An Application of Systems Theory to the Perception of Combat in Martial Arts

Authors: Evangelos C. Papakitsos, Hellenic Ministry of Education,
         Research and Religious Affairs**,** papakitsev@sch.gr
         Spyridon V. Katsigiannis, Hellenic Wushu Federation,
         info@dynamo-kettlebells.com

Abstract

Systems Theory consists of specific types of methodologies to understand the perception and analysis of natural and social phenomena. We consider Combat in Martial Arts to be a social phenomenon as well as an adaptive human activity that we can depict and describe through systemic modeling. Here we present a relevant modeling methodology that aims at improving the performance of martial arts practitioners in their training duties, through a better understanding and explanation of this complex social phenomenon in an organized manner.

Keywords: systems theory, systemic modeling, combat perception.

1. Introduction

Systems Theory is the interdisciplinary study of the abstract organization of phenomena, independent of their nature or scale of existence. The purpose of the application of it is to investigate both the principles that are common to all complex entities and the (usually) mathematical models which can be used to describe them (Heylighen & Joslyn, 1992). The main concept of the theory is the "system," which is described as a complex set of components and their inherent properties, the relationships among these components, and the processes by which these components interact with each other as well as with their environment. Thus, every phenomenon is regarded as a system that can be described through a model. The study of systems was initiated by the work of Von Bertalanffy (e.g. see: Von Bertalanffy, 1968).

Important types of systems are the self-regulating or adaptive ones that learn from experience and change their behavior through the process of collecting and applying feedback. Such systems are both natural and social, and included in them are the human learning processes. Consequently, Stichweh (2011) defines the two variants of Systems Theory as:

- the General Systems Theory, such as natural systems, which is influential among biologists, chemists, physicists and mathematicians, and
- the analysis of social systems as a sociological paradigm, which was influenced by the writings of Parsons (1977) and Luhmann (1995).

The original General Systems Theory (GST) is also associated with Cybernetics, as defined in the work of Wiener (1948). Later on, Laszlo & Krippner (1998) applied GST to human activity systems, because "… social and psychological phenomena tend to resist quantitative modelling by posing basic difficulties already on the plane of boundary identification …"

In the analysis of social systems, a crucially important concept is their relationship to the study of perception. According to Laszlo and Krippner (1998):

> 'Perception' refers to the organization of sensory information into meaningful patterns. It begins with the reception of information by the senses and then involves selection as well as active computation. Just as 'behaviour' and 'activity' are labels for output phases of an operation of some types of living structures, 'perception' is a label for an input phase. […] Perceptual events are processed for some time before an organism becomes aware of them.

The study of perception in a systemic manner can be conducted through the methodology of Systems Inquiry (Bánáthy, 1997), where the researcher/scholar attempts to reveal the composite nature of a system by asking questions related to Systems Theory, philosophy and methodology (see: Bánáthy, n.d). This methodology contains a variety of relevant conceptual tools, including 'cognitive maps'. The cognitive map of a specific human being is a conceptual representation of his/her environment (Laszlo et al., 1993).

2. Systems Theory for Martial Arts
The application of Systems Theory to martial arts had been experimentally attempted at least since 2001 (Papakitsos, 2001a) by designing elementary training curricula for Jeet Kune Do (JKD) and the Filipino Martial Arts (FMA). The training material of JKD and FMA had been introduced into Greece, gradually from 1993 to 2000, through seminars by invited foreign instructors and the personal experience of a handful of local instructors (Papakitsos, 2001b). This material originated from more than one style/source, and so it was fragmented in terms of conveying a direct teaching progression system. Thus, there was a need for cohesive and scientifically organized training programs, in order to have these martial arts taught in a systematic manner to the interested public. At that time, the lack of such programs was evident world-wide, considering that top instructors had to design their own curricula (see: Magda, 1995) while the Jun Fan JKD Association organized annual meetings in order to define the nature of their art. Consequently, software engineering techniques that are utilized for the development of Information Systems were applied to design an innovative relevant training curriculum. Later on, as the very first generation of practitioners concluded the basic training programmes developed through this system and some of them were interested in becoming qualified instructors, a need arose for advanced curricula, aiming at the preparation of candidate instructors, as well as for specialized curricula intended for practitioners of other martial arts who were interested in learning Filipino weaponry, or for police and military forces (Papakitsos, 2003; 2008; 2009).

The main technique that the first author for the afore-mentioned tasks used was the Structured Analysis and Design Technique (SADT), which had been created in 1973 by D.T. Ross (1977) and Softech Inc. for commercial purposes (see also: Pressman, 1987; Papakitsos, 2013a, 177-178). SADT initiated an evolutionary path of systemic modeling tools, consisting of the IDEFx family of models, created in 1981 by the same developers after a requirement of the US Air Force for a modeling methodology (Grover & Kettinger 2000; Papakitsos, 2013a, 178), and the Organizational Method for Analyzing Systems (OMAS). The latter one is also a systemic modeling method that was originally developed by Papakitsos (2010), with a second revision (OMAS-II) released in 2011 (Papakitsos, 2011) and the last version (OMAS-III) introduced in 2013 (Papakitsos, 2013a, 178-185; 2013b). OMAS is compatible to the Systems Inquiry methodology. Consequently, for testing the conceptual framework, it has been applied for designing curricula not only of martial arts (Papakitsos, 2015) but of other disciplines as well, like language teaching (Makrygiannis & Papakitsos, 2015) and career guidance (Papakitsos et al., 2015), among other applications (Papakitsos, 2013a, 185-189).

The previous to OMAS systemic models (SADT and IDEFx) had originated from Information Systems, and thus were already tailored to applications of GST. OMAS was developed in order to be extended for applications of social systems as well, since combat of any scale (from duel to battle) and type (competition or self-defense) is regarded herein as a human activity system. Moreover, it is an adaptive system that learns from experience, thus combat can be perfectly described by the generic systems model (Sanders, 1991) through the relevant looping quadruplet:

input (perception) > *process* (selection/active computation) > *output* (behavior/activity) > *feedback* (learning/experience).

Namely, the perception of the combat conditions (*input*) leads the practitioner to devise an action plan (*process*) that he or she applies in tactical terms (*output*). Finally, the practitioner evaluates the outcome of this application (combat results, damages/casualties, resources spent, efficiency of weapons and actions, etc.) to generate new knowledge to apply to a subsequent confrontation (*feedback*).

Accordingly, the perception of combat by an instructor is a factor of crucial importance for the proper training of the practitioners. The analysis of any system using OMAS is based on the seven so-called *journalist's questions*:

Why : for its Purpose/Goal (competition/self-defense/military engagement);

What : for its Output/Results (victory/defeat/draw);

Which : for its Input/Resources (weaponry, equipment);

How : for its Rules/Conditions (competition regulations/engagement rules);

Who : for its Participants (allies, opponents);

Where : for its natural/virtual spatial aspects (battlefield, ring, cage, street and position related to the opponent); and

When : for its relevant/absolute temporal aspects (time of day and timing of action);

therefore facilitating the methodology of Systems Inquiry in a 'natural' linguistic manner, since we use the same words (i.e., the *journalist's questions*) daily to ask anything we want in order to learn whatever we seek. In addition, the accompanying notation of OMAS that depicts the journalist's questions in a figure (Papakitsos, 2013a, 180) helps an instructor to form a cognitive map that facilitates the understanding and the memorizing of the various combat aspects. The outcome of this methodology is demonstrated in the next section.

3. Systemic Modeling of Combat

Combat is an activity comprised of a number of aspects that can be classified in three major groups (Table 1). The first group includes the constituent elements of the activity, such as subjects, objects, conditions and ideas that we will refer to as *factors*. We will term *phases* as the aspects that relate to the time-progression, from start to finish, according to which the activity of combat unfolds (see subsection *Combat Phases*, next). Finally, all the actions taken in every aspect of combat are organized accordingly. We will call this structural group of aspects *levels* of combat.

Table 1: Combat Aspects.

FACTORS : Elements		
CAUSES (Why)	Survival, Prize	
MEANS (Which)	Weaponry	
PARTICIPANTS (Who)	Allies, Opponents	
PRINCIPLES	Strategy, Tactics, Techniques	
OUTCOME (What)	Victory, Defeat	
PHASES : Progression (When)		
PREPARATION	Training (Before)	
OPERATION	Conduct (During)	
EXPLOITATION	Results (After)	
LEVELS : Structure		
STRATEGIC		Morale
	Abilities	Physical, Mental, Functional
	Goals	Doctrine, Justification
	Plans	Intentions, Initiative, Guidelines
TACTICAL		Maneuver (Where), Power
	Space	Environment, Position
	Time	General, Specific
TECHNICAL		Targets, Tools, Techniques

Combat Factors.
According to the systemic approach via OMAS, every system has an input (initial data), an output (final results), persons involved, and rules controlling the activity of the system. If one applies this approach to combat, it is easy to see that the aspects we designated as *combat factors* are the causes of engagement, the input (*means*), the persons involved (*participants*), the controlling rules (*principles*), and the output (*outcome*) of the system.

Causes:
The most common *causes* for participating in combat are rooted in human aggression, which can be explained in terms of competition for scarce resources. These resources can be either material, connected to our survival (or that of our offspring), or material and psychic (sometimes in the form of a prize), the demand for which is socially created. In both of the previous cases, we apply Miller's research that shows that competition for scarce resources leads to aggression and violence, which are expressed through the hierarchy of territoriality (Miller, 2008). So, in a simplified way, we could say that a criminal who first confronts and then decides to attack his or her victim in order to steal money sees the victim as a resource connected to his survival; a fight among football hooligans is a rather territorial affair; entering an amateur martial arts tournament has a distinct hierarchical flavor and little survival value, while competing professionally in a combat sport is both hierarchical and connected to one's choice of vocation for survival, since, after all, some do see it fundamentally as a way of making a living[1].

---

[1] It should be noted that territorial and hierarchical aggression are a cross-specific behavior - not in any way unique to humans - in which mostly young males participate. Corrections officer, self-defense instructor and writer Rory Miller interestingly refers to hierarchical and territorial violence among young male humans as "monkey dancing" and claims that this sort of violence can always be avoided if one simply chooses not to participate in it (Miller, 2008).

Means:
The term "means" refers herein to weaponry. Weapons can be classified into three major categories concerning their way of construction:

- *Artificial* or *exclusive*, like guns, swords, lances, etc. Some of the many subcategories by which to classify weapons are offensive or defensive (shields, helmets, etc.), holding or throwing (e.g. javelins), heavy or light, firearms, etc. These classifications refer to the original purpose for designing any particular weapon. Additionally, this category of commonly used weapons can include those that have been originally designed for hunting or for home/field use, like knives, axes, tonfas, scythes, etc., but their shape and range of functionality make them useful and effective for fighting as well.
- *Natural* or *improvised*, like stones, metallic pipes, screwdrivers, pens, wooden-sticks, etc.
- *Physical* or *anatomical*, like our hands and legs.

Fighting with weapons of the last category is commonly regarded as "weaponless" or "unarmed". Yet, we will refer to the usage of weapons as "tools" herein (especially in reference to the terminology of JKD).

Participants:
They are the adversaries that engage in combat. These are either friends or foes. The latter is a potential or expected enemy, while in the case of martial sports, another athlete.

Principles:
Despite the common current usage of the term "no-rules fighting", there is actually no such thing. The people who use the term probably mean "no-regulations fighting" (or more accurately, "few regulations fighting") which is something completely different. The activity of combat has *principles* that, when applied, ensure a high probability of success. These are the rules of combat, which in the case of martial sports are supplemented and occasionally substituted by the regulations of each particular sport.

Outcome:
The *outcome* of an instance of combat is the result of fighting, as evaluated by the participants and according to their predefined criteria. We have to mention though that between victory and defeat there is a range of potential results that are neither the former nor the latter, and are expressed as draw, questionable victory or questionable defeat.

Combat Phases.
The *phases* of combat describe the process of conflict, namely what happens before, during, and after the actual fight.

The *preparation phase* includes all the actions taken before the combat takes place. These consist of the martial arts training and having a method of acquiring and honing the skills used in the method of fighting, as well as the actions done at the *Strategic Level*.

The *operation phase* consists of the actual conduct of combat. It includes all the actions taken during the combat, as applied at the *Technical & Tactical Level*.

The *exploitation phase* consists of the actions after the main combat, including the *disengagement* from the battlefield and the *submission/negotiation* or *pursuit* of the opponents.

Combat Levels.
The *levels* of combat present an efficient way to organize the actions of a complex problem (that of fighting) into smaller, more manageable parts. Thus, combat is carried out by dividing the original problem into sub-problems and then attempting to solve each sub-

problem separately[2]. Consequently, the *strategic level*, the *tactical level* and the *technical level* constitute an attempt to define as well as structure this approach.

Strategic Level:

The *strategic level* refers to the activity before the actual fight (*preparation phase*) and with the a priori definition of the *factors*. It concerns the *abilities*, the *goals* and the *plans* of the adversaries. The *abilities* can be:

- *physical* (strength, speed, endurance, flexibility);
- *mental* (self-discipline, know-how, determination, persistence, concentration, thinking); and
- *functional* (timing, coordination, sensitivity/reflexes, readiness).

To sum up the sub-level of *abilities*, we have to answer the following questions:

Who is the potential opponent?

Who am I?

The *goals* are the formulation of the *doctrine* and *justification*. The *doctrine* is a set of beliefs[3] that provide the definition of the *factors*. It is a crucial aspect because everything else (plans, tactics, techniques) is based upon the *doctrine*, regarding any particular martial art. An example of martial doctrine is the firm conviction of some grappling arts (e.g., Brazilian Ju-Jitsu, Hurimao Pentjak Silat) that most one-on-one fights inevitably end on the ground. The doctrine of kicking arts is that the leg-muscles are the most powerful of the body, so leg techniques are the prime weapons used (Murdock, 2006). JKD includes in its doctrine the principles of simplicity, economy of motion and efficiency. Clearly, the content of doctrine affects the character of these martial arts tactically and technically, and thus is the foundation of their entire curriculum. The definition of the *factors* and especially of the *causes* dictates the *justification* as well. Namely, it is of crucial importance to know:

What my potential opponent will fight for?

Why will I fight?

The *plans* of combat concern our overall attitude towards fighting, under given circumstances. They include the *intentions*, which can be (any one or combination of) an *aggressive*, *passive*, *elusive*, or *decisive* behavior, as well as whether the practitioner will take the *initiative* of the activity or not. In accordance with the *intentions* and the *initiative*, the *guidelines* along with the *goals* directly affect the implementation of the above at the *Tactical Level* (discussed below), in relation to the actions of one's opponent(s) and the given conditions. For example, a practitioner should have specific guidelines by which he or she will face an aggressive opponent if one is alone, and these are probably different from those guidelines against the same opponent if one is protecting somebody else. These plans should have been practiced for all possible variations of the opponent's behavior (aggressive, passive, elusive or decisive), being alone, or protecting something other than one's self (persons, areas, objects). Once again to simplify, the questions concerning *plans* are:

How will my potential opponent fight?

How will I fight?

To summarize the features of the *strategic level*, we must know our personal assets (*what*), our justification to fight (why) and *how* to do it, and also know those for our potential opponent as well. Knowledge of the above allows the practitioner to get properly prepared through *training* (*preparation phase*) for the *conduct* of combat (*operation phase*) by implementing the *tactical* and *technical levels*. This level formulates the *morale* of the practitioner, which is an indication of his/her self-confidence for combat. It is the essence of

---

[2] This is an initial standard practice of solving problems in Software Engineering (e.g. see: Sommerville, 1989).

[3] This set of beliefs is, more often than not, axiomatically accepted by the practitioners of a particular martial art.

strategy, since without the will and determination to use knowledge and tools for achieving a goal (victorious combat), everything else is useless.

Tactical Level:

The *tactical level* deals with the actions during and after the main combat (*operation* and *exploitation phase,* respectively). It concerns the combative aspects of *time* and *space*. Both aspects must be evaluated regarding the environment in general and the adversaries in particular. The aspect of *space* regarding the *environment* concerns the type of surroundings (cramped or spacious, crowded or isolated, slippery or not, with or without obstacles, boxing ring, cage, etc.). Regarding the opponent, it concerns the relevant *position* towards us (frontal, sideways, behind). Accordingly, we must answer the questions:

Where is the battlefield?

Where do we contact the opponent?

The aspect of *time* is both *general* and *specific*. The *general* mode refers to the time of day (day-light or dark), which affects visibility, and the duration of the fight (e.g., the rounds of a match). The *specific* mode (*timing*) refers to the moments of our reactions regarding the movements of the opponent (before, during or after). If we react before the opponent's movement, then we *intercept*; if we react during the movement, then we simultaneously *counterattack*, or, finally, if we react after the movement, then we *defend* first & *attack* later. The questions to be answered are:

When does the combat happen?

When do I react in relation to my opponent's action?

To summarize the *tactical level*, we have to know *where* and *when* we fight, and then estimate the consequences. The main action of this level for consideration is the *maneuver*, i.e. where, when and how do we move in order to bring our *power* (see *technical level*) at such an advantageous position so as to maximize its effectiveness. The choice of actions at this level is more restricted than at the previous level, because choice and actions are martial art specific. For example, practitioners of wrestling arts eventually have to move close in to end the fight, while those of striking arts can be effective at a longer distance. Moreover, the former uses time-consuming techniques compared to the latter, thus prohibiting that martial arts applicability against many opponents.

Technical Level:

Lastly, the *technical level* deals with the management of our *power*, coming from the use of weapons (*means* of *combat factors*). Here, we will also use the term "tool". A *tool* is a weapon of any kind (e.g. the fist) being used in a particular way (e.g. the straight punch). Each *tool* is designed to be most effective against specific *targets*. The *targets* are all the vulnerable anatomic areas of the human body. The *techniques* are simple or composite actions of our *tools*, aimed to elicit specific results. For example, a hook punch to the jaw is a simple *technique*, while a twist and take down is a composite one, requiring a coordinated use of hand and leg *tools*. The choice of weapons dictates the range of useful *techniques* as well. With this, we arrive to the last question:

Which weapons do we use?

Once again, the answer is also related to the opponent's choice.

Commentary.

The three levels of combat are not separate from each other. On the contrary, they are directly related, and interact in every aspect. The overall relation is shown in Fig. 1 in a systemic manner, using the notation of OMAS-III. For example, the combat attribute of *know-how* (*strategic level*) is directly related to the usage of *tools* (the *techniques* of *technical level*), which in turn is related to the combat aspects of *time* and *space* (*tactical level*).
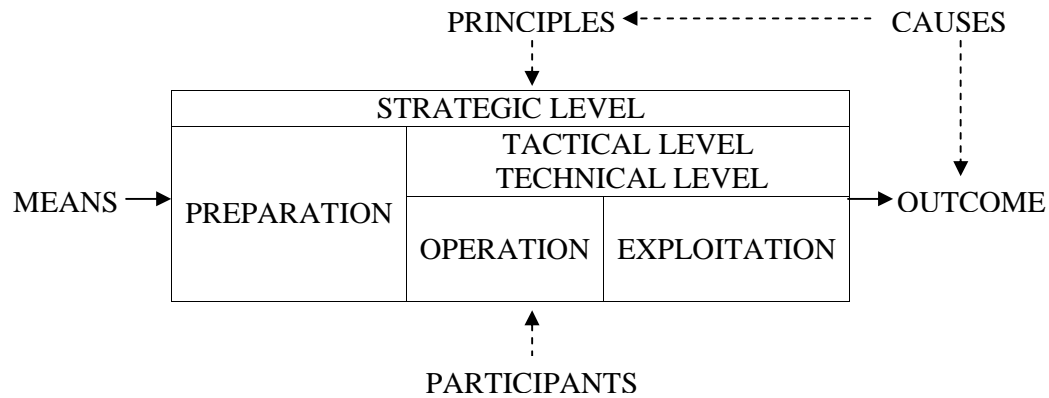
Figure 1: Systemic relations of combat aspects

The purpose of the classification we have done so far is solely to facilitate a better understanding of combat issues, so this presentation should not be considered as complete or dogmatic. Just like in the study of any other aspect of human behavior, there are no definitive approaches, merely functional or useful ones.

4. Epilogue

In this paper, we have considered combat in martial arts as an adaptive human activity system that it is compatible with the generic model of systems, described by the [perception (input) – computation (process) – behavior (output) – learning (feedback)] loop. We have described the system of combat through Systems Theory, according to the methodology of Systems Inquiry, aiming at the formation of a representative cognitive map of this human activity system. We have depicted this innovative perception of combat by using the systemic modeling method of OMAS-III. Combat has been analyzed in constituent parts, along with their properties, relations, interactions and processes that we have defined accordingly. Finally, we claim that such modeling was implemented in order to enhance the ability of instructors to become more efficient in their training duties.

References

Bánáthy, B.H. (n.d). The Evolution of Systems Inquiry. Part I & II, International Society for the Systems Sciences. Retrieved September 10, 2015 from: http://www.isss.org/primer/003evsys.htm.

Bánáthy, B.H. (1997). "The evolution of systems inquiry." *Systems*, *2(1)*, Techn. Univ. Wroclaw, Poland.

Grover, V., & Kettinger, W.J. (2000). *Process Think: Winning Perspectives for Business Change in the Information Age.* IGI Global, DOI: 10.4018/978-1-878289-68-1.

Heylighen, F., & Joslyn, C. (1992). Systems Theory. In F. Heylighen, C. Joslyn & V. Turchin (Eds.), *Principia Cybernetica Web* (Brussels: Principia Cybernetica), Retrieved October 10, from http://pespmc1.vub.ac.be/systheor.html.

Laszlo, A., & Krippner, S. (1998). Systems Theories: Their Origins, Foundations, and Development. In J.S. Jordan (Ed.), *Systems Theories and A Priori Aspects of Perception* (Ch. 3, pp. 47-74). Amsterdam: Elsevier Science.

Laszlo, E., & Masulli, I. (1993) with Artigiani, R., & Csányi, V. (Eds.). *The evolution of cognitive maps: New paradigms for the twenty-first century*. New York: Gordon & Breach.

Luhmann, N. (1995). *Social Systems*. Stanford, Cal.: Stanford U.P.

Magda Institute (1995). *The Magda Institute of Martial Arts*. Reseda, CA: Magda Institute of Martial Arts.

Makrygiannis, P.S., & Papakitsos, E.C. (2015). "Writing or programming an essay? An interdisciplinary systemic experiment in language teaching." *Journal of Global Research in Education and Social Science, 4(1)*, 16-24.

Miller, R. (2008). *Meditations on Violence*. YMAA Publications.

Murdock, R. (2006). *The RMAX Training Group Manual*. RMAX.tv Productions.

Papakitsos, E. (2001a). *The Martial Art of Kali: Manual*. Athens, Greece: National Library of Greece (in Greek).

Papakitsos, E.C. (2001b). *Hellenic School of Kali*. Athens, Greece: National Library of Greece (in Greek).

Papakitsos, E. (2003). *Training Manual of Kali*. Athens, Greece: E.A. Litina, DSA 41360 (in Greek).

Papakitsos, E. (2008). *Exemplary Training Program of Jun Fan Martial Arts*. Athens, Greece: E.A. Litina, DSA 46748 (in Greek).

Papakitsos, E. (2009). *Vital Kali Combat System*. Athens, Greece: E.A. Litina, DSA 46989 (in Greek).

Papakitsos, E. (2010). *Organizational Method of Analysing Systems*. Athens, Greece: E.K. Thessalou, PDSA 626 (in Greek).

Papakitsos, E.C. (2011). *Basic meanings of Linguistic Computing*. Athens, Greece: E.K. Thessalou, PDSA 673 (in Greek).

Papakitsos, E. (2013a). "The Systemic Modelling via Military Practice at the Service of any Operational Planning." *International Journal of Academic Research in Business and Social Science*, *3(9)*, 176-190.

Papakitsos, E.C. (2013b). *Linguistic Software Engineering: I. Preparation*. Athens, Greece: National Library of Greece (in Greek).

Papakitsos, E.C. (2015). "Escrima DeFondo martial style." In E.C. Papakitsos (Ed.), *Applications of Systemic Theory* (d). Athens, Greece: E.K. Thessalou, PDSA 926 (in Greek).

Papakitsos, E.C., Makrygiannis, P.S., & Tseles D.I. (2015, September). *Modeling the application of Blended-Learning in Career Guidance projects of the Hellenic Secondary Education*. International Scientific Conference eRA–10: The SynEnergy Forum, Piraeus University of Applied Sciences, Aigaleo, Greece.

Parsons, T. (1977). *Social Systems and the Evolution of Action Theory*. New York: Free Press.

Pressman, R, (1987). *SOFTWARE ENGINEERING: A Practitioner's Approach*. 2nd Edition, London: McGraw-Hill.

Ross, D.T. (1977). Structured Analysis: A Language for Communicating Ideas. IEEE Trans. Software Engineering (pp.16-34).

Sanders, M. (1991). *Communication Technology Today and Tomorrow*. Glencoe/McGraw-Hill.

Sommerville, I. (1989). *Software Engineering*. 3rd Edition, Wokingham, UK: Addison-Wesley.

Stichweh, R. (2011). Systems Theory. In B. Badie et al. (eds.), *International Encyclopedia of Political Science*. New York: Sage.

Von Bertalanffy, L. (1968). *General system theory: Essays on its foundation and development*. rev. ed., New York: George Braziller.

Wiener, N. (1948). *Cybernetics: or Control and Communication in the Animal and the Machine*. Cambridge, Mass.: MIT-Press.