

Below is an EXCERPT ONLY including title, abstract, TOC, and ONLY sections 6.0 and 7.0.

U.S. PATENT # 7,402,743 Issued July 22, 2008

Free-space (non-tactile) Human Interface for Interactive Music, Full-Body Musical Instrument, and Immersive Media Controller

ABSTRACT

“Method and apparatus entraining interactive media players into a sustained experience of “Kinesthetic Spatial Sync,” defined as a perceived simultaneity and spatial superposition between a non-tactile, full body (“free-space”) input control process and immersive multisensory feedback. Asynchronous player input actions and (MIDI tempo) clock-synchronous media feedback events exhibit a seamless synesthesia¹ or multisensory events fused into an integral event perception, this being between musical sound (hearing), visual responses (sight), and body kinesthetic (radial extension, angular position, height, speed, timing, and precision). This non-tactile interface process and multisensory feedback “look and feel” is embodied as an optimal ergonomic human interface for interactive music and as a six-degrees-of-freedom full-body-interactive immersive media controller. The invention provides for a wide scope of fully reconfigurable transfer functions between kinesthetic input features and media responses (“Creative Zone Behaviors”) managed by means of MIDI protocol and/or display interface commands. Alternative forms of optomechanical embodiments are disclosed, including floor Platform systems and floor-stand-mounted Console systems, all of which exhibit identical free-space input and integrated media response paradigms.”

¹ (Webster’s) Syn•es•the•sia “...a concomitant sensation...”

TABLE of CONTENTS

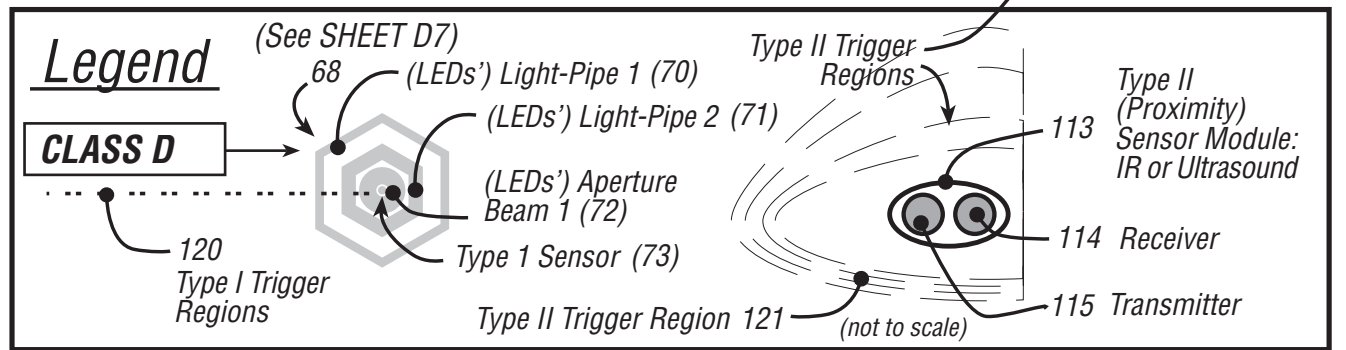
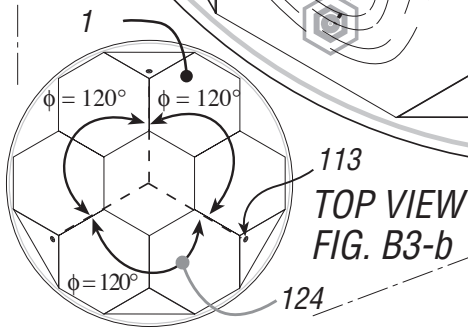
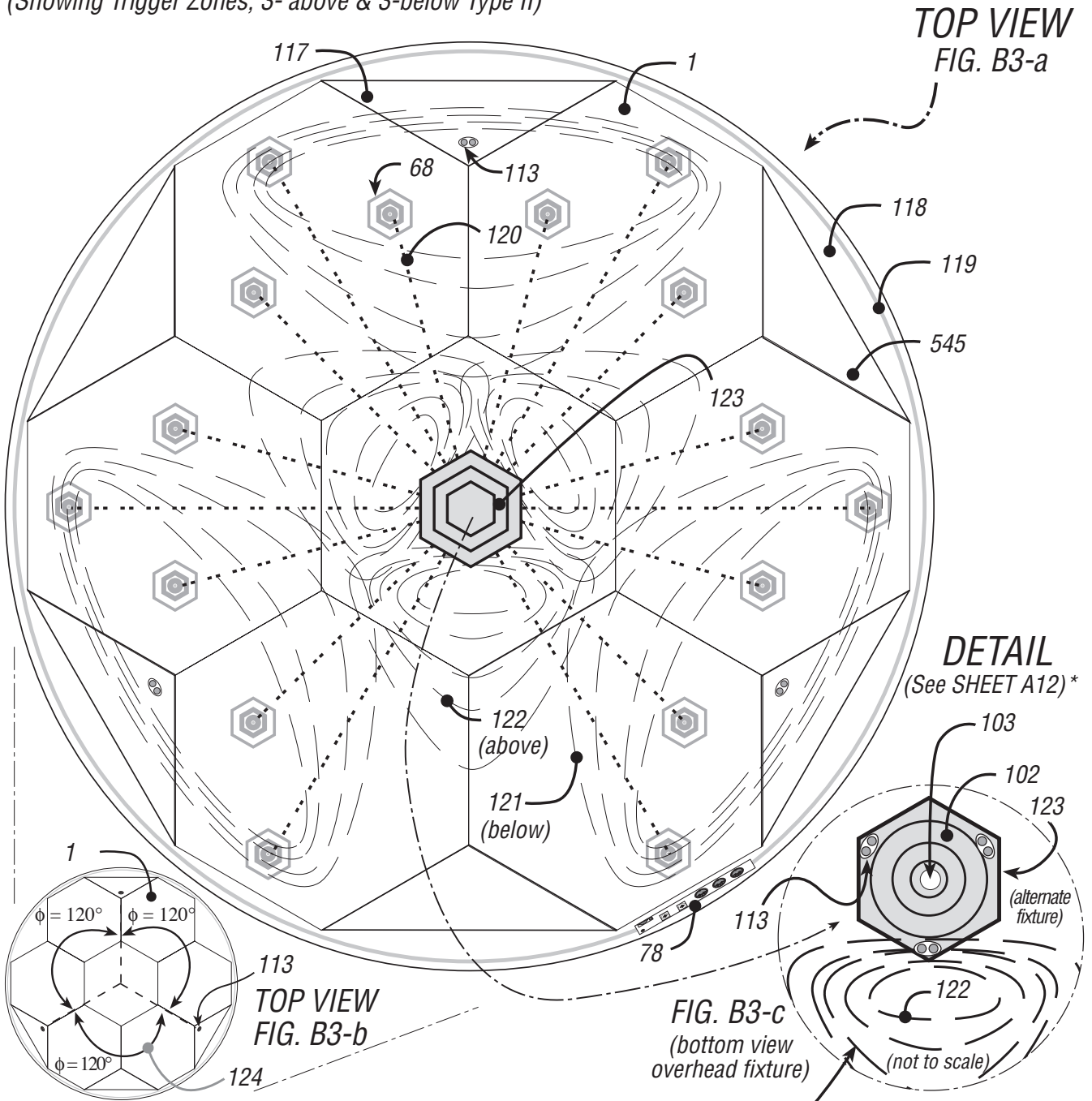
<u>Section</u>	<u>Page</u>
Table of Contents.....	ii
Index to Drawings and Corresponding Description Sections.....	iv
Index of All References to Drawings (as a Figure, Sheet, or Series)	vii
Formats of Drawing References.....	x
PART 1: DRAWINGS.....	1
PART II: SPECIFICATION	81
1.0 Scope of the Invention.....	81
1.1 Introduction.....	81
1.2 Sensors.....	82
1.3 Visual Feedback	83
1.4 Ergonomics.....	84
1.5 Media Response and Sync.....	84
1.6 Command Interface and MIDI	85
2.0 Overview of the Invention.....	88
3.0 Background of the Invention - History of Transparency & Symmetry	92
4.0 Method and Apparatus	97
4.1 Visible and Infrared Floods	97
4.2 Primary (Type I) Sensors.....	98
4.3 Secondary (Type II) Sensors	105
4.4 Visual Feedback – Apparatus.....	108
4.5 Visual Feedback – Functional.....	111
4.6 Methods of Play	114
4.7 Musical Response	116
4.8 Command Interface and MIDI	120
4.9 Setup, Portability and Safety.....	122
5.0 Descriptions of the Drawings.....	125
5.1 <u>Series A</u> : Platform Optomechanics, Biometrics, and Visual Feedback .	125
5.2 <u>Series B</u> : Preferred Platform Embodiment.....	129
5.3 <u>Series C</u> : Console Embodiment	131

(continued)

TABLE of CONTENTS (cont.)

5.4	<u>Series D</u> : Response State Changes and Sensor/LED Modules	134
5.5	<u>Series E</u> : Gestures, Ergonomic Timing, Visual Feedback, MIDI Notes Response and Sync Entrainment	140
5.6	<u>Series F</u> : Software Modules, Electronics & Data Flow Architectures	148
5.6.1	Overview	148
5.6.2	Groups.....	148
5.6.3	Design Constraints and Solutions	149
5.6.4	MIDI Protocols.....	151
	(A) Free-Space Event Protocol.....	151
	(B) Visuals and Sensor Mode Protocol.....	152
	(C) Creative Zone Behavior Command Protocol	153
	(D) Other 3rd Party MIDI Protocol Uses and Conventions.....	156
	(E) Global Sync Architecture	158
5.7	<u>Series G</u> : Creative Zone Behaviors (CZB) Conceptual Overview.....	172
5.8	<u>Series H</u> : Creative Zone Behaviors for Notes	172
5.9	<u>Series i</u> : Display Interface for Notes Behaviors: Control Panels	173
5.10	<u>Series J</u> : Display Interface for Notes Behaviors: Applied Controls.....	174
5.11	<u>Series K</u> : Display Interface for Local Visuals Behaviors.....	175
6.0	Human Factors Impact on Psychology	176
7.0	Utility and Benefits of the Invention	179

(Showing Trigger Zones, 3- above & 3- below Type II)



* Note: As shown on Sheet A12 except with addition of 3 Type II Modules and Data Cable)

3-Zone Platform w/ Type I Sensors

(Showing Microbeams, Player, Visible Shadow, Attack Events, Response States)

OBLIQUE VIEW

FIG. A8-a

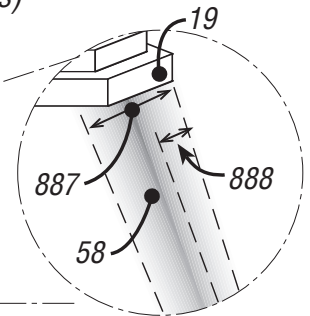
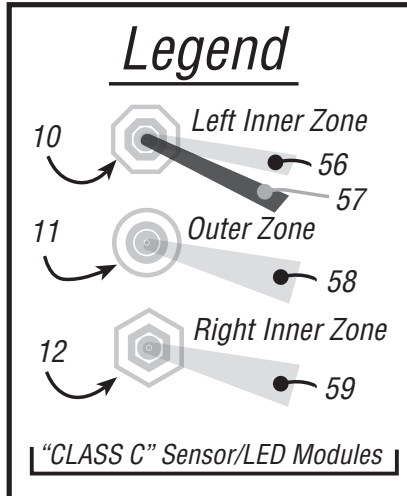
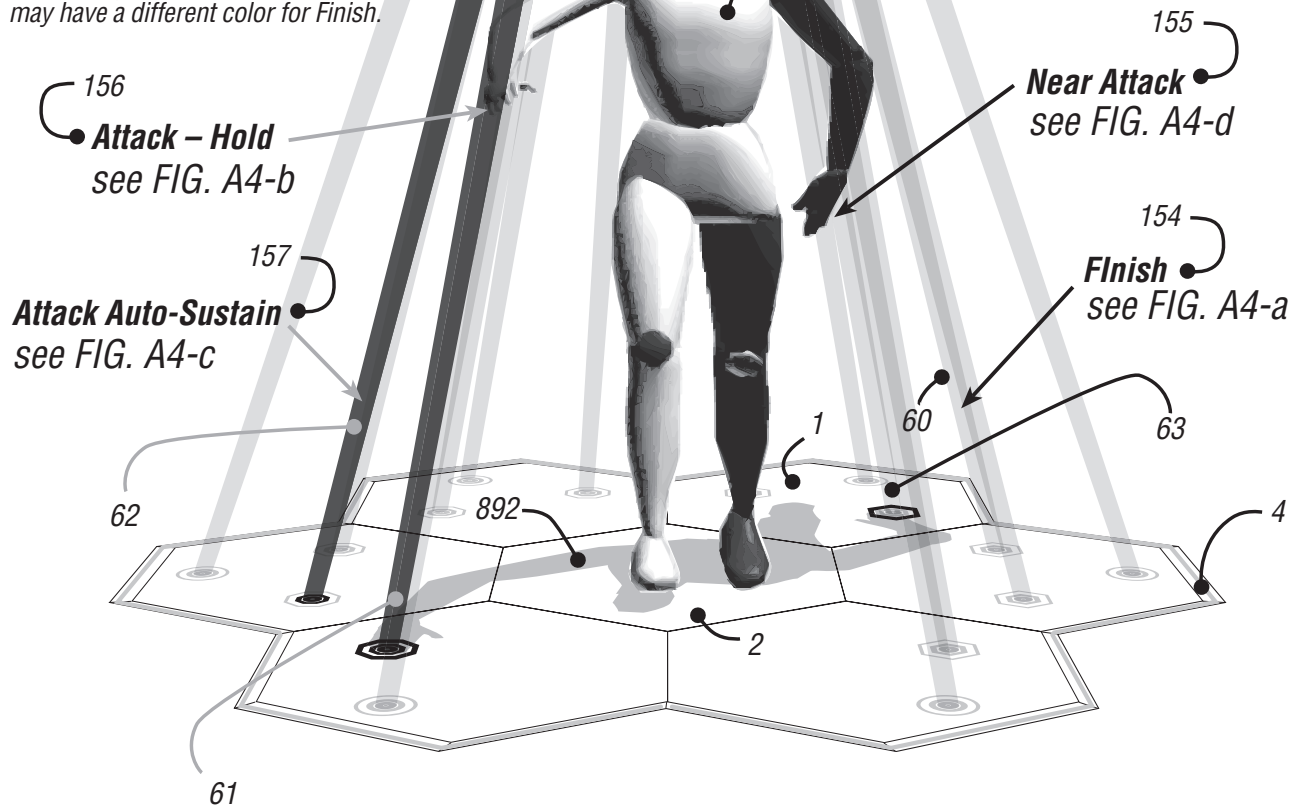
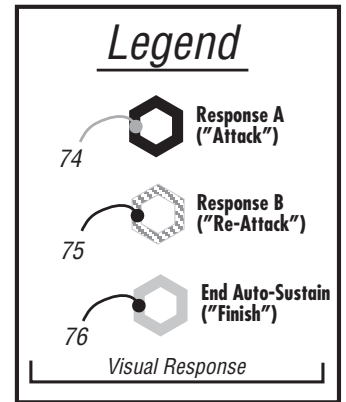


FIG. A8-b
DETAIL

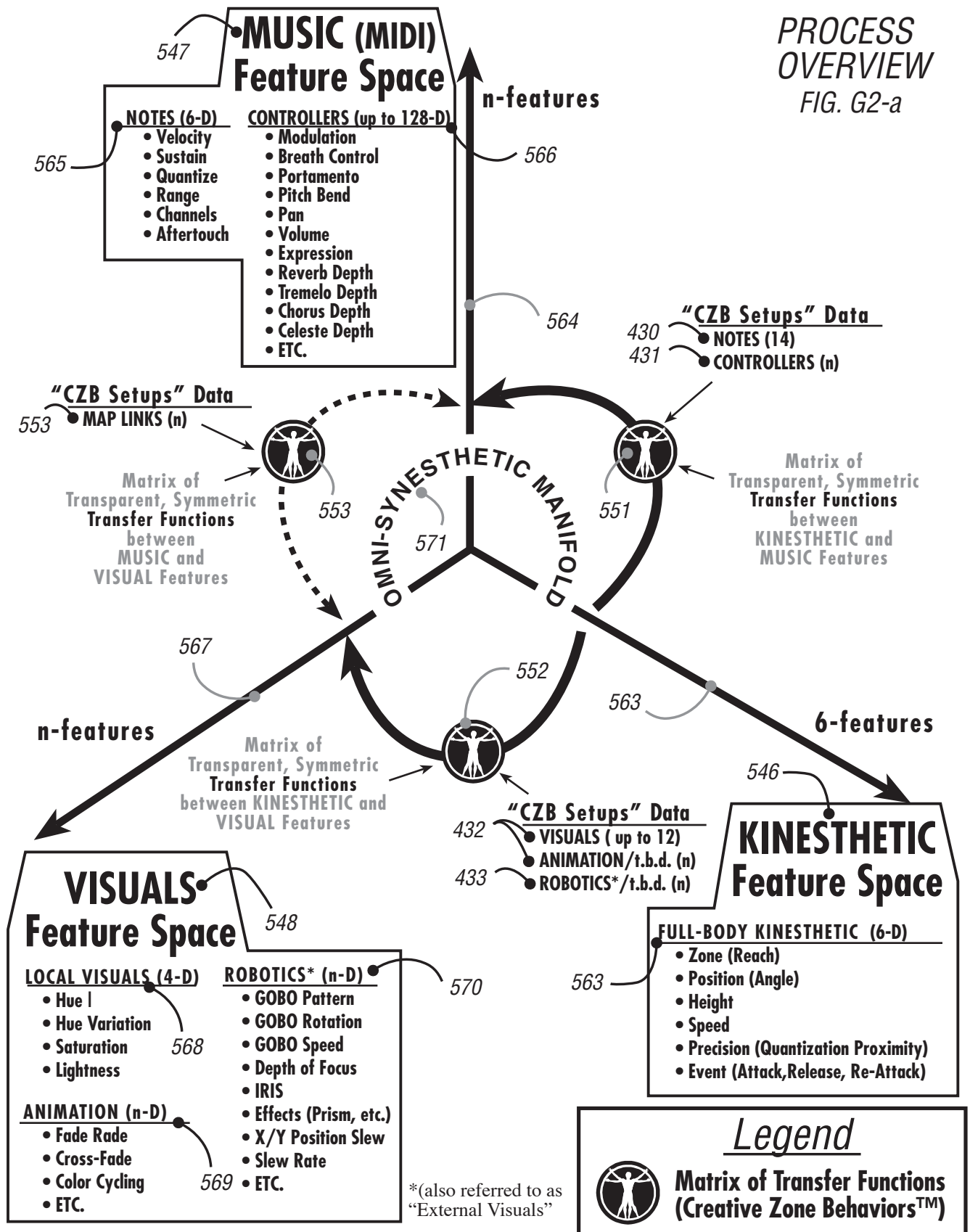


Note: for clarity in this view all Zone Microbeams in Finish State are shaded equally, even though in practice each Zone may have a different color for Finish.



Transparent & Symmetric Transfer Functions Between Kinesthetic, Music, and Visuals Features

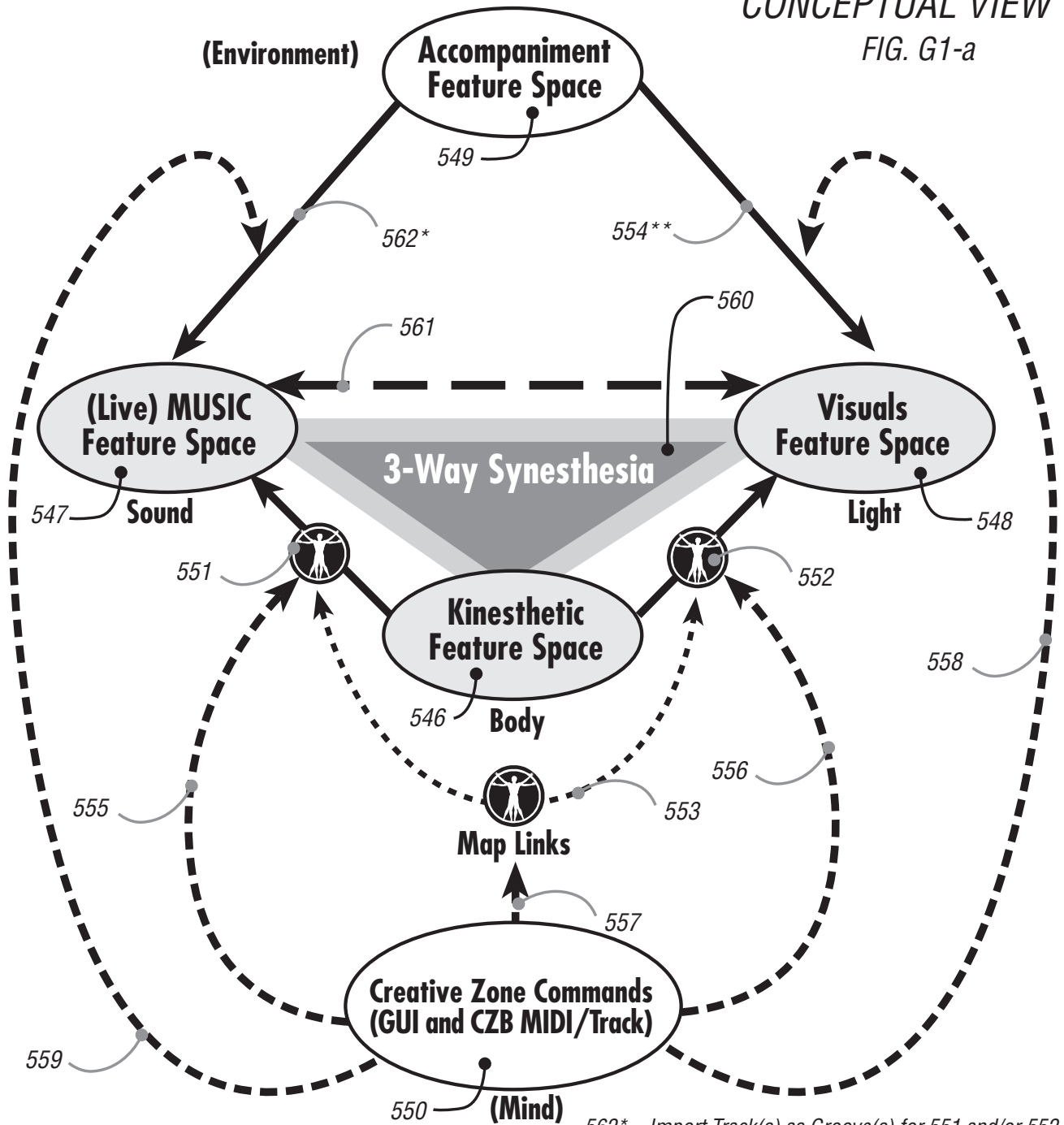
PROCESS OVERVIEW
FIG. G2-a



Relationship of Accompaniment and Creative Zone Commands to Perceived "Synesthesia"

CONCEPTUAL VIEW

FIG. G1-a



562* – Import Track(s) as Groove(s) for 551 and/or 552.
 554** – Lock Parameter to MIDI IN for 552.

	Implicit Synesthesia	Legend
	Explicit Synesthetic Transform Functions	
	Control of Transfer Functions	
	Visuals/MIDI "Behavior Map Links"	
	Primary Synesthesia: Sound/Light/Body	

EXCERPT

6.0 Human Factors Impact on Psychology

Simultaneity and Synesthesia. [Sheets G1, G2]. Simultaneity is critical to perception of “Synesthesia” (560) which is that type of perception where multiple sensory stimuli (546, 547, 548) are perceived coherently as aspects or features of a *single event or stimulus*. A key enabler to reaching the threshold of a synesthetic event is in fact simply that perceptions *are* being experienced at the same time. Non-simultaneity reinforces perception of multiple (distinct) events across the sensory modalities, thus directly negating Synesthesia which by definition must be a unified perception amongst those sensory modalities. Non-simultaneity precludes, or at least greatly suppresses the chance for Synesthesia. Perceived simultaneity of multi-sensory events (546, 547, 548) is thus critical to enabling Synesthesia, which in turn is critical to achievement of the invention’s Kinesthetic Spatial Sync biofeedback entrainment effect (306).

Reported “Gestalt” Effect and Supporting Hypothesis The free-space interface’s transparency of Kinesthetic Spatial Sync and with its “collision metaphor” of visual feedback, evokes a psychological *Gestalt* effect, wherein the unaided body in continuous motion becomes subjectively perceived as the sole and precision instrument. The traditional concept of “instrument” (defined as something beyond and separate to the human body) appears to disappear, or at least, becomes greatly reduced in emphasis.

Effortless Entrainment. By directing feedback (547, 548) to sustain the players' focus of attention to the immersive media responses, which are perceived as precisely and kinesthetically coupled (306, 307) to the body in empty space, the system evokes a spontaneous and effortless entrainment into a continuous Gestalt of:

“My body IS the instrument.”

Hypothesis of Cascading Entrainment. Given the nearly universal degree of intimate control by player choice over body motion (a practical unity of choice and kinesthetic), the first Gestalt cascades into a deeper Gestalt, wherein the immersive media responses become effectively near-telepathic in “human interface” character or subjective feeling. At this level, we find an intention-response coupling, where the Gestalt becomes “my choice

creates aesthetic media response.” For reference, first consider (by way of contrast) the use of traditional musical instruments in terms of:

$$[\text{intention}] \times [\text{body-kinesthetic}] \times [\text{instrument behavior}] = [\text{media response}]$$

Entrainment Phase 1. The invention stimulates players into an evoked Gestalt of “My body is the instrument,” which may also be expressed in terms of:

$$[\text{intention}] \times [\text{body kinesthetic}] = [\text{media response}]$$

Entrainment Phase 2. The entrainment then naturally cascades into a deeper Gestalt, given the effortless and intimate relationship of intention and body kinesthetic (for the average unimpaired player):

$$[\text{intention}] = [\text{media response}].$$

Creative Unity. This psychological process evoked by the invention is hypothesized to include a reduction from the more common duality of everyday Causes and Effects into what might be termed “Creative Unity” wherein intention and result become simultaneous and integral while yet in a context of continuously harmonious, aesthetic, engaging and complex results.

Identification with Transparently Modified Response. The Kinesthetic Spatial Sync experience continuously provides a visceral (physical) body kinesthetic perception of the otherwise rarely juxtaposed properties of:

$$[\text{precision}] \text{ and } [\text{effortlessness}].$$

Akin to Inner Psychology of Experts. This experience of effortless precision may be both compared and contrasted to the following. Virtuoso or skilled musical instrument performers report that they sometimes lose physical awareness of their hands or feet entirely while in precision performance, and subjectively connect only their inner thought or feeling with the ultimate physical sound results. Their matrix of internal (mental) and physical (bodily) transfer functions has become invisible or subconscious; gone from conscious attention or focus are details of eyesight processing music notation, and the actions of hands, arms, diaphragm and/or lip muscles. This is part of the reported inner psychology of expert conventional music instrument performance, typically subsequent to years of learning and sustained practice. A free-space musical instrument employing the

invention appears to make immediately accessible to the unskilled, novice or casual player (as well as to musicians and practiced free-space players alike), experiences which are at least akin to those arising in the inner psychology of expert musical expression, yet in a context of compelling, visceral bodily awareness as well.

Critical Enabling Effect of Omni-Transparent Multiple Transfer Functions. [Sheets G1, G2]. Free-space media systems employing the invention's Creative Zone Behaviors biofeedback paradigm for interactive music are uniquely able to provide transparent transfer functions (551, 552, 553) for all feature spaces (546, 547, 548) thus comprising an *Omni-Synesthetic Manifold* (571) of experience. The invention co-registers all of these synesthetic transparencies within a unified clear kinesthetic and visceral perceptual-motor ergonomic paradigm. In so doing, in free-space, rhythm is the "last" (most recent in the evolution of musical instruments) musical transfer function to be made simultaneously transparent and symmetric. This form of rhythmic processing is a *critical enabler* when employed simultaneously with the other transparent transfer functions previously available (for timbre and pitch). *What is enabled* by the Kinesthetic Spatial Sync effect is the evoking of a perceptual-motor Gestalt of *Creative Unity*, and the unconditional subjective "ownership" of effortless virtuoso precision in aesthetic creative expression.

Disclosed Human Factors Reflect a "Process". In constructing a device or system exhibiting the disclosed human factors, the implementation and fabrication methods (including sensor electronic hardware, sensor control software, system enclosures, mechanical packaging, sensor array spatial configuration, LED indicators, external visual response systems, and musical response systems) are all to be constrained within the invention's disclosed Kinesthetic Spatial Sync feedback paradigm, namely the operational *process* of the Creative Zone Behaviors. One skilled in the relevant arts could execute a variety of implementations employing varied control means, alternative optical and electronic materials and technologies, all the while exhibiting the disclosed ergonomic, optical, cybernetic, algorithmic, and human factors design constraints.

7.0 Utility and Benefits of the Invention

Test Player Reports. Utilizing developmental prototype reductions to practice, hundreds of trial players encompassing a broad player demographic (including those with no prior musical skill or training) have reported various experiences which we loosely categorize into the following common results:

- (a) Experienced *intersubjectively aesthetic musical and visual media responses*;
- (b) Maintained a *perception of direct ownership of creative acts*;
- (c) Discovered the natural ability to *apply unrelated and previously acquired perceptual-motor skills* into successful intersubjectively aesthetic musical expression, including such as martial arts, dance, sports, aerobics, gymnastics, sign language and Tai Chi, and the ability to do so with maintained precision, aesthetic and variety in media responses; and
- (d) Evoked a *“Creative Wellness Response”* or subjective therapeutic effect. Casual (first-time) players as well as expert (practiced) players described their free-space-interactive experience in subjective terms including: “satisfying, all-positive feedback, emotionally healing, uplifting of self esteem (including performance to others), energizing, compelling, visceral, inspiring, comforting, promoting a sense of balance, well-being, alertness and euphoria.” This subjective effect may have physical counterparts.

Creative Empowerment. The invention provides the experience that body motion (input) is spatially superposed and simultaneous to aesthetic media creation (output). A more psychological perspective might describe this in terms such as *“creative physical expression becomes inescapably synonymous with sharable beauty and harmony in perception”*. This powerful positive feedback encourages continued creative expression and exploration through continued body motion. The combination of unrestricted free-space interface and aesthetic musical and visual responses thus collectively entrain continuous player body motion. Continuous body motion in turn further amplifies and sustains the desired ergonomic effect of *“effortlessly creating aesthetic experience.”* The continuously positive and synesthetic feedback to full-body creativity appears to spontaneously evoke the *“Creative Wellness Response”* which further empowers creativity, thus forming a self-reinforcing biofeedback process.

Therapeutic Benefits. How therapeutic effects from free-space media are achieved may be suggested by the empirically applied techniques and well-documented benefits found in the healing arts of music therapy, creative therapy, art therapy, dance therapy and physical therapy. The invention makes available a repeatable, participatory creative experience to players which appears to spontaneously elicit many of the benefits previously derived separately by techniques of these various therapeutic disciplines. The invention claims to be a significant improvement of the arts of these therapies, considered separately and collectively. Although typically to be provided in entertainment venues, the utility of the invention includes in particular importance its therapeutic and healthful application.

Prediction of Measurable Health Benefits. It is anticipated that repeat players may develop significant objectively measurable benefits in the areas of pain relief (endorphins), hormonal balance, immune system strengthening (S-IgA or salivary immunoglobulin A). Players may also experience improved rates of basal metabolism, blood pressure, respiration and cardiac (including heart rate variability or HRV). Regular use may also stimulate results such as improved perceptual-motor performance, increased intelligence (IQ), enhanced problem solving skills, improved spatial-synthetic reasoning and various other psychological and sociological skills including many for which accepted metrics have been developed.

Relevant Applied Arts. The practiced arts and scientific research in the fields of music therapy as well as dance therapy, art therapy, creative therapy and physical therapy together with such as biometrics, ergonomics, neuropsychology and neurophysiology comprise a relevant multi-disciplinary frame of reference for exploring the therapeutic potential of the invention and evaluating empirical results.

Evoked Euphoria. A subjective "euphoric" nature of the disclosed free-space-interactive experience was reported by many trial players, a condition however being simultaneous with increased alertness, self-awareness and enhancement of perceptual-motor performance.

Group Body Effect. Furthermore in group multi-player context this free-space media biofeedback system provides an experience wherein all participants are continuously dynamic and individually creatively expressive while always in harmonious, successful and seamless aesthetic integration with all creative expressions of each other, even given

arbitrarily mixed player demographics. Group free-space-interactive media deployment may thus engender emergent coexisting behavioral spontaneity and synchronicity perceivable as an integral whole “*synesthetic body of shared experience*” visible (and audible) as the collective immersive media state space.

Group Mind Effect. The psycho-motor “group-body” metaphor may both express and further evoke unforeseen and spontaneously emergent group mental and psychological skills including for example some form of functional “group mind” phenomena. This may be akin to flock behaviors of birds, or to schools of fish, or be entirely different and distinctly human in characteristic. Such skills if engendered may furthermore have broad practical applications in telepresence, telerobotics, and control and cybernetic systems for distributed propulsive, biomechanical, and/or navigational applications.

Profound Internet Venues. Shared Internet venues may utilize existing arts including real-time MIDI networking, GPS, and telepresence. The transparency of time-quantization and rhythmic sync will improve perceived real-time performance even over variably latent networks, providing a “more sharable now” in the “look and feel” experience of free-space media players. This may represent as an improved tele-biomechanical paradigm, the application of free-space-interactive interfaces with Kinesthetic Spatial Sync effects (305, 306) across mutual telepresence.

Inter-Cultural Shared Creative Expression. The universality of human body movement capacity, together with the universality of musical expression and appreciation in human cultures, places the group use of the invention also into a context of accessible omni-cultural and trans-lingual co-creative expression and communication.

Use by Vision- and Hearing-Disabled. The invention allows the creation of intersubjectively aesthetic music performances even by the deaf (utilizing the multiple visual feedback), as well as the creation of intersubjectively aesthetic visual responses even by the blind (utilizing the musical feedback). Sufficient practice may yield even virtuoso levels of performance in both of these extreme cases.