300 Body Scans in a Year: Data for Lifegraph Solutions

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Abstract

A lifelong addiction to a multi-modal digital double that educates your parents, then you and your offspring, informs you of environmental factors and enables monetization of your life's plan, presence and past, in part or entirety, starts with 3D-body scanning. A vision for a LifeGraph (LG) product composed of a Human HealthGraph (HHG) built on the daily acquisition of a whole-body surface scan using a personalized body scaffold for a multi-modal sensor array with total-body field of view (FOV) is presented. Based on the history, state and trends in digital human modeling & simulation, motion capture and humanoid animation LG/HHG requirements are discussed. A summary of 300 body scans of the author from August 2014 to August 2015 is presented. A portfolio of projects to develop the LG/HHG product line for the prototypical 100-year human life is presented in the context of daily, if not, continuous education, measurement and monetization.

Keywords: 3D body scanning, biometrics, biotelemetry, digital human model, health education, human simulation, lifelogging, monetization, quantified self, system dynamics, virtual human interface

1. Introduction

Why doesn't the data generated from our body's structure and behavior, a singular, self-contained, semipermeable membrane of consciousness, feedback into a simulateable model of ourselves from the time we are detected in utero to the last data collected postmortem? Instead, the data are stored by the acquirers, occasionally exchanged between payers and rarely mashed up with the person's goal, plan and history. The human health and services' data, information and knowledge system architecture, operation concepts, and security constructs have capability gaps. The lack of dynamic digital double of the human, the surrounding environment and the products owned, possessed and used by the human are partial solutions to the gaps. The idea of a digital double or twin is not new. It embodies a digital human model initialized with the -tomes and -omics of your ancestors; tuned with the your biometrics and psychometrics, and guided with your goals and plans out to life expectancy. This vision presumes 3D total-body surface scanners and imagers become affordable to the same mass market as smartphones. With the ubiquity of such hardware, the software development of LifeGraph Solutions becomes viable. A value proposition is a lifelong multi-modal digital double that educates your parents, then you and your offspring of data sources, information elements and knowledge gaps just-in-time to achieve your goals via your planned and scheduled activities. Linking an individual's longitudinal health data to environmental and product information and to a socio-cultural knowledgebase of healthcare systems that are slowly transforming can be catalyzed by such digital doubles. In 2015, the US Air Force initiated a 'Digital Twin' program to regain understanding of the complexity in its air fleet, which has aircraft older than the longest career possible of its airmen. [1] Hopefully, the DoD will initiate a 'Digital Servicemember' program that personalizes the decade old Virtual Solider Program by issuing a Digital Twin to recruits in every Armed Force. [2]

The holy grail of personalized user interfaces might be a Digital Double coupled to a multidimensional NoSQL database. It would feed multimodal displays via high-fidelity simulators of multi-scale digital models in real-time. Actually, the term Digital Double is not a new one. [3] They are under development but the developers focus a conversational interface, which appeals to the scaffolded mind discussed later. Nonetheless, a total-body skin, hair and nail, speech and touch simulation and animation of functional and physical realism for managing your health are features of an user interface that should be immune to abandonment (i.e., perpetual engagement). Capturing full-body surface scans and images of infants let alone from the Digital Imaging and Communications in Medicine (DICOM) modalities of a fetus with every other image including those from postmortem disposition (e.g., virtual autopsy, etc.) are neither convenient nor affordable today. [4] The hardware, software and service support of 3D whole-body surface scanners and imagers are cost and space prohibitive for the mass market. Whole-body surface scanners and total body photography rigs cost tens of thousands of dollars, use several square and cubic feet, and the files require manual touch up in 3D mesh applications depending on the intended usage. This is a non-starter for expecting parents! I spent more than $10,000 and have dedicated a spare bedroom for my SizeStream scanner. More importantly, software doesn't exist to manage the thousands of full and partial scans and images of an individual as a continuous, water-tight mesh with occasional ruptures, rips, peels and burns (e.g., lacerations and punctures) from an active lifestyle.

For a large adult human encased in a 2.000000 m^2 skin, the uncompressed data volume for its skin at human eye resolution (i.e., 0.1 mm^2 or 20 million skin elements encoded with 15 bytes (i.e., body reference system coordinates--3B per coordinate and 6B for deep color) per skin element) is 300 MB/adult-skin. Rounding up by ignoring the childhood years when the skin is a small fraction of its adulthood area, the 100-yr (or 36,525-day) uncompressed data totals 11 TB. Add multispectral, thermal and kinetic values at the same or lower spatial resolution at the same or different temporal frequency, and you get 22, 33 or 44TB respectively. And while skin is the largest organ of the human body, it might not demand the fastest or largest data acquisition of a human's anatomy, physiology and/or personality to manage, measure and monetize one's health as I have conceptualize it. Regardless, my back of the envelope calculation for the pan-health data volume after a century of goal setting, planning, tracking, and analyzing is less than 100 TB uncompressed. I expect a century after LifeGraph Solutions first customers become centenarians they will not need all their data in main memory despite any estimate of low-cost, off-line consumer-grade storage solution.

Interestingly, I could not find a resource that estimates the biometric and psychometric data volume, velocity, variety, and veracity of a 21^{st} century born human life spanning 100 years based on a present day construct of healthy living with medical devices accessible to consumers and clinics. Despite no governmental institution, academic conglomerate or industry consortium summarizing the digital artifacts of the measurement panoply for human anatomy, physiology and personality, I created the graph shown in Figure 1 to represent the temporal boundaries implied in this paper. In Figure 1, the first biomedical data from digital devices are assumed to occur sometime during the prenatal phase whose start is at the origin (e.g., 2D or 3D ultrasound image or movie). At this point, the parents could generate a baseline of biometric and psychometric parameter-values extending to their child's 100-year life expectancy, which remains unchanged in my chart and is labeled "dead line". The reality of every life will not be line at all but a piecewise continuous trajectory of segments changing with each accident, injury and recovery. The Y-axis represents real-time in years like the X-axis. If there were data types and volumes charted for the baseline established at the time of fetal imaging, they would be color-coded for the date-stamped calculation (or expectation) engendering a Z-axis to represent parameter identifiers. As time elapses and the fetus is born then matures, the area under the postmortem boundary and to the right of the birth-line represents the volume of data actually archived for a given epoch regardless of the delay ingesting the data.

Electronic Medical and Health Records are databases represented by the area to the left of the Y-axis. These database systems exist in a 'Red Ocean' of competition with little to no hope of evolving into a LifeGraph solution. On the other hand, LifeGraph Solutions will provide the features to populate the +X-axis using digital models of one's environment, products and self to set achievable goals and plan realistic activities. The 'Blue Ocean' is the software to enable humans to fill in the area of the right triangle and managed monetized biotelemetry. Software features allowing someone to virtually sculpt (with intelligently derived limitations demarking when surgery or Rx is required) their body starting from their body surface scan become possible. Users will create a dietary and exercise plan derived from the body differences during the same session. The same kind of planning will be possible for defining new levels of human performance.

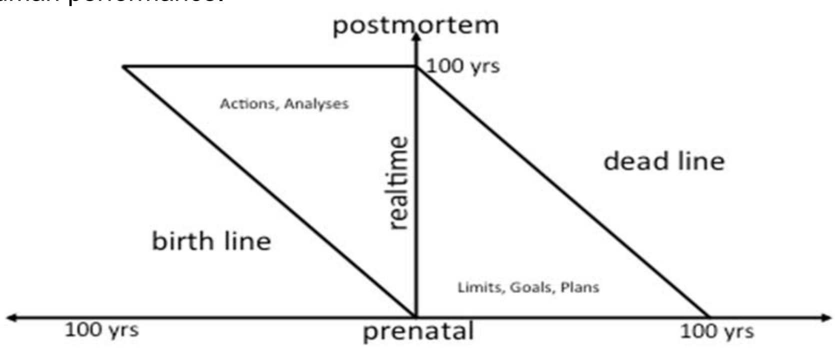

Fig. 1. Human health data volume, velocity variety and veracity womb to tomb

Total Recall by Gordon Bell is about How The E-Memory Revolution Will Change Everything. [5] I contend the Total Foresight Revolution via LifeGraph Solutions will be about How The Digital Double Will Change Every community one citizen at a time. Collaboratively using Digital Doubles or Twins, virtual geo-environments and Computer-Aided Design / Engineering / Manufacturing / Logistics (CAD/E/M/L) of goods and services will give individuals the capability to 'see, hear and feel out' their goals and plans to achieve them. [6]

2. Life Graph

The LifeGraph architecture is composed of three types of graphs distinguished by the unique coordinate reference systems used for their respective digital models as much as the ontologies for the data and information they store and manage. The World Geodetic System (WGS-84) will be used for global positioning of humans, natural environments and even goods like where the ground vehicle was while driving it. But human body-centered spherical coordinate systems are likely to be used for positioning and locating internal and external features and goods in, on and attached to articles on the body. Room coordinates based on Cartesian coordinates for locating and positioning household goods will be used.

2.1. Nature Graph

Quantifying the natural environment of things, living and nonliving influencing (near- and far-field) the individual is an essential part of a Lifegraph. Think of the Nature-Graph as a Native XML database of forces and fields (e.g., air and space weather, water and soil data, etc.) that are fed into the digital human model for activity planning, streamed with biotelemetry and queried for causal analysis (i.e., consumer diagnosis). A requirement for automating the discovery and service request of an individual's natural environmental is in the Life-Graph specification. It is based on sending the location of the individual to environmental data service providers. The measurements from environmental sensors individuals have under their operational control and proximate to them are mashed up with the data returned from service providers, which could be other individuals who monetize their environmental data and was proximate too. These data are used to drive digital product simulations based on materiel descriptions (i.e., digital product models) of the personal protective equipment (PPE) (e.g., clothing, personal vehicle, residence, etc.) from the Product-Graph. Digital product simulations matter in digital human simulations because the forces and fields acting directly on digital humans originate from digital products between the natural environment and the human. Simulating a few seconds or several days of physiological functioning using a digital human model should include the parameter-value pairs from PPE and Rx. This paper does not attempt to cover the complexities of amassing and parsing the myriad types of environmental data records an individual might use and be affected by over a 100-year lifespan. The PPE Use Cases have one of the highest priorities in the Life-Graph portfolio of projects.

2.2. Product Graph

There are fewer and few products designed, engineered, manufactured and even used without computer aiding the human operator, if any. The same can be said for logistics and maintenance. Many of the products with a Global Trade Item Number, which can identify more than a trillion unique items, have its data in the Standard for the Exchange of Product format. [7] The challenges of accessing the Computer-Aided X-files are many, typically involving risks of intellectual property infringement, especially with the additive manufacturing technologies becoming more affordable and popular to consumers. The same goes for genetically modified organisms via computer-aided statistical methods. Regardless of the good or service (i.e., the product), having the metadata for the 'thing' used by a LifeGrapher is the other essential input to her digital human model of high fidelity. This paper does not attempt to cover the complexities of amassing and parsing the myriad types of products an individual might own, posses, use and be affected by over a 100-year lifespan. This paper focuses on the Human Health-Graph.

2.3. Health Graph

The Health Graph in a LifeGraph is an extensible, simulateable digital human model guided (i.e., extended based on goals) by the parents' data inputs until the child matures to do so, navigated (i.e., queried based on real-time interests) by stakeholders who paid for access or were granted access freely, and controlled (i.e., tuned using external data and introspection) by stakeholders who are trusted by the modeled human including herself. The history of digital human modeling, human simulation and that of crowds are decades old and today supranational and national portfolios of projects amount to a billion dollars or more in (bio-) digital (virtual | parametric | physiological | anatomical | cyber | semantic) human modeling and simulation domains (and markets). [8-14] Health and healthcare crises many nations face arguably are caused by governments' value system regarding health, medical and clinical knowledge, information and data democratization. The opportunities to institutionalize these causal factors lie in what is compulsory for social security, employment, federal service, military service, high school graduation, residency, and citizenship. Simply put, a life-long personalized curriculum is needed for every human (or family) to use in collaboration with his/her stakeholders be it (extended) family, friends, employers, and governmental institutions managing entitlements. The belief a digital double front-end to the Health-Graph database application suite is ready technologically and for manufacturing represents the time has come to initiate Life-Graphs for the soon to be conceived in the next decade. Until this century, the knowledge and technology to engineer a computing platform for life management that is abandonment-free (i.e., lifelong engagement), mass marketable to expecting parents and willing to be institutionalized all levels of government in pre-K through 12th grade, conditions of citizenship (i.e., entitlements) and requirements of residency were intangible.

Table 1 lists some health parameters consumers can quantify with devices accessible over the counter compared to devices not accessible by to them by federal and/or state regulation. [15-18]

Table 1. Many Digital Imaging, Measurements and Devices.

Consumer Ownership Accessible	Consumer Ownership Inaccessible
Blood gas analyzer	Computed Tomography (CT)
Blood pressure	Functional MRI
Brain activity	Magnetic Resonance Imaging (MRI)
Cholesterol testing	Positron Emission Tomography
Drug discovery	Single-Photon Emission CT
Food toxicity detection	Ultrasound
Glucose	X-Ray
Heart rate and its variability	X-Ray Computed Tomography
Hydration	
Infectious disease	
Ingestion	
Movement	
Muscle activity	
Oxygen level	
Posture	
Pregnancy testing	
Respiration	
Skin conductance	
Sleep	
Whole-Body surface (point cloud)	
Temperature	
Whole-body skin imaging	

The HealthGraph capability will provide an interactive environment to set human-scale goals (i.e., physical, mental and social fitness goals) using even micro-scale data from clinical and consumer devices. [19] It will provide decision support for planning activities simulated to verify achieving the goals set within the constraints of one's personalized digital human, product and environmental models germane to such plans. Obviously, it leaves the purposes to execute all plans and achieve goals to the owner who is advised of the risks in doing so.

3. Requirements

The archetypical 21st century-born human should thrive all the way to 100 years of age. A way to intuitively integrate, interface and interact with human-scale health data and sensors over a 100-year lifespan is a capability gap that no one owns in the US government or any other nation-state I surveyed. [20-22] No commercial entity has a vision, mission or value proposition that addresses the shortfall either. [23] Every parent of minor children and adult are challenged to manage her health and prepare for postmortem disposition. The self-care challenge is defined by managing knowledge of your environment, composition the goods & services used and self to make informed decisions about your activities in environments and with others.

The requirements for the HealthGraph in LifeGraph Solutions are being engineered using the literature for preventative medicine, self-care guides, medical education curricula, and evidence-based treatment starting with pregnancy and ending with postmortem actions that generate data from the corpse. [24-38] The scope HealthGraph User stories range from guided cognition associated with self-actualization to virtual coaching for exercise, virtual counseling and even virtual rehabilitation. [39-41] My business model depends on a causal loop that balances the time and money spent learning, measuring, modeling, simulating, and monetizing one's graphs as streams and/or graphlets.

Table 2. Estimated Resources for a 100-Year HealthGraph.

Resource Type	Estimated Value
Individual Effort	$3 * 10^8$ seconds
Hardware	1,000 items
Energy	$3 * 10^9$ Joules
Data	$300 * 10^{12}$ bytes
Volume (non-contiguous)	10 m^3
Area (non-contiguous)	10 m^2
Costs (goods and services)	$50,000 USD (2015)
Software	3,000 Function Points
Revenue (from monetization)	$50,000 USD (2015)

3.1. 300 Body Scans

It was not hard to realize my priority had to be to amass a body surface dataset no one seem to have in order to build the virtual human interface no one appeared to be building. This interface is to sustain customer engagement of health apps. Because health app abandonment, in particular, after six months or more is significant, I figured the opportunity to innovate the user interface and eliminate abandonment will be very profitable. [42] I purchased a SizeStream 3D body scanner and assembled it in my garage in August 2014. I scanned myself everyday unless away from home. I moved in April 2015, disassembling the scanner and reassembling it days later in a bedroom where I use it now.

The temperature and humidity varied significantly in my garage despite scanning during the same time of day (i.e., in the evening) over three seasons in the state of Maryland. I didn't calibrate the scanner before every scan so there is preventable measurement noise in my data set. I do not calibrate before scanning now since I control the temperature and humidity in the bedroom it is in. But I do run the 5-minute calibration when I move the scanner, something that occurs when I clean up around it. After filtering out body scans with erroneous measurements from 300 different scan dates, nearly 500 body scans on 206 different dates remained. Figure 1 illustrates the delay in minutes until the subsequent scan for the 206 dates. The average time between the scans was 40 hours. The max delay was 379 hours and the standard deviation was 49 hours.

SizeStudio software calculates 119 parameters from each scan but I discuss only five normalized (to the parameters' average) measurements in Figure 1 because they are representative of my body shape variation. After smoothing the data using first to fourth order polynomials, a story appears about my body shape changes. First, my estimated weight constantly dropped while my circumferential measures took a cyclic path. The largest difference between estimated weights was 3.5 kg. My chest circumference increased while my seat, stomach and thigh measurements decreased. I started training in September for my Air Force Reserve fitness test that November, which consists of a 1.5 mile run, pushups and sit-ups. This probably explains the uncorrelated trends in upper and lower body measurements.

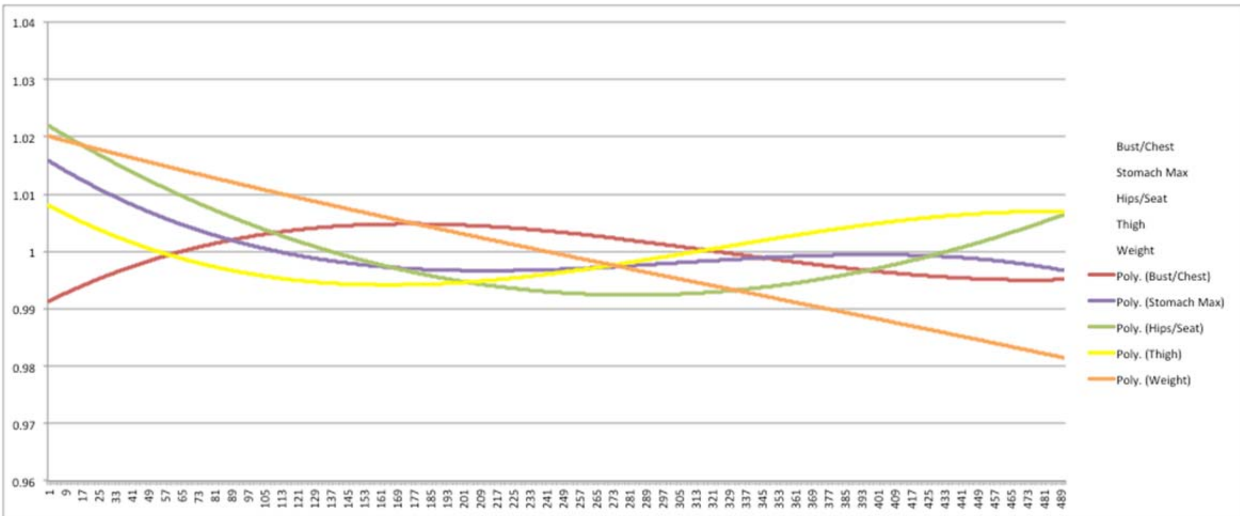

Fig. 1. Smoothed Body Metrics (August 2014 – August 2015)

I continue to scan my body daily and use networked Withings products for weight, body fat percentage, pulse, blood pressure and activity tracking. A data access strategy I see vendors take is shipping data export to common text formats (e.g. comma separated values) features in their device software so users can transform and load into databases. [43] This is unsustainable for mothers with infants and even most adults with busy schedules. The marketplace for the right side (goal setting and activity planning) of my graph in Figure 1 is non-existent. For example, SizeStudio does not have customer requirements to sculpt your scan to nonsurgical possibilities, generate nutrition recommendations and exercises to within your time and money budgets so subsequent scans are automatically used in a tracking feature (that doesn't exist) estimating what you didn't do if you didn't enter what you actually did relative to the recommendations.

3.2. Body Scaffolds

Of all the hardware form factors for instantaneous total-body measurements, the body scaffold is the most important because it permits adolescent and older humans to measure nearly every square tenth of a millimeter of bare skin, hair and nail in privacy and quickly. Body scaffolds will be lightweight (<1% of user's weight), collapsible for convenient storage, extensible to form-fittingly encase its user from birth size to adult-size a century. Of course, versions adapted to pregnant women, disfigured, dismembered and otherwise disarticulated humans will be want make a body scaffold personal.

The body scaffold will be like a server rack in a data center in some respects. It will have affixed to it medical devices that depending on the protocols are nodes in a Personal Area Network, Body Area Network, Local Area Network and/or Health Area Network. The scaffold will structurally support in-, on- and off-body body and mind sensors (and actuators). Wireless Body Area Networks, IEEE 802.15.6 Body Area Network (10 kb/s – 10 Mb/s) being one, are thought to be ubiquitous in modern (urban and suburban) societies so near continuous connectivity will be likely and affordable. [44]

3.3. Digital Human Modeling & Simulation

Models (mathematical, dynamical, computer, and digital) of human genes, cells, tissues, organs, organ systems, whole-bodies, and personality (emotions) exist, are in development or are planned to start amongst the developed countries [45-47]. Depending the problem being solved or the answers sought, the human models are reusable and extensible for a germane modeling project. But none are designed to be a life-long digital double for personal use. The idea of users having the knowledge, motivation and time to maintain such scientific and technical representations of themselves is unthinkable no matter how little it might cost now. And LifeGraph Solutions was established to provide that individualistic model and simulation capability to the mass market educated in using it from birth. Knowing the commitment associated with getting the utility out of their Graph, life-long health education is the priority Use Case and User story.

The computing infrastructure for one's models and simulators is not as much an issue even today compared to there not being a market for semantic applications that use machine learning from genetically relevant human LifeGraphs and your LifeGraph to support your healthcare decisions. The

BioGears, Virtual Soldiers, Parametric Humans, Digital Patients, Digital Astronauts, Digital Driver and other digital age-, gender-, job-based virtual human simulation platforms are designed for medical researchers, pharmaceutical companies and product developers, not ordinary citizens [47].

3.4. Motion Capture (MoCap)

3D motion capture has a history quantified by the many file formats and user communities of them [48]. LifeGraph Solutions requirements for MoCap data format and interface standards map to the spatial and temporal range of evolving anatomical structures and dynamics n one's DHM. For example, Fetuses and infants have more bones (and thus joints) than adults but limited mobility (range of motion, speed, acceleration and jerk of articulations) due to their fine motor control and musculature. There are requirements to derive body posture, position and motion from instrumented product usage & repositioning, video and acoustic surveillance, vehicular operation and occupancy, and other forms of tracking out and indoors. The MoCap objective with LifeGraph Solutions is to deduce the owner's posture and motion from reasoning with ontological models of living (e.g., purchasing goods and services in stores, at parks, etc.) and working when not instrumented or being tracked by others.

3.5. Humanoid Animation (H-Anim)

3D humanoid animation remains a labor-intensive art even with the best tools of the trade that have reduced production time n-fold from the beginning of computer-generated character animation [49]. The LifeGraph Solutions requirements in this area address the automation of web-based real-time animation using the behavior patterns derived one's archive, biotelemetry and plans. Given the sensors in-, on- and off-body will vary day-to-day if not during the day (e.g., times asleep versus awake), having a sensor-aware humanoid is essential for multi-modal rendering. The automated humanoid (avatar) animation from future, present and past data queries and streams will provide individuals an unprecedented perspective of their development, status and degradation. Hopefully, the international standard for H-Anim will evolve to support the medical fidelity needed for superimposing many humanoids in immersive environments for visual and acoustic comparisons of stature, speech and behaviors to name a few Use Cases.

4. Portfolio of Projects

The strategy to maturing LifeGraph Solutions from an idea into an iconic company in a trillion-dollar a year global healthcare marketplace is to offer goods and services for the unborn and meet that segment's needs through its postmortem, hopefully a century later. LifeGraph Solutions will not yield to market pull for products for humans older than the inaugural customer segment. A strategic goal is to saturate the market with LifeGraph Solutions of current and subsequent birth-year groups not previous ones. Later fetuses will benefit from the continuous service improvements with respect to the initial launch. This means designing goods and services to a customer segment with relatively few health conditions, needs and cognitive abilities in it first year out of the womb. Body scaffolds will be the smallest and lightest because newborns are 1 - 5% of their adult weight, volume and surface area. The digital human model will have the fewest interface parameters because of the relatively controlled environment pregnant women and newborns are exposed to for safety and security reasons. Gamifying the DHM care & feeding via a mother's digital baby double will be the greatest challenge if a mother's digital hygiene expectations from the government and family do not reinforce the long-term benefits of sustaining her children's LifeGraph. Therefore educating the mother on being a great mom via her baby's digital double is one of three projects described. The measurement project describes the ways and means of equipping mothers and caregivers with sensors, devices and tools to acquire biometric and psychometric data from the baby no matter what state of consciousness or area she is in. Finally the monetization project describes cash, credit and non-cash exchanges possible as the network effect on LifeGraph Solutions develops.

4.1. Education

You cannot find an interactive, immersive Web-based resource with all the health (i.e., medical, clinical, dental, mental, pharmaceutical, device, …) knowledge, information and data to back it for an archetypical male and female (who bears two children, not twins) at an hourly or daily resolution for 100 years of life (from womb to tomb). After three years of searching, I am convinced such a resource just neither exists in a national government, public or private academic institution nor an industrial consortia. There are dozens of specialized and bite-sized educational resources delivered via computer-based platforms on and off the WWW nonetheless. The LifeGraph Solutions portfolio addresses this resource gap with its Education Project.

The principal project goal is a health-driven lifelong education service for a digital double. Using artificial intelligence, the service agent reads the LifeGraph for the goals, plans, real-time telemetry, archived goals, plans, events and measurements to compose time-sensitive educational lessons about the owner, the natural environment and/or man-made product (usage). There are plenty of extensible mark up language of concepts and terms covering structure and behavior of the natural environment, the human and the computer-aided X products to integrate logically over networks. There is not a personalized software agent that learns about you from your measurements and motivations in a LifeGraph to query, stylize and interactively teach you about yourself to optimize your health, environment and potentially wealth.

4.2. Measurement

Full-body and scaffolded measurements can be costly in time, energy, side effects, and money to mention a few burdens even when someone isn't busy living fast and furious. [50] Conversely, a critical mass of the 'right' measurements advertised in the opportune markets can be profitable, prize winning and a powerful defense or weapon in a court of law (or bedroom). So lagging only by the time it takes to achieve the first milestone in the Education Project, the Measurement Project will be initiated. Its goal is to design and manufacture panoply of body and mind sensors, devices and scaffolds for personalized education, digital human modeling & simulation, and wholesale LifeGraph monetization. Starting with the fetus, the project will address engineering changes to extant sensors, devices and scaffolds to effectuate wireless, personal and body area networking challenges. All the typical topics of internetworking and human factors will be in scope of this project—style, mass, clothing and apparel durability, information assurance, sensor tipping and cueing, energy management, built-in test, authentication, interference (intentional jamming and unintentional), etc. The project will explore the feasibility of cooperative measurement between instrumented babies and mother, which should carry forward to siblings, classmates, lovers, spouses, and other face-to-face team members who desire off-body sensing (i.e., outward facing/pointing sensors worn by one transmits that data to the proximate person who accepted or requested to available data stream) be streamed to their BAN for fusion or integration. While unnecessary medical testing due to a lack of exchangeable electronic medical/health records is a bad thing, unnecessary (in the moment or relative to health condition) body and mind monitoring due to a mindset from the Education Project will be a potential revenue generator for the individual. How the individuals are taxed if at all for selling their health data by the parameter-second will be addressed only after the authorities determine there is enough digital currency flowing to not acknowledge the activity.

4.3. Monetization

Who is willing to buy my baby's data like that? What online services (i.e., the Craigslist of biotelemetry and psychometrics collectively termed graphlets) are available to advertise and easily close the deal during a browsing session for my baby's data? And the questions never end depending on whom you ask. The Monetization Project is defined to answer many such questions by designing an online platform to market your data via your advertisements likely featuring your digital double. With many examples of online trading platforms serving niche markets (e.g., man-made goods, undeveloped lands with and without mineral, oil & gas deposits, and bodies of water, and human services), this project has to write and satisfy requirements for User Stories that are variations of extant consumer-to-consumer market behaviors. I suspect a lot of volatility in the beginning despite the fact the humans are children whose data might be sought for intense public health studies before being required and accepted to daycares, schools and before-and after school programs. The volume, velocity and variety of non-cash exchange of health data for reduced service fees between parents and service providers could be surprising. Early childhood development experience setbacks and strides forward with the advent of LifeGraphs serving as a supplemental communications medium to short descriptive comments about behavior during the day. The parents could review health data ingested by the child's BAN from the service providers wireless sensor network and from the child's proximate classmates BAN if enabled to auto-connect for off-body sensing. Once job-aged and sexually matured or legally married, users will be able to create valuations for LifeGraphs adding them to their balance sheets and income statements. I only hope the economics of lifegraphing becomes a net positive for the person, her blood relatives and the stakeholders that come and go throughout her life.

5. Conclusion

Daily 3D body scanning with personalized body scaffolds to update one's digital double for life management is a catalyst to lifelong learning, digital human modeling and data monetization. This can be accomplished while securely and privately exchanging data and information with governments to better manage dwindling natural resources. As a swelling population stresses our lives by its complex contributing causal effects on our natural environment, a smarter planet via individualized digital human models should dampen population growth and the concomitant human greed with more scaffolded minds thinking to consume closer to their needs until population is in balance with nature. The energy burden to organize data, information and knowledge into a LifeGraph, educate and train a human for a 100-year lifetime via her digital double, and equip her with a personalized panoply of sensors to meet the spirit of anticipated regulations and laws of citizenship, residency, high school graduation and employment is estimated at 3 GJ. The LifeGraph strategy to grow across its inaugural customers' birth-year forward will be implemented with the portfolio of projects described.

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