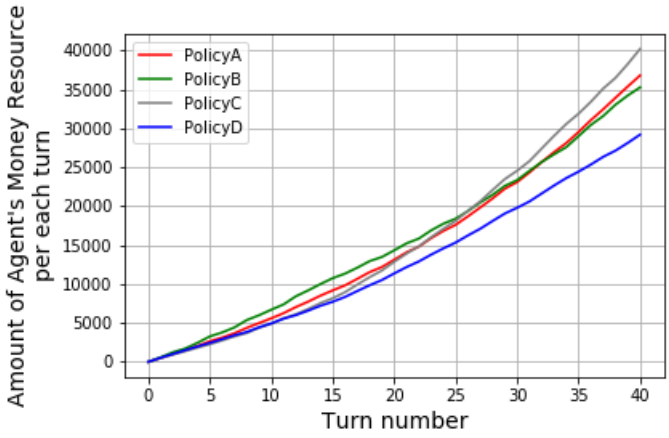

Fig. 3. Figure for time series change in money resource

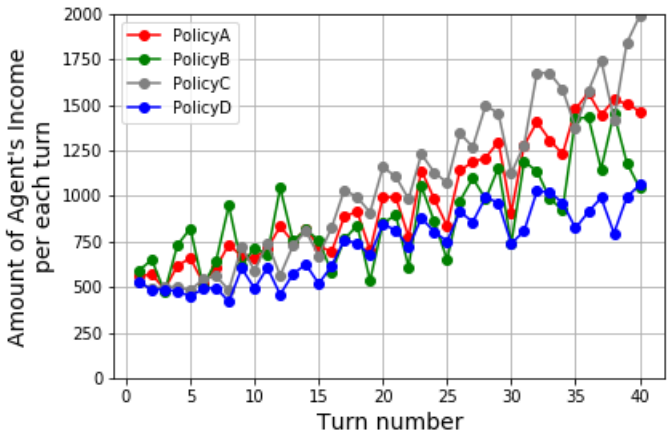

Fig. 4. Figure for time series change in income

A or Policy B, which allocate resources to FW and SW in addition to PW, seems to be relatively large. The reason for the large drop in the income of these software agents is that their income from labor other than PW was cut off due to the economic recession. The recent collapse of Lehman Brothers and the pandemic of the new coronavirus caused many non-regular workers and freelancers to reduce their income significantly or lose their jobs. This result may reflect this reality.

C. A relationship similar to that between ants and grasshoppers

Among the four software agents prepared in this experiment, it can be seen from Figure 3 that the money resources finally earned by the software agent with Policy D that considers only income stability to be important are less than those earned by the software agents who chose other policies. This software agent allocates resources only to PW, while other software agents invest resources in various activities in addition to PW, and succeed in increasing their income. In particular, software agents with Policy A or Policy B allocated resources to LN and engaged in skill development. Even as the speed of ability growth in PW slowed in the second half of their working lives, They continuously grew their

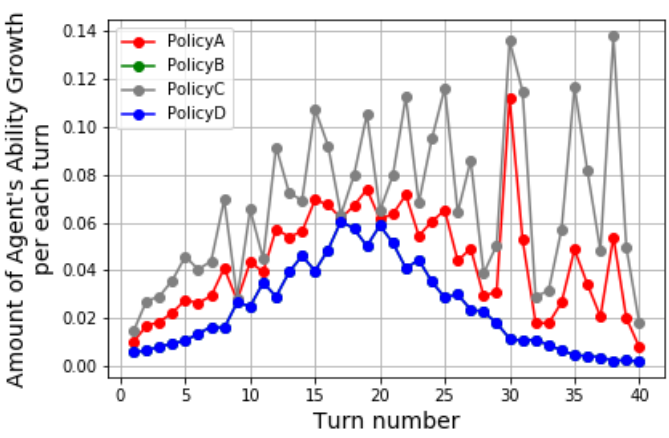

Fig. 5. Figure for time series change in ability growth

skills (see Figure 5) and increased their income (see Figure 4), The difference between the two groups is similar to the relationship between the ant and the grasshopper in Aesop's fable, "The Ant and the Grasshopper. The grasshopper (Agent with Policy D) seems to have widened the gap in income with the ant (Agent with Policy A, Policy B, or Policy C), which steadily accumulates resources, over the course of 40 turns.

VI. Conclusion

In this study, we proposed a gaming simulation: the Shin-Life Career Game, which allowed players to choose various careers. To test the behavior of the game, we conducted a gaming experiment using software agents that had different policies and behaviors regarding resource allocation. As a result of the experiment, we found that (1) the income of the players temporarily dropped when they experienced an economic recession in all the strategies, and (2) the strategy of devoting resources only to the core business (permanent work) might result in less money resources acquired through gaming than the strategy of distributing resources to the core business and other activities.

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