Learning socially about and engaging in green business

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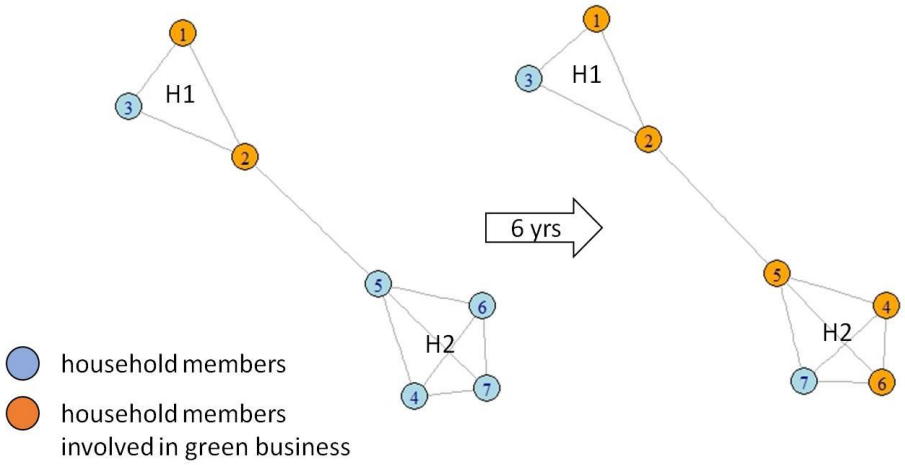
This example describes one of the simulations used to further verify the knowledge acquired in Bohdanska Dolyna and the cognitive multi-agent knowledge-based model for which the knowledge was acquired and operationalized (Sotnik 2018). The simulation involves hypothetical artificial household member agents engaging in collective action and inter-network social learning. Specifically, the example shows household member agents from two households over a period of 10 years selecting from their agent-specific sets of employment decision options and learning from each other about available employment opportunities.

One of the households, household 1 (H1), consists of three household member agents: (a) household member 1 (H1 M1) is a 35-year-old female, who in addition to working also keeps track of expenses and savings; (b) H1 M2 is a 30-year-old male, also working; and (c) H1 M3 is a 75-year-old female, who receives a pension. H1 M1 & M2 operate a family-owned green business. The family-owned business is a collective action that, first, requires at least two household member agents to be interested in and committed to participating in at the beginning of each period and, second, at least 100,000 monetary units of savings, (₴).

The other household, H2, consists of a family of four: (a) H2 M1 is a 40-year-old female, who works abroad; (b) H2 M2 is a 35-year-old male, who in addition to engaging in housework also keeps track of expenses and savings; (c) H2 M3 is a 14-year-old female, who picks and sells mushrooms for income; (d) and H2 M4 is a 50-year-old male, who receives disability.

Each household represents a social network comprised of its member agents. In addition, H1 M2 and H2 M2 are also members of a social group, which is a third social network, connecting the two households. The social network structure is depicted in Figure 6. As shown, only H1 M1 and M2 are engaged in the collective action of operating a family-owned green business. However, this changes in a period of six years.

Figure 1: The social network structure of the two households over time.



The above-described and -depicted social learning can be traced from period to period by analyzing SHE's output, which is organized in Table 2.

Table 1: Output depicting evolution of mental models.

			P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
H1	M1	age	35	36	37	38	39	40	41	42	43	44
		# of kh	6	6	6	6	6	6	6	6	6	6
		income (₴)	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
		expenses (₴)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
		savings (₴)	100,000	163,800	227,600	291,400	355,200	419,000	482,800	546,600	610,400	674,200
	M2	age	30	31	32	33	34	35	36	37	38	39
		# of kh	6	6	6	6	6	6	6	6	6	6
		income (₴)	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
	M3	age	75	76	77	78	79	80	81	82	83	84
		# of kh	6	6	6	6	6	6	6	6	6	6
		income (₴)	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
H2	M1	age	40	41	42	43	44	45	46	47	48	49
		# of kh	6	6	**7**	7	7	7	7	7	7	7
		income (₴)	16,000	16,000	16,000	16,000	16,000	32,000	32,000	32,000	32,000	32,000
	M2	age	35	36	37	38	39	40	41	42	43	44
		# of kh	6	**7**	7	7	7	7	7	7	7	7
		income (₴)	0	0	0	0	0	32,000	32,000	32,000	32,000	32,000
		expenses (₴)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
		savings (₴)	10,000	26,300	42,600	58,900	75,200	**107,000**	202,800	298,600	394,400	490,200
	M3	age	14	15	16	17	**18**	19	20	21	22	23
		# of kh	2	4	**5**	5	5	5	5	5	5	5
		income (₴)	500	500	500	500	16,000	32,000	32,000	32,000	32,000	32,000
	M4	age	50	51	52	53	54	55	56	57	58	59
		# of kh	6	6	**7**	7	7	7	7	7	7	7
		income (₴)	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800

In period two (P2), H2 M2 learns (through the process of social learning) from H1 M2 about the collective action decision option of starting a green business and, in P3, shares this potential

decision option (again, through social learning) with other H2 members. However, since H2 does not have the necessary savings (the savings of H2 in P2 is ₴26,300 < ₴100,000), its members cannot open a green business. In P5, H2 M3 becomes 18 years old and joins H2 M1 in working abroad. The new influx of higher income (from ₴500 to ₴16,000) speeds up the second household's ability to reach the minimum for starting a green business. In P6, the members of H2 see that their household's savings are now above the minimum for starting a family-owned green business (₴107,000 > ₴100,000) and agree to and collectively start a green business that period.

The above example demonstrates the coevolution of mental models through a complex relationship among factors influencing decision-making, which, in this case, included access to knowledge and personal- and household-level constraints. Recognizing and analyzing these complex relationships has the potential of improving our understanding of context-specific social change and, in turn, our ability to plan proactive adaptation to changes in the climate.

Reference

Sotnik, Garry (2018) *Knowledge acquisition and operationalization for cognitive multi-agent knowledge-based models*. Manuscript submitted for publication.