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Realizing Interdisciplinarity Among Science, Humanism, and Art

A New Paradigmatic Explication of Community Problem Solving*

Hak-Soo Kim**

Distinguished Professor, College of Transdisciplinary Studies, DGIST, Daegu and Professor Emeritus of Communication, Sogang University, Seoul, South Korea; Fellow, International Communication Association and Korean Academy of Science and Technology

Abstract

Dire problems such as climate change and epidemic diseases challenge us. To solve them demands interdisciplinarity among science, humanism, and art. However, we have failed to effectively link them. Interdisciplinarity for problem solving, whose essence resides in community problem solving, is not going to be realized without, first, solving the problem of community that relates to collective behavior per se. Thus, this paper explicates the behavioral process of making community possible and constructive with a new paradigmatic view. Finally, it delineates the mechanics or technologies for composing or choreographing the process of effective interdisciplinary or community problem solving before the fact so as to solve those dire, situational problems.

Keywords: interdisciplinarity, community problem solving, body vs. behavior, science vs. humanism vs. art, composition, development, realization

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**hskim@dgist.ac.kr, hskim@sogang.ac.kr.

Dire straits await us, a gathering 'perfect storm' of global climate change, human population explosion, epidemic diseases, resource depletion and of related problems. But what of our ship and its crew? How prepared are we? Will mobilization ('All hands on deck! To your stations!') suffice? Do we need collective capability not yet realized in order to solve our problems?

Development of our collective capability for problem solving has had limited success. Instead, individual efforts have been ardently attempted and much respected. To prevent *the tragedy of the commons* re overpopulation, Hardin (1968) appeals to individuals' conscience and Crowe (1969) to their consciousness. Both say there is no technical solution. For example, to solve the problem of climate change, Caldeira (2012) looks forward to individuals' affordable energy inventions. All such solutions count on individuals' efforts, on *aggregate* not collective capability. They are insufficient as well as unfulfilled.

In reality our problems harbor a duality: two kinds of problems—the *situational* one that threatens our life at a time and place and the *behavioral* ('How') one to solve it. For example, many problems call on us to solve the *behavioral* problem of community so that we can then solve those *situational* problems together. We are poorly poised or developed for the former, the problem of community, that is, the How (e.g., procedures) to bring community into existence and then to give it effective capability as a 'problem-solving' agency. Thus, the latter, situational problems are left to be solved by individuals acting alone or in aggregate. For example, their rational solutions and resolutions are said to depend on individuals' attributes such as trust, reciprocity, and reputation (Ostrom, 1998). We need to look into the behavioral problem of community and its solving. That endeavor is likely to demand a new paradigmatic view for collective behavior.

Interdisciplinarity and interdisciplinary research have unfolded in the direction of collective problem solving. They do not lose sight of the situational problems threatening humanity, their complexity, and their demand for concerted efforts. However, emphasis has usually been to mobilize diverse disciplines and aggregate or pool their knowledges and methods. Thus, interdisciplinarity is referred to as "the attempt to link disciplines creatively in the search for new knowledge and practical pathways for human betterment" (Rosenfield & Kessel, 2008, p. 430). It is conceived as the promise of innovation in parallel with disciplines' differentiation and specialization (Weingart, 2000). However, without *prior* attention to the *community* problem, to the challenge of *interdependence*, interdisciplinarity can be just a nominal appeal about the possibility of solving a situational problem collectively.

One of many hopes for interdisciplinarity is to unify *science*, *humanism*, and *art* for effective problem solving. Each of their respective establishments has prided itself on an identity with distinctive knowledge processes and products. However, each also deplores its lack of problem-solving capability, arguing for interdisciplinarity with the others (e.g., Brozek & Keys, 1944; Ramalingaswami, 1986; Boggs, 2001; Woodward, 2009). Problem solving is very likely to demand *composition*, beyond mere combination of those establishments' achievements and practices. So, any problem-solving community of science, humanism, and art should be constructive and developmental. In a word, interdisciplinarity is and ought to be the *developing* process of community problem solving (Kim et al., 2014; Kim et al., 2016).

The purpose of this paper is to theoretically explicate interdisciplinarity – i.e., the process of community problem solving here. To do so, this research will offer a new paradigmatic view. Thus, it is necessary to deal with *theoretical constructs* whose

meanings derive explanation beyond identificatory function from their relationships with regard to one another in a theoretical system, unlike (more familiar) *empirical concepts* whose definitions focus on marking boundaries of existing phenomena, based on attributes. Then we will delineate how the behavioral problem of community can be solved and thereby how our dire situational problems can be solved by the community of science, humanism, and art.

Requiring a new paradigm for interdisciplinarity

Whether more *situational* like the problem of climate change or more *behavioral* like the problem of community, the notion of problem is not simple. This distinction is theoretically grounded, because it is related to the (fundamental) Nature of Things, according to Carter's (2010; 2015, Topic III) theory about Everything. Everything comprises not only order but also *lack of order*. This persisting condition of *partial order* in the universe after the Big Bang asserts that the fundamental nature of things, a *theoretical* notion, contrasted with and beyond the (existing) things of nature, is inclusive of the order of things. That fundamental nature has two other persisting generalities: *discontinuity* and *consequentiality*. Each behavioral entity (e.g., human) in this incompletely ordered universe is separate, which is the general condition of discontinuity. Each is also *in* consequence and *of* consequence, which is the general condition of consequentiality.

Together with partial order, discontinuity and consequentiality make collisions (and problems) inevitable, whose consequential instance is the relatively recent birth of the Earth or Life in the long history of the Universe. To avoid or arrange collisions for

survival invokes an art of problem solving, especially for living entities. Thus, the need for problem-solving capability is the condition most shared by humans. Now, we see why interdisciplinarity is so desperately needed for problem solving, for example, by unifying humanism re problems, arts of composition, and sciences of discovery.

The partial order condition implies conditions of incomplete instruction, of behavioral necessity, and of possibility for any behavioral entity. Because we are not given complete instruction for taking steps, we may and ought to *compose* our own instruction. To avoid and arrange collisions, behavioral capability is a necessity. We should *make* new steps in order not just to take available steps. This allows us to *imagine* and *realize* new possibilities. So, problem solving via interdisciplinarity can grow beyond the traditional interdisciplinary research focus on "a mode of research…that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines…" (National Academies Committee, 2005, p. 188). Interdisciplinarity, whether defined as the response to complex phenomena (Newell, 2013), by intensional properties or extensional instances (Szostak, 2015), or consideration of social justice and values (Frodeman & Mitcham, 2007), does not need to be confined to *integration* of different disciplinary insights for a holistic understanding or a pertinent decision making in contemporary life.

Insofar as problem solving is embedded in the fundamental nature of things, humanity has had to struggle with it. Humanism had been concerned with social serviceability and the worldly problems before social sciences took them on in the late 19th century (Kuklick, 1992). Art was initially of "*all* humanly made things" for practical useful functions, distinguished from Mother Nature's products (Davies, 2006, p. 6). Its current,

delimited usage on aesthetic quality began to emerge with the dissolution of patronage system and the development of market economy and middle-class society in the 18th century (Shiner, 2001). The history of humanity might essentially be one of problem solving.

Our dire situational problems are readily recognized because of their threatening power to our bodies. However, to solve these situational problems requires us to pay attention, and give priority, to *the problem of behavior*: the 'How' one. Carter (1988) argues that behavior (steps made and taken) is *structurally independent* of body (actor or observed entity). However, body and behavior are *functionally interdependent*. Community, a theoretical construct to be realized rather than an empirical concept, is clearly first of all a *behavioral problem*. To think together and work together, which is to bring about collective capability, is a must for solving a collective situational problem. Kim (2012, p. 274, italics added) says, "This community (per se) exists in its behavioral process, having no *inherited*, *corporeal* body … Above all, this collectivity goes forward for *construction* of a new solution (s), not just to make a choice."

Unfortunately, science, humanism, and art have not looked deeply into the problem of behavior as a theoretical construct. They have often attributed solving capability of behavior per se to this or that body, as for example, genius or talent (e.g., an Einstein) or its particular attributes (e.g., intelligence, leadership). In essence, they did not distinguish *body* and *behavior* (e.g., 'Is as does' and 'Does as is'; 'Stupid is as stupid does' in the 1994 movie Forrest Gump). Otherwise, their problem-solving capability has been attributed to *circumstances* (e.g., stimuli and influences), sometimes in consort with the body (e.g., instincts). Thus, most knowledge in science, humanism, and art is largely about *relationships* within and/or among bodies and circumstances (e.g.,

causality, correlation), whether it comes from trying to resolve puzzles or to solve situational problems. It seldom acknowledges the contribution of the process of behavior per se *before the fact*. (to be elaborated below)

The structure of behavior comprises two modes of relating: *minding* and *moving* (Carter, 2010, 2015). They are interdependent. Minding instructs moving and moving requires a singular direction from minding. Thus, the structure of community as collective behavior demands *co-minding* and *co-moving*. Co-minding, especially, to be realized poses a huge task, that of making a *community* possible and constructive, not failing by falling into a pseudo-community such as an *aggregate* mass or a *partisan* public (Kim, 2003). We have long dreamed of its realization, but always failed in that, mainly due to lack of a better paradigmatic foundation. Now, we should be able to better solve any situational problem by succeeding in building up an interdisciplinary community among science, humanism, and art.

Building the community for interdisciplinarity

Co-minding, as a requisite for enabling the community and the process of collective problem solving can't be a single action. It is instead a sequence of acts. Kim (2003, 2012) explicated that process of co-minding as potentially comprising six collective acts: co-exposing, co-focusing attention, co-cognizing, co-remembering, co-questioning, and co-imagining. A composition of those acts affords a (principled) *operational system* for enabling and enriching the community. Some systems can be very simple, some very complex, depending upon what the solution we are pursuing demands.

A sequence of *co-exposing* and *co-focusing attention* is basic for

solving the behavioral problem of community. The community begins to emerge in and by the act of co-focusing attention (Kim, 2003, 2012). For example, if we are to solve climate change, we ought to be not only co-exposed to but also co-focused in our attention. We are abundantly exposed to the climate problem by news media. However, we find it very difficult to develop it into a global *community agenda* by obtaining *co-focused* attention (Myers & Kulish, 2013). And without co-cognizing and co-imagining of the climate problem's potential impact, we may not be able to maintain focused attention on it.

This behavioral process for the community has little to do with collective intentionality, a body-focused relationship. As Searle (1990, p. 413) says, "Collective intentionality seems to presuppose some level of sense of community before it can ever function." Co-focal attention can be magnified by potential community members' effective communicating about a situational problem's inherent collective consequentiality and/or urgency.

Given co-focal attention, we may be ready to co-cognize – to think together. *Co-cognizing* is about identifying situational elements and *relating* them via inside-outside, before-after, and/or similarity vs. difference *relations* (Carter, 1992; Carter & Stamm, 1994; Kim et al., 1996; Kim, 2007, 2019). For example, we may cognize 'science' as inside or outside, before or after, or as being similar or dissimilar to 'technology.' We may bring in our past experiences about an agenda via *co-remembering*. We may rectify or enrich those lessons. We may get into *co-questioning*: clarifying together some doubt or fuzziness; we can raise possibilities with *co-imagining*.

Solving the behavioral problem of community asks us to meet the need for capacities and capabilities for all these co-minding acts. It speaks to *development*, not just *evolution*. For

example, only the two acts of exposing and focal attention are readily invoked by sensory capacities as embedded in the evolved body. (Although memory has evolved, human memory [e.g., verbal memory] owes much to development.) The other minding acts of cognizing, questioning, and imagining are much underused and, if used constructively, attributed to an individual's (body's) talent. Thus, we have not developed well our individual behavioral (processual) capability. So, too, pseudo-communities that are little concerned with realizing and developing those co-minding acts prevail in co-ops, school districts, corporations, associations, societies, interdisciplinary research groups, even in family and married couples' lives.

We can envision diverse *behavioral solutions* that realize community. Behaviors composed with the five co-minding acts (excluding initial and easy 'co-exposing') enable numerous operating procedures (minimally 120: 5 x 4 x 3 x 2 x 1), not only to solve the behavioral problem of community but also to bring forth further *compositional change* to solve the community's situational problems (Kim, 2012; Kim et al., 2014). For example, co-questioning and co-imagining might lead community members to compose a very innovative *situational solution*. On the other hand, pseudo-communities – poorly realized in terms of needed functionality (Carter, 2015, App. XIX) – are more likely to immediately adopt a *decision-making* strategy, using whatever solutions are *already* available or given (e.g., Downs, 1972; Hagendijk & Irwin, 2006). They will not bring to fruition the potential of the *compositional capability*. Now, we can see how much we miss our compositional capabilities, individual and collective, disciplinary and interdisciplinary, focused on solving this or that situational problem … and producing a bigger, more complex problem (Crowe, 1969).

On the other hand, Logsdon (1991) shows success of

community problem solving in Silicon Valley, California, even though the community achieved only a minimum step of co-exposing and co-focusing attention on two problems: traffic congestion and chemical storage tank leakage. It is found critical to make a community *agenda* whether it starts from a collective concern like traffic jam or an individual one like chemical contamination in a drinking water well. Even the effort of community problem solving is found to improve students' scientific literacy (Roth & Lee, 2004). When students worked together with science teachers and local villagers in order to solve environmental problems (e.g., poor water quality, extreme water level) of a local creek in Vancouver Island, Canada, they had more interest in and knowledge about relevant science through a so-called 'lived curriculum.' We also hear many anecdotal success stories (e.g., Gertner, 2012) of The Manhattan Project, Bell Labs, NASA, and CERN regarding their respective research organization's community functionality and realization. But these have not yet been fully examined.

The notion of so-called 'knowledge democracy' is concerned with producing a commons of knowledges between the hegemonic and the dispossessed, between the dominating North and the emasculated South, between scientific knowledge and other ones, or between university experts and citizens (De Sousa Santos, 2016; Hall & Tandon, 2017a, 2017b; Visvanathan, 2009). But the 'How' questions remain: "How do we contribute to the building of new academic cultures … that genuinely respect and appreciate *difference* and *diversity*…? How do we become a part of creating the *new architecture* of knowledge that allows *co-construction* of knowledge between intellectuals in academia and intellectuals located in community settings?" (Hall & Tandon, 2017a, p. 17, italics added). They might be answered by the mechanics or technologies (e.g., above 120 operating

procedures) of the process of community problem solving that could solve the community's behavioral problem before the fact and subsequently get to produce an innovative solution or knowledge for its situational problem.

The multi-functionality of communicating is absolutely vital for solving the behavioral problem of community. It serves minding's symbolic needs along with furnishing a low-cost act of *moving* to enable the *co*-functionings. Communicating and minding are interdependent, facilitating each other and, together, fundamental to community building.

Co-focusing attention re problems, which can deepen via communicating, is humanism's stepping stone toward realizing community, insofar as *humanism* started from concern with humanity's problems to be solved (Kuklick, 1992). But it is questionable how well today's humanities (e.g., literature, history, philosophy) are fulfilling this basic function of humanism, which relates to solving the behavioral problem of community as a consequential mission of humanism and to enabling us together to focus attention on our collective situational problems.

Co-cognizing, helped greatly by communicating, far exceeds *science's* inter-observer agreement. It comprises not only co-orienting (obtaining available information and being informed together) but also co-reorienting (comparing the outcome of our past move to an instruction and adjusting our next move together) and co-constructing (providing our own instruction and informing ourselves together) (Kim, 2003). It affects the *questions* scientists come to ask given the *problems* they see (e.g., brain mapping re dementia) as well as the *problems* they must solve to answer the *questions* they have (e.g., supercollider re the Higgs boson).

Co-imagining seems to relate more to (modern, less

representational) *art*, with its emphases on composing beyond combining, possibility beyond probability, and realization beyond reality. But to envision what is *not* there yet, what is to be *made* if not yet to be found, is a capability essential to innovative solutions.

The so-called 'behavioral architecture' (Carter, 2015, C-90), basically composed of the acts of minding and moving, of co-minding and co-moving, embraces the shared concerns and capabilities of humanism, art, and science. Its realization unifies the three in community problem solving – in contrast to their respective, disparate establishment histories. It can help continue what the interdisciplinarity has launched for problem solving. Indeed, such an interdisciplinary community can succeed to *develop*, as surmised in the history of Bell Labs that teamed up theoreticians, experimentalists, engineers, and even technicians in close proximity and incubated eight Nobel prizes (Gertner, 2012).

Solving the behavioral problem of community via behavioral architecture can be consequential beyond *aggregation* of individuals' capacities and capabilities. *We*, not *us*, to be realized only in the behavioral process of co-minding and co-moving, is what we need. It begins with *needed functionality*, the fundamental nature of things' shared human condition with behavioral principles for survival; then *development* of capabilities to meet the needed functionality, especially that of *composition* to make needed steps; then as product, as step taken … and then to 'after-the-fact' analysis of step making, step taking, and the changes effected by the step and/or its outcome (i.e., science). On the other hand, the *traditional* concept of community is as a *particular entity* without the principled process of realization: a communal settlement like a primordial village (Gemeinschaft), a social accomplishment containing relevancies, differences and byproducts of choices of action in a vision of commonality (e.g.,

Rothenbuhler, 2001), or a so-called 'authentic' community as an ideal unity of collective intention or consciousness for a common good (Bessant, 2011). There, lacking the realization of behavioral architecture, community problem solving quickly proceeds to summoning *individuals* and/or their collective *decision making*.

Unfortunately, collective decision making has taken the place of community problem solving. In the former, problem is replaced by 'issue,' where only *already* available solutions compete (Carter et al., 1992; Kim, 2007). Hence the notion of 'public' has become more popular (e.g., for opinions, voting) than that of community (Kim, 2012). For example, focusing on voting's rational *choice* theory, modern political or social science divorced itself from humanities (Lepore, 2013).

The notions of *issue*, *public*, and *decision making* dominate social sciences, depriving us of our tremendous, potential collective capability for community problem solving. We are urged to become *informed* and *deliberative* citizens for making a rational decision of political candidates or policies (Benhabib, 1996). We are invited into a public sphere with interpersonal discourse, again for enhancing deliberation over issues and choices toward a more civil, democratic society (Habermas, 1989). Even the problem of climate change is said to be solvable by decision making with information from multidisciplines (Fischhoff, 2007). Hagendijk and Irwin (2006) analyzed 26 case studies of collective, deliberative decision making done in Europe over such issues as adoption of genetically modified foods and nuclear energy. Their finding is that the process of public deliberation often proceeds in unexpected ways and tends to generate further problems. But we also find that abundant information does not necessarily guarantee a better decision (Stasser & Titus, 1985), and people tend to make a decision quite intuitively (Kahneman, 2003). Collective decision making, though

extolled as the ideal societal convention in our free and democratic society, is seldom constructive, often producing more *conflicts* and *losers*. It erodes community, perpetuates crippled community, and prevents new community from emerging.

Communication is expected to be functional for collective decision making, if not for community problem solving. Information availability and exposure are emphasized, hoping in vain to help resolve issues effectively (e.g., the notorious 'communication problem'). Media (e.g., the Internet) have developed so as to expand our co-exposing. But, however much information is provided, it is never enough to resolve an issue. Any choice is made by weighing *valuations* and/or *evaluations* for options (Kim, 2003). Issue-centered public journalism and public opinion polling improve democracy less than expected. They are weakly constructive and productive, mostly dealing with decision making, not the process of problem solving.

Also, to build community demands *balance* between individuals' services to the community and the community services to individuals. Individuals and the community are independent of each other, but should and can be functionally interdependent (Carter, 2015, Topic XI, C-71). They can help to develop each other. If they seem to be in *opposition* to each other, then they have been *poorly* realized. Thus, they should first make efforts to share a collective problem and a common sense of behavior.

Collectively, we as individuals need to figure out when and how our individual capacities and capabilities can contribute to community and when and how community can help us develop as individuals. This foreseeability of *interdependence* is implicit in membership. Membership's materiality begins to be realized with achieving and maintaining balance between individual and community. This membership differs from that of

pseudo-communities (e.g., a 'member's fee' is charged). Interdisciplinarity should try to accomplish such membership among multidisciplinary individuals from the start.

Membership already implies some community buildup. But how much? Collaboration readiness is often presumed to be an antecedent condition for successful interdisciplinarity (Stokols et al., 2010), but it should be further developed in the process of community problem solving. Members must be ready to *share* with, *care* for, *trust* in and be *fair* toward one another. Interdependence among members is established so that they can relate constructively to one another for solving a situational problem.

Not only interdisciplinarity but also multidisciplinarity and transdisciplinarity have been called team science, but with *little* concern for how the team *per se* could be developed (see National Research Council, 2015). An extensive survey of studies of small group, team and teamwork could confirm only the importance of communication and (shared) leadership (Fiore, 2008), or that of an *aggregate's* circumstances (e.g., climate, design), of its characteristics (e.g., cohesion, efficacy) or of its products (e.g., performance, effectiveness) (Kozlowski & Ilgen, 2006). They have not seen the community (aka team) as the behavioral problem it is.

Composing the interdisciplinary team among science, humanism, and art

Interdisciplinarity is not just to bridge the gaps among humanism, art and science establishments. Nor is it just to bridge gaps among disciplines, among experts, or between experts and public. Rather, and also, it is to begin to *remove* the gaps among

them. (Some of these gaps are as anthropogenic as some of our problems.) But gap-bridging is in style.

Gap-bridging is to integrate or pool and share all the relevant *existing* knowledge; gap-removing is to bring together *new* ideas and bring out *new* knowledge, not just to bring together established knowledge. Many literacy campaigns have been done to bridge knowledge gaps, but people would not simply engage in literacy gain (Paisley, 1998). Public information campaigns primarily confirm, "Like communicates best with like" (Dervin, 2010, p. 251). When the audience has the common demographic and trait attributes as the institutional expert sources, the two can communicate with and reach each other more easily.

Science and art have evolved toward humanism. Science, via engineering, has reached out toward human problems. Art, via social applications of the arts (e.g., instruction via drama, artist visits to prisons), has also reached out (Boggs, 2001). However, removing the gaps will require a *developmental* program to unify them, such as a HAS (Humanism/Art/Science) discipline (Carter, 2015, App. VIII), with its own distinctive technology. *Bodily* or *structural* evolution, rather than *behavioral* or *functional* development, seems so far to be the chosen history. But how well is evolution working out as a behavioral strategy for human understanding?

For any current collective situational problem, stakeholders (a partial aggregate) are likely to initiate any team effort. For example, climate change is of much more concern to countries that would be hurt the most, such as the Philippines and the Alliance of Small Island States. They cry, 'Climate injustice' (Myers & Kulish, 2013). Stakeholders can expedite co-focal attention. But then what? Will this help to solve the behavioral problem of community that needs solving first – or will the process of problem solving be skipped in favor of decision

making? There is also the risk that people will get into a long wallowing at the very beginning and scuttle away from an interdisciplinary project (Klein, 2004).

Establishment of a minimum of community (e.g., partnership) is critical for proceeding on to solve the situational problem (Kim, 2012). *Partnership* demonstrates readiness to act together, even to accepting disparate views. Unfortunately, most small group studies disregard such partnership and focus on decision making. They find that group participants seldom take advantage of their respective knowledges in collective discussion and decision making (see Wittenbaum et al., 2004). Partnership makes a material difference toward functioning as a change agency. Prospectively, a *team* is born.

Commitment to development, to community building, is a persisting matter. It requires *ever-renewing* engagement to the team's self-realization. That commitment may wane is the main reason why many interdisciplinary efforts tend to result in multidisciplinarity of keeping an aggregate of disparate disciplines (see Kessel et al., 2008). Progress through co-minding and then co-moving, making and taking steps, is a hard task.

Communication has to be more than *connection* here, even though that may expand co-exposure – which may unleash a people's accrued frustration into co-taken moves like mass protests (Bennett & Segerberg, 2012). To be most productive, the act of communicating should meet a *corresponding* need for each act of co-minding (Kim, 2012; Kim et al., 2016). For example, when a team is co-questioning, the act of communicating among members should be effectively timed, to give rise to more co-questioning (e.g., for clarification) and room for co-imagining (e.g., idea enrichment, possibility).

When an interdisciplinary effort fails to solve the behavioral problem of community, it follows that it will not achieve

community effectiveness either. There no longer exists a team, *only* an aggregate of people and an aggregate of contributions. Their situational problem is but an aggregate of circumstances. Such a group, perhaps mistakenly seen as an interdisciplinary team, could comprise its participants' individual *attributes* such as passion, mutual respect, security, and expertise (Rowe, 2008; Kahn & Prager, 1994), its supportive *circumstances*, such as institutional funding, flexibility, freedom, patience, and commitment (Porter et al., 2006; Lupia, 2011), and other individual or group *qualities* (e.g., open-mindedness, clear mission, conviviality, sociability) enumerated in the so-called shared cognitive-emotional-interactional (SCEI) platforms for successful interdisciplinarity (Boix Mansilla et al., 2016). These conditions may be argued to be critical for diagnosing interdisciplinarity. But they might be more symptomatic than instrumental for achieving it, because they are mostly *properties* demanded about individuals, aggregates, or circumstances, having little concern with composing or choreographing the collective behavioral process per se *before the fact* of realizing it.

Solutions to problems may sometimes, and fortuitously, be purely *circumstantial*, but human agency and urgency argue for *compositional change*, and collective behavior demands composition of community as well as of the community's proposed solution. Compositional capability, art in its most general sense, requires development re needed functionality, of our minding and moving capabilities for step making and taking. This is a line of *development*, of *realization*, with *consequentiality* relevant at each stage (Carter, 2015, App. XIX). But how do the establishments of humanism, art, and science see this?

We may well wonder. Is each discipline unified among its practitioners (or clinicians), teachers, and researchers? Multi-disciplines within disciplines are common. So are rifts in

academic departments. For example, novelists and literary scholars rarely think or work together as a team. The former produce novels mostly through trial and error; the latter analyze and summarize products at their discretion. Positive, compositional reconstruction is also needed within disciplines.

To unify humanism, science, and art for community problem solving, we need to examine how each of them can contribute to solving a situational problem collectively.

Humanism is concerned with humanity's problems, pending or impending. It is about help. Its first contribution to problem solving can be to reveal the *relevance* of those problems and enable us to *share* their problematic situations. However, as humanists came to specialize in disciplines (i.e., the several humanities), they began to back away from problem relevance. They take pride in dealing with more eternal dimensions such as freedom and its ramified values of dignity, civility, learning, imagination, and sympathy (e.g., Perry, 1940). If they deal with topics related to modern day major problems, such as race, gender, class, sexuality, post-colonialism, and disability, they are considered to weaken their intellectual power (see Berube, 2013). This relative disregard of problem relevance inevitably brought loss of appeal to university and students (Lewin, 2013). The so-called 'public humanities movement' to bridge gaps between humanities and the general public (Woodward, 2009) is questionable for bringing back humanism's first function: to awaken our problem relevance for community problem solving. It looks more like a campaign for enhancing *public literacy* of humanities.

Humanists' departure from problem relevance – and furthermore from problem solving – seems to come from their way of studying, that is, of characterizing and summarizing via *concepts* particular products of literature, history, and life. In

effect, they end up with abstract terms remote from the process of composing such particular products, even though that process is very likely to relate to humanity's problem solving.

Thus, to fully utilize humanism in the interdisciplinary team, we need to regain its unique functions for enhancing and sharing our problem relevance. We can further our problem-solving capability, for example, by getting insight from literature's imagining, history's remembering, and philosophy's cognizing.

Science, natural and social, is usually considered to be the indispensable member for composing the interdisciplinary team to solve a situational problem. It is expected to resolve puzzles – if not problems – by fact finding. Their findings are anticipated to be applied in/for problem solving, as in the 'linear/reservoir model' (Pielke & Byerly, 1998). The traditional, *puzzle* view of science is predicated on discovering the *order* of things *after the fact*. This is in contrast to the *partial order* of the fundamental nature of things, whose consequences pose *problems before the fact* as well as puzzles after the fact.

The scientists' prevalent mission is to discover new *particulars* and *universals* underlying the particulars in the universe. They use minding's acts, especially of questioning and cognizing. But they may use them in a limited way – scientist working relationships to technology notwithstanding. Although they have knowledge of compositions (products) to contribute, they may not know all that is needed about the *process* of step making.

Science is distinctive in its methods for analyzing 'observed phenomena' (Simpson, 1963). It classifies particular phenomena, giving them conceptual labels, and reduces them to uncover their components. Such methods are called substantialism and reductionism (Kaplan, 1964). This emphasis on *identification* has, unfortunately, also influenced humanists' ways of studying. Most tragically, however, has been the influence on the social sciences,

whose focus on relationships after the fact (e.g., effects studies) has often been at the expense of cognitive and compositional relatings before the fact (i.e., processes) – as if experiments were made only to confirm *given order* and not to test *new orderings*. Traditional science can make *factual* contributions to defining problems and toward solving them. However, as it gets into *process* consequentiality (Carter, 2015, C-16), back into the development and exercise of compositional capability, it could do more.

Art's linchpin role in the interdisciplinary team could be spectacular, because art essentially relates to compositional capability. Composing needs all the acts of minding, most prominently those of cognizing's constructing and of imagining (see Kim, 2003, 2012). Its product is a new ideational relationship, with new elements and/or relations (see Kim, 2019).

However, art disciplines do not focus on *art* as *process* ('design' excepted) as much as on products, with special concern for the concept and criterion of *beauty* applied after the fact. They have identified attributes comprised by the concept of beauty, as evinced in fine art, music, play, or dance. Some 20 attributes are mentioned, such as unified, balanced, graceful, moving, vivid, powerful, and so on (Sibley, 1959). Also, their relationships are argued to constitute a theory of aesthetics (Beardsley, 1962). This way of studying art appears influenced by traditional science, because it has also tried to find universals for a theory of art. Efforts have been made to classify and reduce artistic products to essentials. They lose sight of art's *composing* capability, even when social applications of the arts are summarized and reviewed (Boggs, 2001).

Now we see how important humanism, science, and art are to composing and operating the interdisciplinary team. They provide the three 'basic' conditions for successful problem

solving: problem relevance from humanism; problem definition from science; solution composition from art. This justifies their unification, for example, beyond the EU social scientists and humanists' appeal of simple values in the Vilnius Declaration for participating in interdisciplinary research on tackling HORIZON 2020's societal challenges (Hackett, 2014). But humanism, science, and art need to regain and strengthen their respective functionalities: for example, humanities' focus on *problems* – not just after-the-fact values like freedom or dignity; sciences' focus on *problem solving* – not just puzzle resolving with regard to available order/orderings; arts' focus on principles of *composing* – not just after-the-fact abstract concepts like beauty.

If the interdisciplinary team is composed and working well, another welcome outcome may follow. That is the *prevention* of collective decision making as a substitute for collective problem solving. Most importantly, interdisciplinary capability that works for one problem will be available, for communities and individuals, to help solve other situational problems because the behavioral problem of community has already begun to be solved (e.g., building 'social capital').

Conclusion and discussion

Anthropogenic problems, if unchecked, will only increase. Climate change, epidemic diseases, population explosion, and resource depletion will find company in increased *behavioral dysfunction* – armed conflict being but the most appalling. Increased *lack of efficacy*, as for community building, also seems likely. And with all these there are the additional threats from natural disasters like earthquakes, storms, volcanic eruptions and tsunami.

Behavioral dysfunction – the roiling winds and currents of our gathering perfect storm – has two features very much in evidence here. There is the *absence* of functional, behavioral capability, exemplified by *needed* community development, for which interdisciplinarity is a start toward *union* and effective *interdependence* of humanism, art, and science. And there is the *presence* of dysfunctional behaviors, such as conflicts and mob actions, which population increase and resource decrease (not to mention unsatisfactory mobilization efforts) will just exacerbate, further increasing the behavioral problem of community.

For all this, we are unprepared, individually and collectively. 'All hands on deck. To your stations!' What stations, lacking composed community? All hands on deck just to rush to the railings?

What happens when capability is lacking? *Responsibility*, unfortunately, can become the focus of attention. A good example can be seen in the aftermath of the tragic April 2009 earthquake that killed 309 citizens in L'Aquila, Italy. Six renowned geophysicists, who had checked seismic tremors there in advance, were initially given six-year prison sentences for their 'negligence and imprudence' in transmitting risk information to the public. Failing to assess and perhaps excuse their lack of *co-minding/co-moving* capability among themselves and with citizens, an Italian lower court assessed and declared responsibility instead. Global, ongoing controversy too is often attributed to the scientists' poor communication of science and/or risk toward the public (Clark, 2012; Ropeik, 2012).

Interdisciplinarity is not, however, the only starting point on the path to effective interdependence among humanism, art, and science. Nor is it the only productive deployment of them. Given our paradigmatic change, we can add something here – and add to the already notable achievements in the name of humanism,

art, and science (e.g., as by Leonardo da Vinci and Louis Pasteur, who embodied all three). From the fundamental nature of things, we can derive five basic stages (S1–S5) of *realization* with respect to *functionality* of behavior (e.g., Carter, 2015, App. XIX):

S1. Fundamental nature of things (partial order) ⇒ needed functionality (principled behavior for survival);
S2. Needed functionality ⇒ development of behavioral capabilities (e.g., minding's cognizing and communicating for composing);
S3. Exercised (developed) behavioral capabilities ⇒ realization of composing steps (behavioral architecture);
S4. Exercised (realized) composing steps ⇒ emergent structures (behavior's consequences: developed products and effected changes);
S5. Emergent structures ⇒ their particular, limited functionalities.

When we say, 'Those who can, do … but they only do what they can,' we are commenting on the risks that come with a 'Stage 5' dependency, on the risks that attend such a 'sole' strategy of interdisciplinarity as *the* door toward effective interdependence among humanism, art, and science. The behavioral problem that is community says that we cannot afford to start only there – utopian shared-value efforts notwithstanding. Most constructively, we should be able to start from, and not skip, the *prior* Stages 1-4, at least Stage 4.

We may have been relying on *evolution* (e.g., Stage 5, of structures or bodies) to shape future history, to the relative neglect of behavioral development from needed functionality. But if we were to include a meta-strategy that emphasizes *principled* development of needed capabilities, we can add a second starting point, the fundamental nature of things (bearing

on the *behavioral* problem as well as *situational* problems), for the journey toward *community development*. 'Principled' is key. It is key to a more 'informed' trial and error, a knowledgeable way to produce more knowledge by composing better questions. Experimental communities, whether among disciplines or between professional experts and ordinary citizens, would be a case in point. An investment there, working to solve the behavioral problem, would pay off in better solutions to situational problems.

Now we can see that 'technology' to serve and expand capability development, especially for minding and co-minding, becomes feasible. Contrary to the Hardin-Crowe supposition, if we distinguish *puzzle* from *problem* then a *technical solution* becomes feasible, because such a composed behavioral solution (e.g., a collective behavioral procedure for realizing community, as one of minimum 120 operating procedures mentioned above) is outside the *given* 'order of things' domain. What is enabled is an *optimizing* (genuinely *democratic*) technology, to work together toward effectively solving the behavioral problem (i.e., for individual and community) – this to accommodate any optimal technologies dictated (and predictable) by the limited, and limiting, paradigm of an (available) order of things. More equitable or better democracy could be developed with such mechanics or choreography of the collective behavioral process. We could also overcome "Trained incapacity: the more we know how to do something, the harder it is to learn to do differently" (Kaplan, 1964, p. 29).

Development, starting from needed functionality, can be systematically pursued. Humanism, art, and science can work together in problem solving. Experimental problem solving – i.e., *principled* trial and error – can become a second front of science-aided questioning, of *knowing* as *realization*. An obvious

place to start in this effort would be in the schools, beginning the emphasis on *compositional change*, which is to say problem solving, in the earliest grades and continuing through post-graduate university work, and then continuing on among those collectivities that present themselves as 'learning' organizations. However, for instance, the US National Science Foundation's interdisciplinary education and training program for graduate students, called Integrative Graduate Education and Research Training (IGERT), seems to be little concerned with development of both community and solution composition for tackling a situational problem. Instead, Hackett and Rhoten's experiment (2009) attempts to show that those IGERT students in a task of formulating a better 'puzzle' are interested in 'pooling' their respective disciplinary knowledges or 'expediting' their group performance.

Interdisciplinary problem solving is critical especially to the governance of natural resources and environmental conservation/development. For example, Riggs et al. (2018) studied governance of a forest landscape in Lombok, an island of Indonesia. They could identify major actors (governmental institutions, civil society, NGOs, research groups, and so on) for coordinating landscape governance, but *not* show an operating procedure for composing a community among those actors for constructive problem solving, not just decision making, except for stressing communication. In general, materials research is considered one of the most interdisciplinary research areas in science and engineering. It encompasses such fields as metallurgy, ceramics, solid-state physics, and chemistry. In the late 1960s, U.S. industry pressured the government to allot block funding for materials research. Many university interdisciplinary research groups were funded. However, later evaluations found that the block-funded research groups, compared to non-funded

groups, did not differ in any accomplishments (Roy, 1977). They must be considered to have not accomplished community in the first place.

With regard to interdisciplinarity for problem solving, the approach of realization of community's or team's composing steps and effective interdependence among humanism, art, and science would have us give equal attention to 'development and research' relative to the more familiar 'research and development' – the latter perhaps more commonly operationalized as 'research and then development.' The former's (*D&R*) exemplar is Louis Pasteur who not only solved pressing problems (diseases) but also made epochal discoveries (microbes). He was involved in problem solving, first and foremost, and got to succeed in puzzle resolving too (Debre, 1998). Development in/by *imagination* and *composition* was tested through research. Now, 'Those who know, can!' Development and research (by interdependence and for interdisciplinarity), improving on *unprincipled* trial and error, adds a second way of 'knowing' … and of becoming 'able to do,' furthering human *realization*.

An importance of interdisciplinarity among science, humanism, and art comes from the need of collective problem solving. It relates precisely to the challenge of composing interdisciplinary community. So, we put a strong emphasis on a theoretical explication of the behavioral problem of community that has *no corporeal* body but comes to realization *only* in the collective behavioral process. To do so, we paid attention on Carter's theory (2015) whose key assumption is to theoretically and structurally distinguish between body and behavior or step. The latter has its own *independent* principles and structure that can produce *ever-developing* behavioral or step solutions for collectivity as well as individual, *irrespective* of bodies, circumstances, their relationships, and/or their characterizations

such as attributes and properties. This enabled us to explicate community and interdisciplinarity in a new paradigmatic view. Finally, we could show how we could *compose* the genuinely interdisciplinary community or team among science, humanism, and art in order to solve any situational problem. We could envision how manifold, developmental, and constructive the *process* of interdisciplinary problem solving could be and how innovative the *situational* solution could be. Basically, we could see a new paradigmatic explication and its derived principles and mechanics, its practical footholds (e.g., minimum 120 behavioral, technical solutions), for the process of community problem solving, which can and must be effective, constructive, and democratic.

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