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The Artificial Society Analytics Platform

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Abstract. Social simulation routinely involves the construction of artificial societies and agents within such societies. Currently there is insufficient discussion of best practices regarding the construction process. This paper introduces the Artificial Society Analytics Platform (ASAP) as a way to spark discussion of best practices. ASAP is designed to be an extensible architecture capable of functioning as the core of many different types of inquiries into social dynamics. Here we describe ASAP, focusing on design decisions in several key areas, thereby exposing our assumptions and reasoning to critical scrutiny, hoping for discussion that can advance debate over best practices in artificial society construction. The five design decisions are related to agent characteristics, neighborhood interactions, evaluating agent credibility, agent marriage, and heritability of personality.

Keywords: Artificial society, agent-based model, design decisions.

1 Introduction

This paper introduces the Artificial Society Analytics Platform (ASAP), a computational model designed to function as an extensible artificial society for studying social life in developed western cities. Our purpose here is to discuss some of the design challenges we faced when constructing ASAP. By surfacing these challenges and explaining our design decisions, we hope to foster dialogue about best practices in building artificial societies. In other words, we are addressing the theme of the 2018 SSC by "looking in the mirror" – taking a hard look at how well we are doing in constructing realistic and functional artificial social worlds. Societies are so complex that their intricacies may seem to defy computational modeling. However, we believe that the construction of sophisticated artificial societies is becoming increasingly feasible – that is, both computationally tractable and materially useful for scientific research.

A wide variety of general agent-based models have been developed over the years as scholars in this field have made advances in simulating the emergence of macro-level societal phenomena from micro-level interactions [1]–[9]. We believe the field of social simulation can mature even more quickly if we engage in sustained, self-critical discussions about how well we are modeling critical aspects of social complexity.

We designed ASAP to handle a variety of specialized inquiries related to the evaluation of scientific hypotheses about – and policies for promoting – healthy social equilibria within urban areas in the developed western world. The platform features "worldview clubs," which may be either religious or secular; this is intended to facilitate the exploration of hypotheses about the dynamics of group life within and between religious and non-religious groups. It includes a majority (host) population group and a minority (immigrant) population group, as well as individual level variables such as outgroup suspicion, ingroup support, and shared norms, which make it suitable for extension to models about immigrant integration. Agents in ASAP are distributed in different neighborhoods and linked to job locations. They meet in a variety of networks, influence one another's worldviews, get educated, seek employment, look for compatible marriage partners and reproduce, age and die. These features render ASAP useful for certain types of policy modeling, estimating cost-effectiveness of policy proposals, and informing debates among policy professionals.

In the latter part of the paper, we describe the agents, agent interactions, and parameters within the computational architecture of ASAP. We conclude with reflections on our experience of looking in the mirror. However, we begin by offering our rationale for some of the design decisions we had to make in constructing an artificial society that could be extended to multiple case studies. Our goal is to foster debate about such decisions among those invested in promoting and improving social simulation methodologies.

2 Design Decisions for Discussion

2.1 Agent Characteristics

The first series of design decisions for scrutiny deal with the definitions of agent variables (which are described in more detail in section 3). Without complex agents in play, an artificial society will be incapable of expressing social phenomena of interest. If agents are too complex, we risk losing cognitive control over the model and creating a computational monster too slow to be useful. Finding the sweet spot depends on the specific inquiry for which the virtual society is being developed and on available computational resources. We plan to use ASAP to answer a variety of questions, and so it needs to be extensible in the relevant ways. Our goal was to identify an ideal set of core agent characteristics that could be used in almost all specific applications.

We settled on the agent variables portrayed in Figure 1 for several reasons. The rationale for the *demographic* variables is that they seem to be those minimally required to simulate almost any interesting social dynamics. These demographic variables frequently interact in ways that are useful for policy modeling. For example, policies aimed at increasing immigrant employment can have negative effects on majority employment rate in western, urban societies of the sort ASAP is designed to simulate.

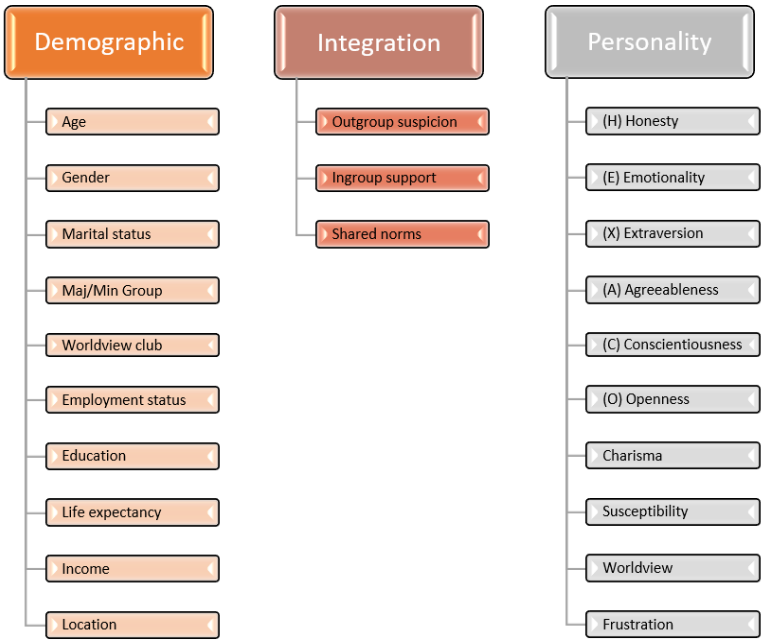

Fig. 1. Three types of agent variables in ASAP.

Although other sociological theories were taken into account in framing the *integration* variables, the computational architecture was strongly informed by the work of sociologist of religion David Voas [10], [11]. These variables combine with some of the demographic variables to help capture the difference between three distinct dimensions or types of integration: 1) *structural* integration, characterized by equality of opportunity in education, employment, housing, civil rights and civic participation; 2) *social* integration, defined as interaction between members of different groups in ways that range from the superficial (brief impersonal encounters, for example in commercial transactions) to the deeply personal (close friendships and intimate relationships); and 3) *cultural* integration, which involves shared norms, values, worldviews, and cultural capital.

We adopted the HEXACO framework [12] for *personality* variables, distributing them in the artificial population in ways that reflect the real world. We preferred HEXACO because it extends the Big Five framework [13] by adding Honesty/Humility, which is an important factor in some interpersonal interactions. Incorporating personality enables us to enrich the representation of several social dynamics, including shifts in agent worldviews and switching in religious/secular worldview club affiliation, since these worldview-related variables are associated with personality (e.g., religious individuals, especially those in religious worldview clubs such as churches or synagogues or temples, tend to be higher in conscientiousness and lower in openness than the population as a whole).

Beyond HEXACO variables, we settled on three personality features critical for interpersonal interactions. The intensity of the effect of an interaction between ego and alter agents is amplified or muted by the *susceptibility* of the ego and the *charisma* of the alter. The *worldview* variable enables us to characterize an agent's religious (supernaturalist) or secular (naturalist) way of thinking, and the way it changes during personal interactions, which is crucial for studying worldview club affiliation, disaffiliation, and reaffiliation dynamics.

2.2 Neighborhood Interactions

Each agent may engage in several sorts of interactions each week. The frequency of salient interactions capable of impacting ego agent variables is an interesting question. We settled on weekly interactions partly because interactions that occur more frequently are rarely significant and partly to simplify computational load. We know of no quantitative data to answer the frequency question, so we relied on the intuition of our subject-matter experts (SMEs). To focus debate, here we discuss interactions in an agent's neighborhood (around the agent's place of residence), which are particularly important when ASAP is used to study immigrant integration.

Figure 2 portrays the decision tree for an ego agent interacting with an alter agent in ego's neighborhood (this is an enlarged version of the matching part of Figure 5 below). We made several assumptions. First, we assumed that minority-majority interactions must be analyzed separately from same-group interactions. Second, we assumed that effects of interactions would depend on a stochastic process in which the relative importance of shared norms and outgroup suspicion govern how well an interaction is likely to go. Third, we assumed that the impact of neighborhood interactions is adequately captured by changes in the three integration agent variables. Fourth, we assumed no other considerations were important enough to include. Each of these assumptions was based on SME intuition and each is worth discussing among those who build virtual societies.

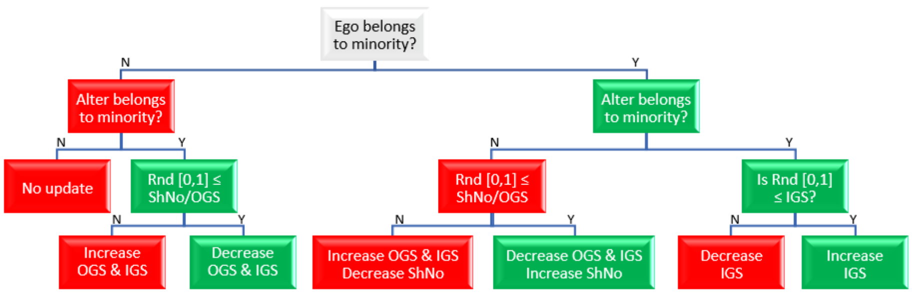

Fig. 2. Dyadic neighborhood interactions in ASAP. Ego=agent possibly changing; alter=ego's interaction partner; Rnd [0,1]=random number between 0 and 1; IGS=ingroup support; OGS=outgroup suspicion; ShNo=shared norms

2.3 Evaluating Agent Credibility during Personal Interactions

We also use ASAP to study secularization, a process facilitated by a lack of religious credibility enhancing displays (CREDs) within a population [14], [15]. Research in this area shows that individuals are more likely to continue believing in the gods of the religious clubs in which they were raised, and affiliating with those clubs, if they encountered during childhood costly displays of belief within their families of origin and religious contexts. When there are inadequate displays to enhance credibility, a population is more likely to become secular, especially when governmental institutions satisfy basic human needs without dependence on religious institutions. This is an example of empirical findings and theoretical developments in the relevant sciences informing our design decisions. We assume that the cohesion of groups whose identity is connected to secular ideology is also partially dependent on the presence of sufficient CREDs in such groups.

We conceived interactions relevant to CRED evaluation in terms of a conceptual framework from epidemiology of representations: the ego agent is a *learner* whose variables are subject to change and the alter agent is an *exemplar* who potentially impacts the learner. The worldview interaction is distinct from the six depicted in Figure 1. We present the learner agent's decision tree for evaluating an exemplar's potential CRED in Figure 3. The learner variables that may change are Worldview, which varies continuously between 0 (fully secular and naturalist) and 1 (fully religious and supernaturalist); and Frustration, which varies continuously between 0 (not at all frustrated with the club ego is in or with being in no club) and 1 (extremely frustrated with ego's club or with being in no club).

When Frustration passes a threshold, ego will act in one of three ways: (1) joining the club of the last club-affiliated person who impacted ego positively; (2) switching from one club to another, joining the club of the last club-affiliated person who impacted ego positively; or (3) leaving ego's current club and having no worldview club. After acting, ego's frustration variable drops dramatically. The worldview club joined tends to be compatible with ego's worldview. It is possible for a secular-leaning ego agent to affiliate with a religious group or vice versa but a person with an extreme worldview value would never join a mismatched worldview club.

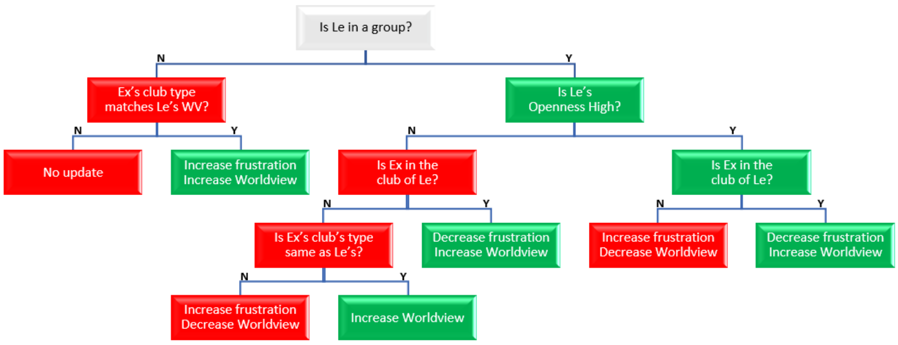

Fig. 3. Decision Tree for evaluating credibility of behaviors in ASAP. Le=learner (ego) agent; Ex=exemplar (alter) agent; club type is Boolean (0=secular, 1=religious).

Critical to the dynamics of worldview change and worldview club affiliation is the ego-learner agent's openness. When ego is in a club, the openness personality characteristic plays an important role in assessing the impact of a CRED from someone in a different club. If ego is low in openness, a CRED from a member of a competitor club will threaten ego, increasing frustration and changing worldview – we call this the pluralism effect, and it acts on low-openness agents. By contrast, if ego is high in openness, a CRED from a member of a competitor club will not trigger the pluralism effect but rather increase worldview confidence and decrease ego's frustration with ego's current group. These dynamics depend on findings in social-psychological and personality research on religious pluralism.

2.4 Agent Marriage and Homophily Constraints

Marriage plays an important role in shaping all human interactions, and especially in the integration of cultures. We therefore tried to make design decisions that would capture the most relevant causes and effects related to marriage that bear on the social dynamics of urban western societies.

Many traits related to religion and personality affect social interactions, and are also heritable, so marriage and producing biological offspring are important conditions for the spread of these traits through a population. Moreover, our SMEs guided us through what social theorists know about homophily in the process of selecting a marriage partner. Figure 4 presents the homophily constraints on the left, the variable changes upon marriage in the center, and the handling of heritable traits in offspring on the right (discussed below). Regarding homophily conditions, we selected the four considerations our SMEs thought were most important on average; these assumptions should be debated.

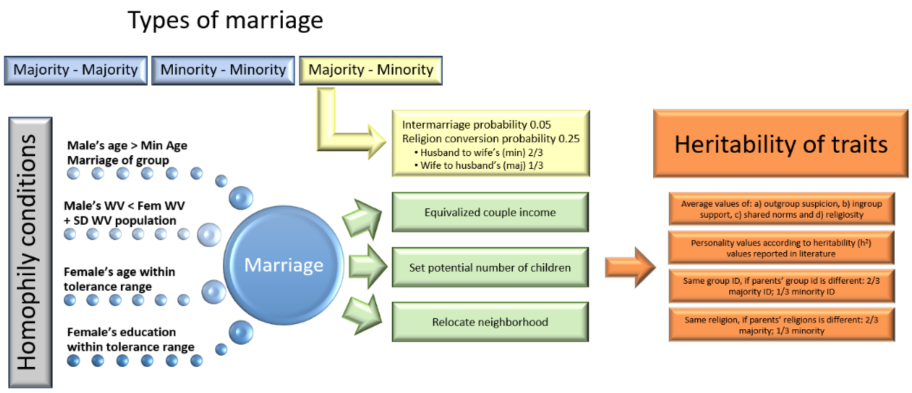

Fig. 4. The marriage process. WV=worldview values, SD=standard deviation. Tolerance ranges are set in model parameters.

2.5 Heritability of Personality

ASAP posits that personality (instrumentalized primarily using the HEXACO six-factor system) informs most relevant personal characteristics and, being significantly heritable, is the principal vehicle for the transmission of traits across generations. We derive heritability factors from research in twin studies [16], [17]. We round heritability factors to the nearest one-sixth in Table 1. Heritability of personality is critical for social dynamics. For instance, we know from twin studies that religiosity, conservatism, and authoritarianism are significantly co-heritable, and that this can be captured through the transmission of personality traits across generations because religiosity, conservatism, and authoritarianism have strong personality correlations particularly with Openness and Conscientiousness.

Personality trait	Heritability (h^2)
H – Honesty	0.33
E – Emotionality	0.33
X – Extraversion	0.50
A – Agreeableness	0.33
C – Conscientiousness	0.50
O – Openness	0.67

Table 1. Children inherit personality traits from parents with heritability (h^2) values, which indicates the extent of genetic (as against environmental) influence.

3 Agent Variables in ASAP

The simulated agents in ASAP inhabit a virtual world where they attend school, get hired and fired, get married and reproduce (for a full list of variables, see Table 2). Agents are categorized into majority or minority *groups* depending on their family of origin. They have variables related to their *demographic* features (age, group, education, employment, etc.), their level of *integration* into society (outgroup suspicion, ingroup support, and shared norms), their personal *worldview* (ranging from religious supernaturalism to secular naturalism), and their worldview *club* identification (religious club, secular club, no club). The values and settings for the demographic variables are based on available data and/or subject-matter expert assessment. For example, we believe that immigrants in the contexts we want to simulate will tend to be more highly educated due to factors such as immigrant selectivity and the high value immigrant parents place on education as a means of social mobility. This is the sort of assumption that ought to be debated in the construction of artificial societies.

Worldview clubs are membership organizations that exist to support people having specific types of worldview and to advance those worldviews; when an agent belongs to a worldview club, the agent's personal worldview variable tends to match the worldview of the club. Agents have personality (using the six HEXACO personality factors and several other personality features), memories of salient interpersonal encounters, the ability to learn from others, and the power to evaluate the sincerity and consistency or hypocrisy of those around them. In the process of interpersonal exchange, agents may change their worldviews and their club-affiliation identities.

On initialization of a simulation run, agents are assigned variables drawn from suitable distributions that may vary according to whether they are in the majority or minority. They attend school until they are at least 16 years old; thereafter the number of years of further education they receive varies. After finishing school, agents attempt to move into the work force; the likelihood of agents getting employed depends on their sex and majority or minority group classification. Agents die with a certain probability or if they reach a natural limit derived from a longevity distribution. They have a chance of getting married once they reach the relevant age threshold. Agents tend to marry agents of their own group, but mixed marriages (between majority and minority groups) are also possible. To get married, agents must satisfy age, education, and worldview compatibility conditions related to their potential partner (Figure 4 above). Once married, agents may have children; newly born agents inherit the personality traits of one of their parents (randomly chosen) and the average value of the integration variables (outgroup suspicion, ingroup support and shared norms). Other demographic variables are assigned according to parameter values specified in the model.

Variable	**Description**	**Values**	**[Min,Max]**
Status	Status of Agent	Student/Employed/Unemployed	NA
Life expectancy Maj	Potential lifespan for majority	Triangular (Min,Max,Mode)	[65,95,80]
Life expectancy Min	Potential lifespan for minority	Triangular (Min,Max,Mode)	[45,85,65]
Total Education Maj	Years of education	Min + Normal ($\mu;\sigma^2$)	[10,20]
Total Education Min	Years of education	Min + Normal ($\mu;\sigma^2$)	[12,20]
Suspicion Maj	Level of suspicion towards min	Normal (μ,σ^2) or average of parents	[0,1]
Suspicion Min	Level of suspicion towards maj	Normal (μ,σ^2) or average of parents	[0,1]
Group Support Maj	Level of maj ingroup support	Normal (μ,σ^2) or average of parents	[0,1]
Group Support Min	Level of min ingroup support	Normal (μ,σ^2) or average of parents	[0,1]
Shared Norms	Degree of sharing cultural norms	Normal (μ,σ^2) or average of parents	[0,1]
Number of Children	Likelihood of having children	0=16%; 1=18%; 2=41%; 3=18%; 4=7%	[0,4]
Level of Authority	Authority given by employment	Uniform [0,1]	[0,1]
Worldview	Worldview identification	Normal (μ,σ^2) or average of parents	[0,1]
(H)Honesty	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
(E)Emotionality	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
(X)Extraversion	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
(A)Agreeableness	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
(C)Conscientiousness	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
(O)Openness	Personality trait	Normal (μ,σ^2) or inherit from parents	[0,1]
Charisma	Personality trait	Normal (μ,σ^2)	[0,1]
Susceptibility	Personality trait	Normal (μ,σ^2)	[0,1]

Table 2. Variables held by agents in the ASAP platform. Maj=majority; Min=minority, NA=not applicable. Triangular=values from triangular distribution (with Min=minimum, Max=maximum, Mode=mode). Normal=values from a normal distribution (with mean μ, standard deviation σ2). Uniform=values from a uniform distribution (over an interval).

4 Agent Interactions

Agents have up to 6 different kind of social interactions on a weekly basis (see Figure 5). To interact agents must be at least 12 years old. A work interaction requires the agent to be employed. Agents interact with others within their family, work, neighborhood, online, offline, and impersonal social networks. Family networks consist of father and mother; neighborhood networks are all agents in same neighborhood as the ego agent; online networks are two agents selected at random from the entire population; work networks are all agents working at the same job location; and impersonal networks are agents within *interaction radius* distance from ego. Offline social networks are stochastic with the probability of being someone else's alter agent inversely proportional to the spatial distance between ego and alter. Every week, an alter agent from each network is selected at random and an interaction with ego occurs. These interactions result in positive, negative, or neutral outcomes, which increase, decrease, or leave equal ego agent variables related to integration: outgroup suspicion, ingroup support, shared norms.

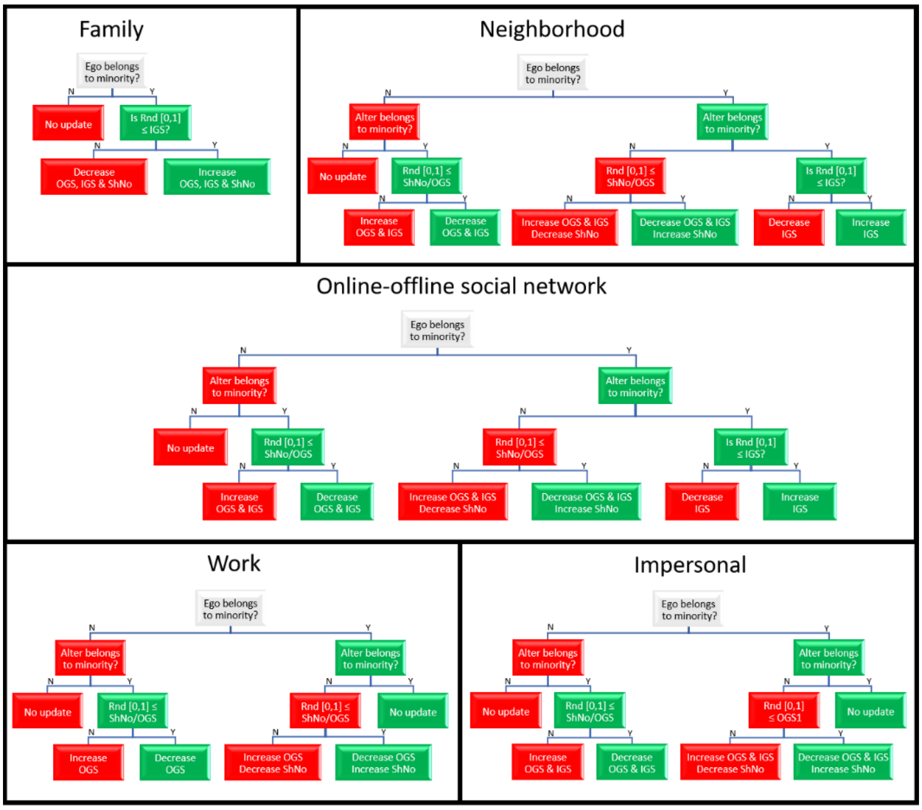

Fig. 5. Weekly interactions in the model and their effect on the agents' integration variables. OGS=outgroup suspicion, IGS=ingroup support, ShNo=average shared norms for agent's group.

Majority-majority interactions produce no changes. A minority agent evaluates interactions with other minority agents based on the average degree of ingroup support in the minority group: if average minority ingroup support is higher than a random number between [0,1], then the result of the interaction is positive (negative otherwise). The outcome of minority-majority interactions depends on the ratio between average agreement level (shared norms) and average outgroup suspicion in the entire population: if the average agreement level is higher than that of outgroup suspicion the interaction will likely be positive (negative otherwise). There is a stochastic element, which is why random numbers appear in Figure 5.

In work and impersonal interactions, average outgroup suspicion is multiplied by *AntiDis* (AntiDiscrimination) and *MinFr* (Minority Friendly), and by *AntiDis*, respectively. *AntiDis* and *MinFr* represent the strength of antidiscrimination laws and multicultural behavior present at job or in ego's impersonal network. Multiplying outgroup suspicion by these variables increases the likelihood of a positive interaction. In impersonal minority-majority interactions, the level of authority of the alter impacts the update of the ego's integration variables. The rationale is that a positive (or negative) interaction in an unimportant encounter (measured by the level of authority of the alter) will have a lower impact than one with a more powerful alter. In family, neighborhood, and offline interactions, women in minority-minority interactions are more vulnerable and thus more likely (10%) than men to rate interactions positively (because of pressure from family, friends, and/or neighborhood); in the model this is represented by subtracting 0.1 from the random number [0,1].

The update of values after an interaction is shown in Table 3. The ego agent increases (or decreases) its current integration variable value by adding (or subtracting) a random value drawn from a normal distribution with mean and standard deviation obtained from the values of the alter agent's group. In the case of family interactions, the random value is drawn from a normal distribution with mean and standard deviation obtained from ego's parents' values. Note that these variables range from 0 to 1; if the updated value goes beyond this range, then the variable is set to its maximum (1) or minimum (0) value.

Interaction	**Updated value**	**μ,σ^2 from:**
Family	CV + Normal (μ,σ^2)	parents
Neighborhood	CV + Normal (μ,σ^2)	agent's group
Online	CV + Normal (μ,σ^2)	agent's group
Offline	CV + Normal (μ,σ^2)	agent's group
Work	CV + Normal (μ,σ^2)	agent's group
Impersonal	CV + (Authority Impact*Alter's authority level) + Normal (μ,σ^2)	agent's group

Table 3. Update of integration variables (outgroup suspicion, ingroup support, shared norms) after positive interactions. The update of negative interactions is the same but the plus (+) sign after current value is changed to minus (–). CV=current value; Normal=values drawn from a normal distribution (with mean μ, standard deviation σ2); Authority Impact is a parameter.

After a year of social interactions (52 weeks) agents: a) die if they reach their life expectancy; b) may die with a certain probability (*Death probability*, see Table 4); c) may get married and have children; d) update their online/offline social networks, e) if in the work force, may obtain/lose jobs; f) if students, increase their education level; and g) if completing their education, enter the work force and may obtain jobs.

5 ASAP Parameters

Parameters in ASAP are fixed for a given simulation run and can be varied to explore model dynamics. Table 4 lists the parameters. Since we are not reporting on experiments, we furnish this as contextual information for explaining our design decisions.

Model Parameters	Description	Default	[Min,Max]
	Population		
Population Size	Number of adults at start of simulation	10,000	[1000,1000000]
Percentage of Females	% of female agents	52	52
Maj-Min split	% of individuals belonging to maj	60	[60,90]
Neighborhoods	Number of neighborhoods	34	34
Death Probability	Probability of dying each year	0.005	[0,0.1]
	Age		
Min Age Maj	Minimum number of living years for maj	65	[55,75]
Max Age Maj	Maximum number of living years for maj	95	[70,100]
Mode Age Maj	Mode value of life expectancy for maj	80	[55-100]
Min Age Min	Minimum number of living years for min	45	[40,60]
Max Age Min	Maximum number of living years for min	85	[65-95]
Mode Age Min	Mode value of life expectancy for min	65	[40,95]
	Education		
Max Edu Maj	Maximum education years for maj	20	[15,25]
Min Edu Maj	Minimum education years for maj	10	[8,15]
Max Edu Min	Maximum education years for min	20	[15,25]
Min Edu Min	Minimum education years for min	12	[8,15]
	Marriage		
Min Age Marriage Maj	Minimum age for getting married maj	26	26
Min Age Marriage Min	Minimum age for getting married min	21	21
Marriage Rate	Likelihood of getting married	0.02	[0.01,1]
Marriage Age Tolerance	Max age difference between agents	2	[1,5]
Marriage Education Tolerance	Max education difference between agents	2	[1,5]
Endogamy Degree	Likelihood agent marries opposite group	0.05	[0,0.4]
	Employment		
Number of Employers	Number of Job locations	5	[1,100]
Min Friendly mode	Mode value of Min Friendly	0.85	[0,1]
Minority Friendly	Degree of multicultural behaviors at job	Tri	[0,1]
Enforced Antidiscrimination	Degree of antidiscrimination laws present at job	0.5	[0,1]
Per Maj Mal Employed	% of males in maj employed	1	[0,1]
Per Maj Fem Employed	% of females in maj employed	0.7	[0,1]
Per Min Mal Employed	% of males in min employed	0.85	[0,1]
Per Min Fem Employed	% of females in min employed	0.35	[0,1]
	Integration		
Suspicion Maj/Min Mean	Mean value of suspicion of maj/min	0.5	[0,1]
Suspicion Maj/Min SD	SD of suspicion of maj/min value	0.25	[0,0.5]
Group Support Maj/Min Mean	Mean value of in group support for maj/min	0.5	[0,1]
Group Support Maj/Min SD	SD of in group support for maj/min	0.25	[0,0.5]
Shared Norms Mean	Mean value of shared norms	0.5	[0,1]
Shared Norms SD	SD of shared norms value	0.25	[0,0.5]
	Personality traits		
HEXACO Mean	Mean value for each HEXACO trait	0.5	[0,1]
HEXACO SD	SD of each HEXACO trait value	0.25	[0,0.5]
WorldView Mean	Mean value of world view	0.5	[0,1]
WorldView SD	SD of world view value	0.25	[0,1]
Charisma Mode	Agent's value of extraversion	Tri	[0,1]
Charisma Min/Max value	Agent's value of extraversion ± 0.25	NA	[0,1]
Susceptibility	Agent's value of Agreeableness	Tri	[0,1]

Susceptibility Min/Max values	Agent's value of Agreeableness ± 0.25	NA	[0,1]
	Others		
Authority Impact	Impact of authority level on social interactions	0.1	[0,1]
Interaction Radius	Spatial radius within which individuals interact	500	[1,1000]

Table 4. Parameters for the ASAP platform. Maj=majority, Min=minority; Tri=values from a triangular distribution (with Mode, Min, Max); SD=standard deviation; NA=Not Applicable.

6 Verification, Validation, Calibration, Computability

ASAP has been built and we have verified that it conforms to requirements. We are in the process of working with subject-matter experts to validate it against data. One validation method is examining a matrix of parameter (input) and variable (output) values drawn from a parameter sweep, looking for plausible and implausible correlations. We have not yet attempted to calibrate ASAP to specific contemporary western cities.

ASAP can be run on a standard 64 bit windows platform with 64 GB of RAM and an Intel ® Xeon ® processor at 2.60 GHz. The model is built on top of the AnyLogic ® platform which is a java-based environment for developing hybrid models (Discrete-Event, System Dynamics, and Agent-based). We have tested the model with 10,000 agents interacting for 30 years. At 500 times the speed of a wall clock, it takes approximately 2.2 hours for a simulation to complete. We believe that we can enhance performance by improving the code, especially in the area of social network management.

7 Conclusion

Our research team's work on the Artificial Society Analytics Platform has been informed by our failures and successes during the process of developing several other models aimed at simulating societal dynamics [16-20]. We believe we are making progress. But progress would be quicker if we could facilitate a debate on best practices in artificial society design. Such a debate could begin with the five design decisions presented in section 2, but it need not end there. Every aspect of the construction process should be under consideration as we seek to provide better rationales for design decisions.

As the field of social simulation enters puberty, critical self-reflection involves "looking in the mirror" at our own artificial society design assumptions and inviting scrutiny from other experts. We have tried to foster this process by hosting sessions on "best practices" at conferences on modeling and simulation such as SpringSim 2019. This sort of self-reflection has the potential for inducing identity crises as well as for prompting moments of inspiration and insight. But that's what will be required to guide our relatively new discipline safely through this transformative period, with its inevitable growing pains, until "social simulation" attains proper scientific adulthood.

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