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(54) **PREDICTIVE AND COUNTER PREDICTIVE VISUAL STIMULI**

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(75) Inventors: **Richard MacDonald**, Portland, OR (US); **Edward Louis Harber**, Godalming (GB)

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(57) **ABSTRACT**

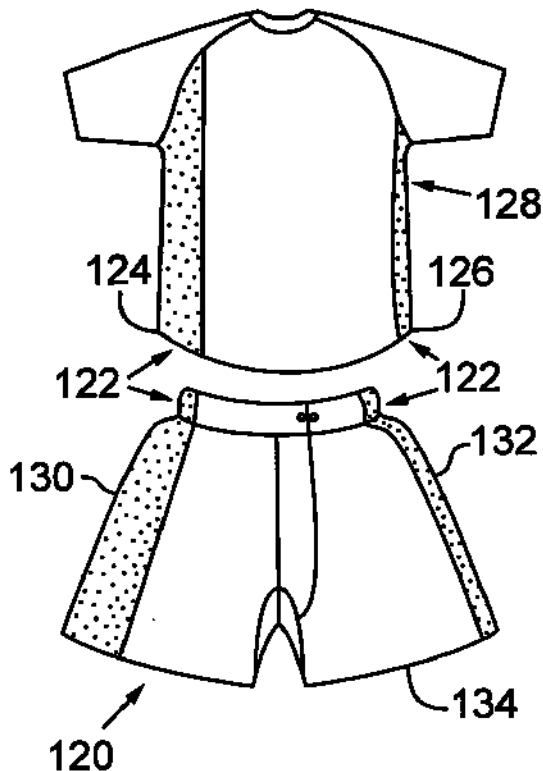
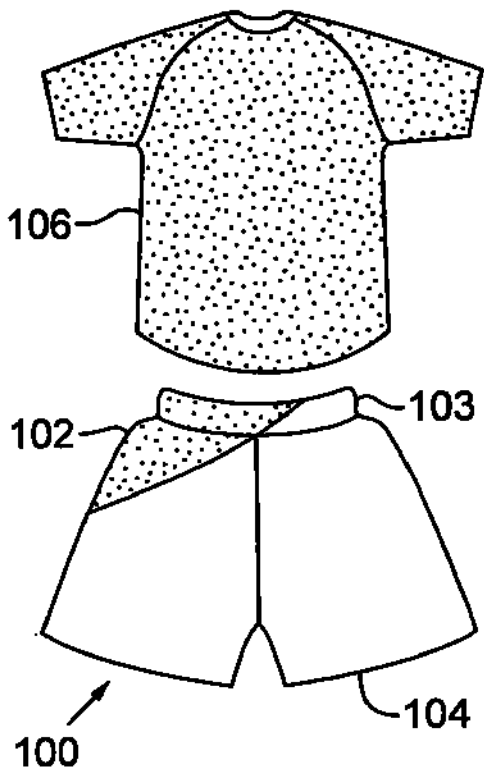
Correspondence Address:
KLARQUIST SPARKMAN, LLP
121 SW SALMON STREET
SUITE 1600
PORTLAND, OR 97204 (US)

Dynamic visual indicators such as counter-predictive indicators are applied to apparel and apparatus for activities such as athletics. The counter-predictive indicators are configured to provide an indication of wearer/user orientation or anticipated future movement that differs from a true orientation or actual movement. Alternatively, the predictive indicators can be provided to reinforce or heighten perception of wearer/user orientation or anticipated future movement. In some examples, dynamic visual indicators provide apparent body axes that are tilted or displaced from a wearer's actual body axis. Such dynamic visual indicators can be selected based on measured responses to activity specific images or events.

(73) Assignee: **NIKE, Inc.**

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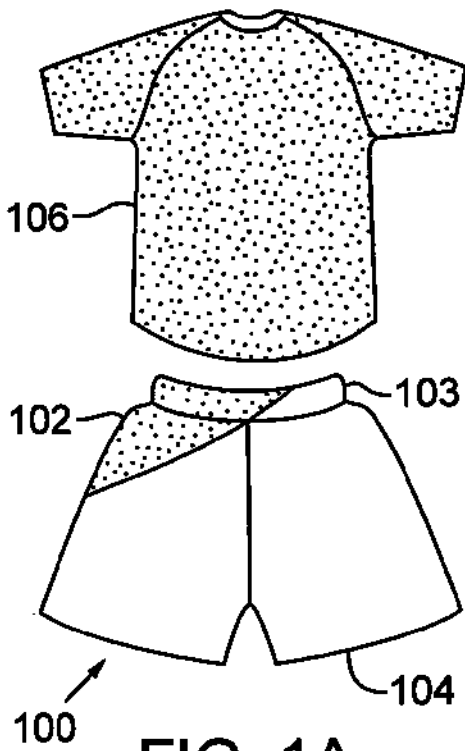


FIG. 1A

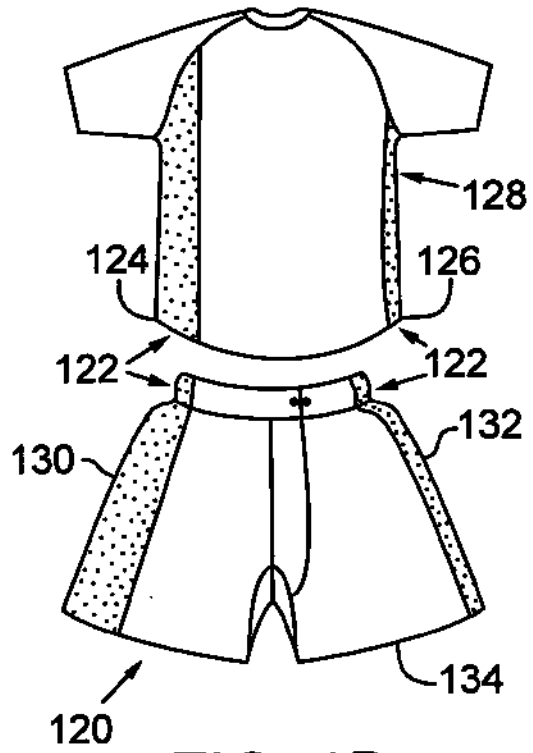


FIG. 1B

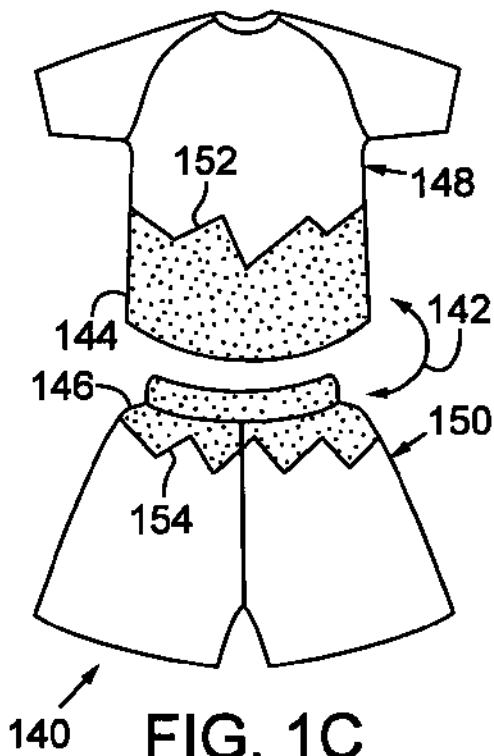


FIG. 1C

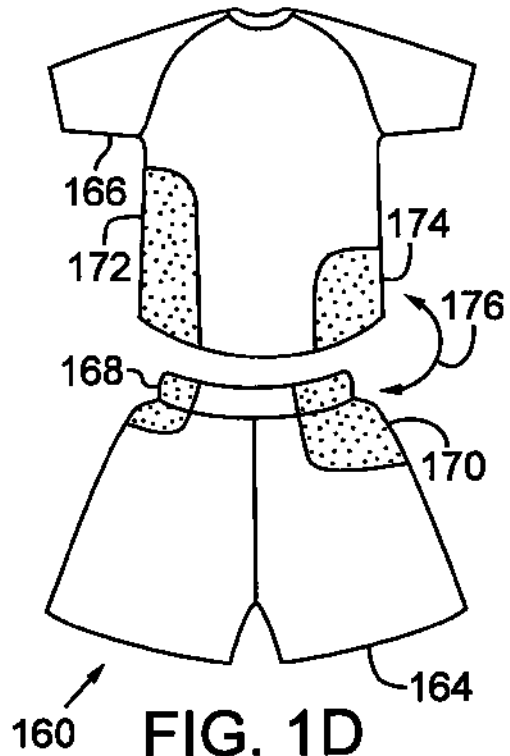


FIG. 1D

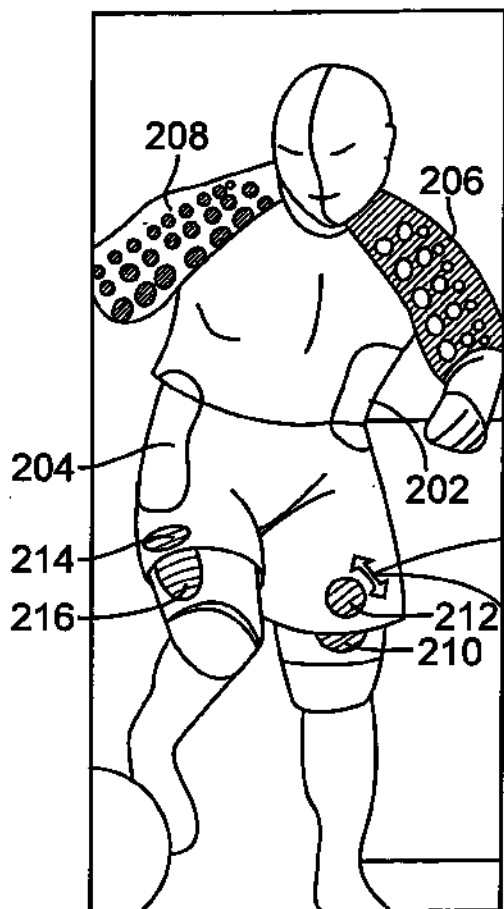


FIG. 2A

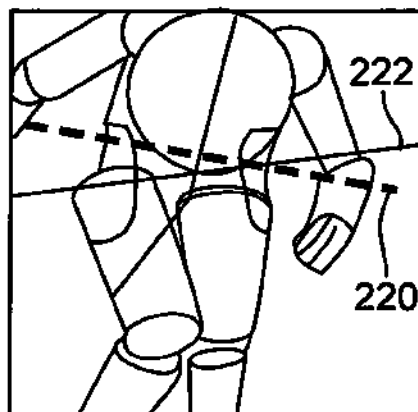


FIG. 2B

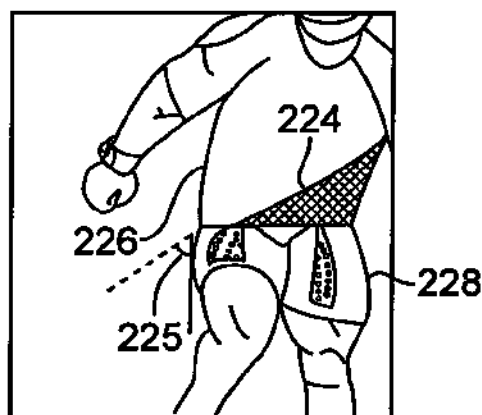


FIG. 2C

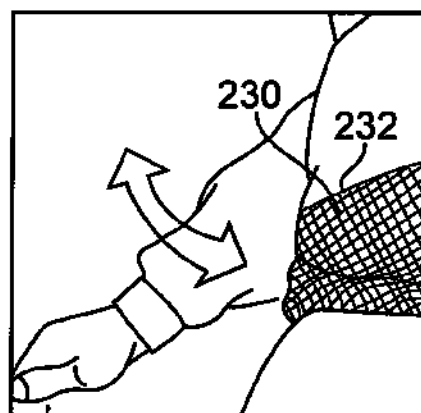
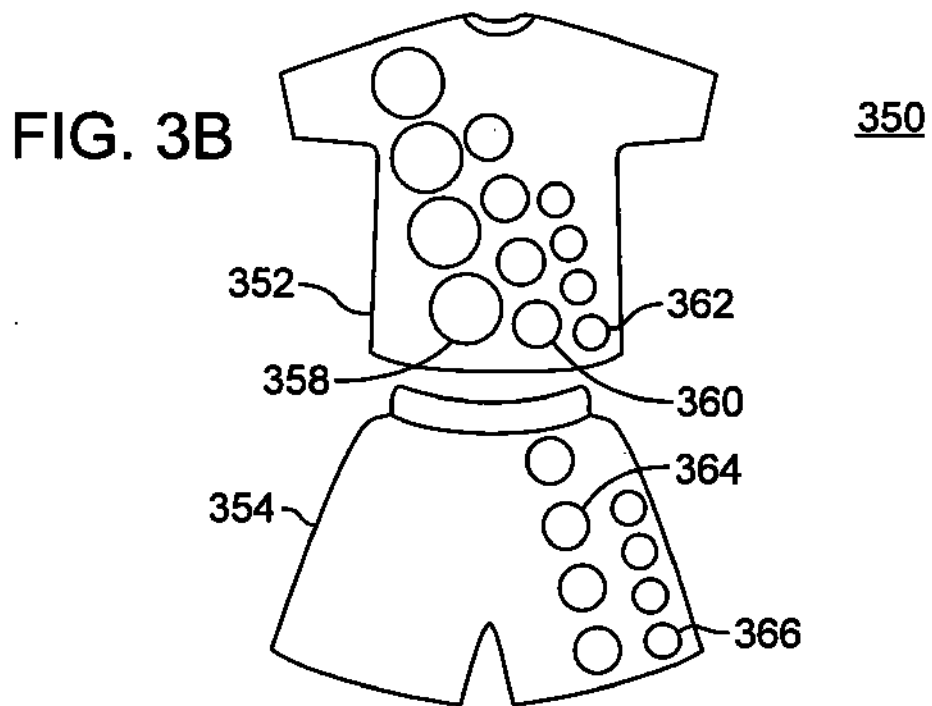
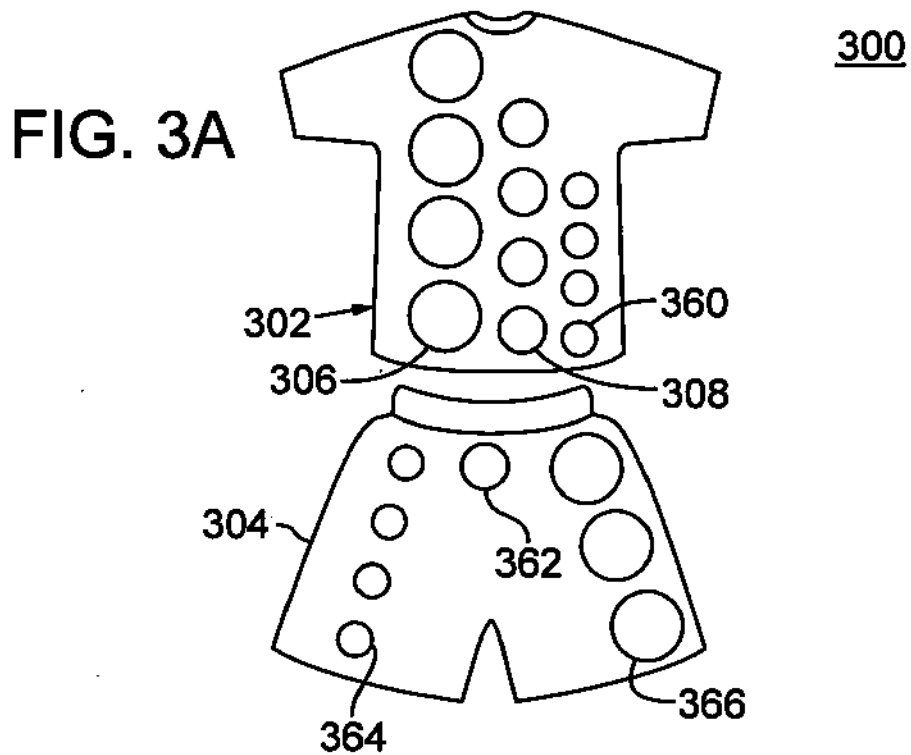


FIG. 2D



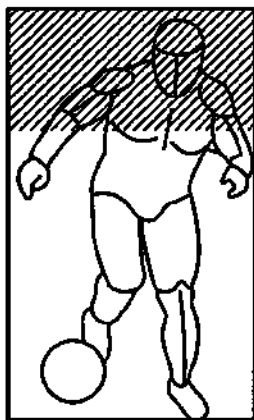


FIG. 4A

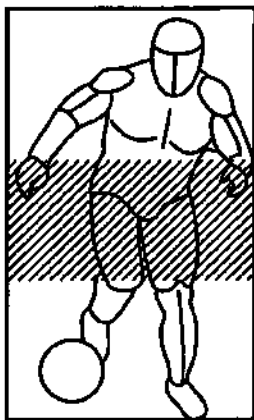


FIG. 4B

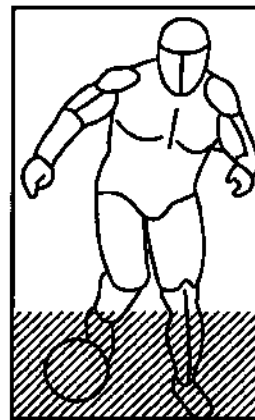


FIG. 4C

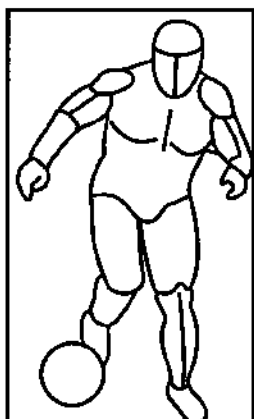


FIG. 4D

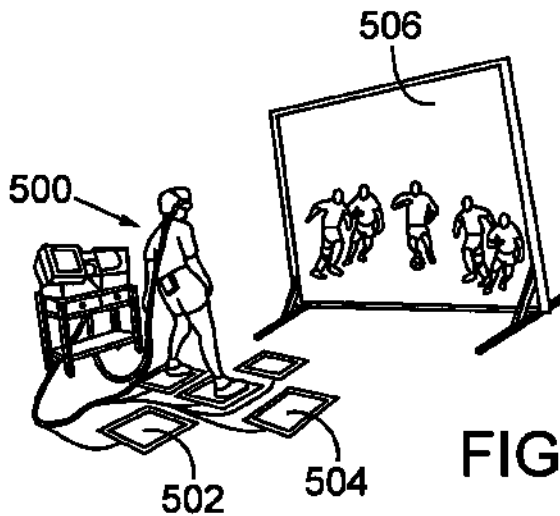


FIG. 5

PREDICTIVE AND COUNTER PREDICTIVE VISUAL STIMULI

TECHNICAL FIELD

[0001] The disclosure pertains to methods for configuring athletic apparel to enhance or reduce accuracy of visual estimations of anticipated player movements.

BACKGROUND

[0002] Apparel for a variety of activities has been customized to provide for wearer safety and comfort, or for aesthetic reasons. For example, athletic team uniforms are often provided in bright colors or constructed of materials that wick perspiration or control heat loss. Athletic attire is frequently decorated to be visually appealing, or to include markings associated with team sponsorship. Apparel for these and other activities can be configured for functionality as well as to aid in the identification of the wearer as a member of team or other group.

[0003] While apparel has been configured to enhance individual comfort and performance for many activities, typical ornamented uniforms and apparel merely promote wearer comfort or provide stylish appearance. Such apparel does not reflect important aspects of wearer dynamics, and improved apparel is needed that can provide additional functionality.

SUMMARY

[0004] According to representative methods, at least one dynamic visual indicator is selected and applied to an object, such as, for example, a team uniform or other apparel for one or more selected activities. In some examples, the at least one dynamic visual indicator is a predictive indicator. In other examples, the at least one dynamic visual indicator is a counter-predictive indicator. In additional examples, the at least one dynamic visual indicator is associated with an apparent orientation of an object axis. In other illustrative examples, the at least one dynamic visual indicator is applied so as to provide an apparent object axis that is tilted with respect to a corresponding actual object axis.

[0005] Articles comprise at least one dynamic visual indicator. In representative examples, the dynamic visual indicator is a counter-predictive indicator or a predictive indicator. In further examples, the dynamic visual indicator is situated to establish an apparent axis that is tilted with respect to a corresponding actual axis. In additional representative examples, a second dynamic visual indicator is provided, wherein the first dynamic visual indicator is a counter-predictive indicator and the second dynamic visual indicator is a predictive indicator. In other examples, the article is a team uniform. In still further examples, a dynamic visual indicator is configured to obscure a hip angle.

[0006] Methods comprise selecting an activity and defining at least one dynamic visual indicator associated with performance of the selected activity. In representative examples, the dynamic visual indicator is applied to an article associated with the selected activity. In other examples, the dynamic visual indicator is a counter-predictive indicator or predictive indicator associated with at least one motion encountered with the selected activity. In still further examples, the dynamic visual indicator is defined as

a predictive indicator associated with at least one motion encountered with the selected activity. In additional representative examples, the dynamic visual indicator is defined to provide an apparent orientation of the article. In some examples, the apparent orientation is substantially misaligned with an actual orientation and in additional examples, the apparent orientation is substantially aligned with an actual orientation.

[0007] These and other features are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIGS. 1A-1D are front views illustrating examples of sports uniforms that include dynamic visual indicators configured to disguise a hip angle.

[0009] FIGS. 2A-2D illustrate additional uniforms that include dynamic visual indicators.

[0010] FIGS. 3A-3B are schematic diagrams illustrating dynamic visual indicators configured to obscure a body centerline or a body rotation.

[0011] FIGS. 4A-4C illustrate occluded views of a football player used to evaluate and select dynamic visual indicators.

[0012] FIG. 4D is an unoccluded view of the football player of FIGS. 4A-4C.

[0013] FIG. 5 is a view of a system for evaluating dynamic visual indicators.

DETAILED DESCRIPTION

[0014] The disclosed methods and apparatus should not be construed as limiting in any way. Instead, the present disclosure is directed toward novel and non-obvious features and aspects of the various disclosed embodiments, alone and in various combinations and subcombinations with one another. Moreover, the methods and apparatus are not limited to any specific aspect or feature, or combinations thereof, nor do the disclosed methods and apparatus require that any one or more specific advantages be present or problems be solved.

[0015] Although the operations and function of some of the disclosed methods and apparatus are described in a particular, sequential order for convenient presentation, it should be understood that this manner of description encompasses rearrangement, unless a particular ordering is required by specific language set forth below. For example, operations described sequentially may in some cases be rearranged or performed concurrently. Moreover, for the sake of simplicity, the attached figures may not show the various ways in which the disclosed methods and apparatus can be used in conjunction with other methods and apparatus. Additionally, the description sometimes uses terms like “determine” and “evaluate” to describe the disclosed methods. These terms are high-level abstractions of the actual operations that are performed. The actual operations that correspond to these terms will vary depending on the particular implementation and are readily discernible by one of ordinary skill in the art.

[0016] For purposes of this disclosure, the word “including” has the same broad meaning as the word “comprising”. In addition, words such as “a” and “an”, unless otherwise

indicated to the contrary, include the plural as well as the singular. Thus, for example, the requirement of “a feature” is satisfied where one or more of these features are present. In addition, the term “or” includes the conjunctive, the disjunctive and both (a or b thus includes either a or b, as well as a and b).

[0017] The disclosure provides representative examples of apparel configured for team sports such as football, soccer, basketball, hockey, paintball, or other sports. In other examples, apparel for individual sports such as tennis, fencing, martial arts, or other activities can be provided. These examples are illustrative only, and apparel, equipment, and other items for other sports and non-sports activities can be configured in a similar manner.

[0018] While activity apparel, accessories, and apparatus can be configured to enhance or reduce wearer visibility, such items can also be configured to enhance or attenuate the anticipation or “prediction” of future wearer movements or to enhance or attenuate visual determinations of precise body orientation and location. For example, many sporting, athletic, and other recreational and professional activities are based on precisely locating an opponent or teammate, and anticipating the movements of the opponent or teammate. For example, knowing the precise position and body orientation of a soccer opponent or teammate on a soccer pitch can aid in accurate prediction of the opponent’s or teammate’s future movements such as a kicking direction, or direction of a cut. A goalkeeper must estimate a probable direction or location for opponent activities—i.e., will the opponent target a particular portion of the goal, or dribble to a particular location. A basketball defender must similarly assess an opponent’s likely next move—to shoot, pass, continue dribbling ahead, cross-over, reverse, or take some other action. Improved estimates of position, orientation, and likely movement and can substantially improve a participant’s effectiveness in countering an opponent or assisting a teammate. In these and other activities, a participant can take advantage of her perception of opponents and/or teammates to anticipate likely future moves. Similarly, a participant’s apparel can be configured to hinder accurate prediction of participant movements or actions. Thus, dynamic visual indicators can be provided to heighten or attenuate perception of wearer orientation or to heighten or diminish accuracy of predictions of subsequent wearer movements.

Predictive and Counter-Predictive Apparel

[0019] Enhanced or attenuated visual estimations can be conveniently based on activity indicators that are defined on items of apparel or other items by configuring one or more portions of the items to have visually distinct colors, patterns, contrast, hues, color saturation, color values, shapes, or sizes. These patterns can be selected and applied to player uniforms to aid in defining or confusing an orientation of a teammate or opponent, or a likely next motion or direction of motion. These indicators can be applied to other articles as well. Visual indicators applied to enhance or confuse determinations of object orientation or likely next movement are referred to herein as “dynamic visual indicators.” Some such indicators can be applied to enhance or confuse perceptions of, for example, a player’s orientation, or anticipated movements. Dynamic visual indicators configured to reduce or attenuate visual perceptions that facilitate estima-

tions of likely future player movements are referred to herein as counter-predictive indicators. Dynamic visual indicators configured to heighten visual perceptions that facilitate estimations of likely future player movements are referred to herein as predictive indicators. Indicators configured to confuse an orientation of a player or an object differ from conventional camouflage which attempts to conceal the presence of a person or thing. In some examples, dynamic visual indicators are configured to be easily noticed, but to produce a visual perception that an object is somewhat displaced or tilted with respect to its actual position or orientation.

[0020] While in some examples, dynamic visual indicators are situated based on body axes such as head-foot/feet, head-hip, hip-hip, knee to knee, shoulder to shoulder, ankle-to-ankle, foot to shoulder, knee to shoulder, gaze direction, in other examples, other vertical, horizontal, or diagonal axes can be used based on elbows, ankles, feet, head tilt, body tilt or lean, or other orientation/position indicators. In addition, placement of visual indicators can be based on body twist, rotations, or apparent locations of body parts. In some examples, visual indicators can be applied to athletic or other activity specific clothing or protective gear to enhance or reduce visibility of selected activity alignments such as, for example, body position.

[0021] Application of activity specific dynamic visual indicators to uniforms or other activity-specific apparel is only a representative example. Such activity specific indicators can be applied or attached not only to uniform garments such as shorts, skirts, pants, socks, hats, shirts, jerseys, sweatbands, and shoes, but to other activity-associated items such as helmets, headgear, helmet chin straps, pads, gloves, facemasks, protective gear, baseball or softball bats, racquets, mitts, hockey sticks, or other items. Such items can be provided with indicators that heighten or attenuate activity specific perceptions, or both heighten perception of one or more selected actions or motions and attenuate perceptions of one or more other actions or motions. Indicators can be applied to other items such as cars, trucks, planes, bicycles, boats, skateboards, balls, hockey pucks, or other items in which changes in motion or likely movements are to be observed and/or anticipated, or in which perception and anticipation of changes in motion or likely movements are to be diminished.

[0022] With reference to FIG. 1A, a soccer uniform 100 is provided with a visual indicator 102 situated in proximity to a waistband 103 of uniform shorts 104. A jersey 106 is configured to provide a visual extension of the indicator 102 to a participant’s upper body, and, as shown in FIG. 1A, the jersey is substantially a single color, shade, or pattern that matches or otherwise corresponds to the activity indicator 102. The indicator 102 tends to confuse visual attempts to precisely locate the wear’s waist or body orientation, and attenuates the effectiveness of attempts to anticipate likely subsequent motions based on waist location, location of a vertical body centerline, or hip angle. The indicator 102 can be defined by, for example, coloring, shading, patterning, or texturing appropriate portions of the uniform shorts 102. Indicator definition can be associated with seams, fabric changes, printing, or application of tiles or pattern segments of other materials. Both front and back sides of the uniform 100 can be similarly configured, but different indicators can be provided on the front and back, and additional indicators

can be provided on the sides, front, or back in addition to the indicator 102 shown in FIG. 1A. Appearance of team uniforms is typically important to teams and players, and the uniform 100 can be configured to be visually pleasing and acceptable to participants. Although provided with the indicator 102, the uniform 100 can also include conventional team insignia or other traditional features.

[0023] Referring to FIG. 1B, a uniform 120 includes an indicator 122 having portions 124, 126 assigned to a jersey 128 and portions 130, 132 assigned to shorts 134. FIG. 1B shows only a front view, and the indicator can be configured to extend to a back of the uniform, or the back can be provided with other indicators, or merely ornamented with team colors, insignia, a player number, or other such features. The jersey 128 and the shorts 134 can be ornamented similarly, or different additional indicators provided. While the indicator of FIG. 1B is defined in portions of both the jersey and the shorts, in other examples, similar indicators are applied to either the shorts or the jersey. In such examples, different indicators can be provided on the shorts and the jersey, or the same indicator can be applied to produce visual misestimations of different axes or orientation directions. As shown in FIG. 1B, a right hand side of the uniform is relatively darker than a left hand side, and visual estimation of a location of a centerline, a hip angle, or other aspect of a wearer's orientation can be impaired or confused.

[0024] FIG. 1C shows a uniform 140 that includes an indicator 142 that includes portions 144, 146 defined on a jersey 148 and shorts 150, respectively. The indicator 142 is situated about a waistband of the shorts 150 and a corresponding lower portion of the jersey 150. The portions 144, 146 of the indicator 142 include respective irregular edges 152, 154. In other examples, the edges can be more or less irregular.

[0025] Another example sports uniform 160 is shown in FIG. 1D. Shorts 164 and jersey 166 include respective portions 168, 170 and 172, 174 of an activity indicator 176. The indicator is shown as several dark regions situated on a light background, but can also be provided as light regions on a dark background. As noted above, such indicators can be defined as a combination of dark and light areas, colors, textures, patterns, reflective and non-reflective tiles, or otherwise defined. Indicators can also be defined as relatively dark areas on a light background, or as relatively light areas on a dark background, and can be configured as predictive or counter-predictive indicators.

[0026] Representative configurations that disguise a player hip angle and present an apparent hip angle are illustrated in FIGS. 2A-2D. With reference to FIG. 2A, a uniform includes misaligned graphics 202, 204 situated at or near a player waist. A pattern 206 of dots is provided on a dark background on one arm, and a similar pattern 208 of dots is provided on a light background on the other arm. Additional graphics 210, 212, 214, 216 can be provided on uniform shorts. Referring to FIG. 2B, an actual hip angle 220 and an apparent hip angle 222 are shown. Referring to FIG. 2C, a uniform includes a graphic having a pattern edge 224 that is tilted at an angle 225 from vertical and that extends from a jersey 226 toward a player's waist as worn. The pattern edge 224 can extend onto shorts 228 as well. This pattern edge 224 tends to reduce actual hip angle visibility. In another example shown in FIG. 2D, a mesh 230

is provided having a tilted edge 232 that also tends to disguise hip angle, and provide an apparent hip angle as well.

[0027] With reference to FIG. 3A, a sports uniform 300 includes a jersey 302 and shorts 304 that have pattern portions 306, 308, 310 and 312, 314, 316, respectively, that form an activity indicator having a jersey portion and a shorts portion. The pattern portions are shown as circles of different sizes, but can be otherwise configured so that, for example, the pattern portion 306 appears larger than pattern portions 308, 310. The pattern portions 306, 308, 310 can be associated with colors, textures, or patterned regions of other shapes such as stripes, squares, rectangles, triangles or other shapes. The pattern portions 312, 314, 316 can be similarly arranged and, in some examples, are or the same size as corresponding pattern portions on the jersey 302.

[0028] A sports uniform 350 with an indicator similar to that of FIG. 3A is shown in FIG. 3B. The sports uniform 350 includes a jersey 352 and shorts 354 that have pattern portions 358, 360, 362 and 364, 366, respectively, that form an activity indicator having a jersey portion and a shorts portion. In contrast to FIG. 3A, these pattern portions are tilted with respect to a vertical axis when the uniform is worn, and the wearer is standing substantially erect. The pattern portions can continue as illustrated to a back side of the jersey 352, the shorts 354, or both, or different indicators (or none at all) can be applied to the backs of either. The pattern portions 362, 364, 366 can be similarly arranged and, in some examples, are or the same size as corresponding pattern portions on the jersey 352.

Indicator Selection and Verification

[0029] While indicators can be selected without confirmation of their effectiveness, suitability of any particular indicator can be evaluated in various ways. For example, in selection and verification for sporting applications, occlusion testing can be used in which portions of a player's body are blocked from the view of one or more test subjects. Representative occlusion configurations applied to a soccer player are shown in FIGS. 4A-4D. In response to an occlusion configuration, one or more test subjects are asked to indicate a likely subsequent player direction of motion with a joystick, mouse, or other pointing device. Alternatively, test subject eye movements can be observed and/or recorded and used to estimate motion anticipated by test subjects. One-on-one or group game situations can be projected as static images or as motion sequences and the test subject can be directed to react as a member of either team shown. Subject gaze directions can be determined for situations in which dynamic visual indicators are used to enhance or confuse a response, or in which such indicators are omitted. In some examples, occluded motion sequences can be presented to test subjects. Different portions of a player's body can be occluded in testing, and two or more unconnected portions can be selected.

[0030] Test conditions can also be presented in context of particular game situations. For example, soccer player location, orientation, and expected movement can be differently evaluated depending on whether the test subject has placed an occluded or unoccluded player image (or motion sequence) at or near his own goal, near an opponent's goal, or at midfield. In addition, test subjects can be instructed that the occluded image is associated with either a teammate or an opponent.

[0031] In some examples, one or more test subjects can be positioned on touch pads, and test subject movements and reactions to player motion observed. Observed and/or recorded eye movements can be used. Typically, test subjects have some or extensive playing experience in a particular sport of interest. During testing, test subject anticipation can be evaluated along with other test subject perceptions such as test subject depth perception, field of view, visual acuity, color vision, and reaction time. In some examples, test subjects stand on suitable test pads, and respond directly as if participating in the activity for which the indicator is intended. Test subjects without playing experience can also be used. Responses of such test subjects can be used to assess visual cues and other visual indications that are learned by experienced participants, and can serve for player training and to evaluate player development. Responses can also be measured in association with particular player experiences. For example, a motion sequence associated with a shot on goal in a soccer match can produce different responses in experienced goalkeeper and an experienced forward.

[0032] While presentation of a single occluded player image is particularly simple, in other examples, test subjects can be placed in three versus three (3v3) or other multi-player situations that can be encountered in a game. In 3v3 testing, a whole player can be occluded, or portions of one or more players can be occluded.

[0033] A representative configuration for test subject evaluation of a selected indicator is shown in FIG. 5. A test subject 500 is situated on footpads such as representative footpads 502, 504 that are in communication with a personal computer or the like and provide indications of test subject motion or position in response to one or more selected occluded or unoccluded images or motion sequences. A viewing screen 506 is situated to display appropriate static images and motion sequences. An eye tracker can be provided to determine test subject gaze direction, and other stimuli such as crowd noise, player communications, lighting conditions, etc can be provided. Player physical characteristics can be recorded, such as heart rate, blood pressure, perspiration, temperature, and any correlation or association with the presented images or motion sequences. Reaction times can be recorded as well as body positioning with in response to the images or motion sequences.

[0034] Although specific patterns, colors, and the like are shown in the above examples, indicators can be configured in various ways. For example, a pattern that includes a plurality of parallel stripes can be distorted to have an appearance similar to that produced by an athlete wearing such a pattern, or regular or irregular series of dots of the same or different sizes or other types of patterns can be used. Indicators can be selected to provide a selected visual impact value. For example, a relatively large pattern region having relatively low contrast can have a visual impact value that is similar to that obtained with a smaller pattern region having higher contrast. Visual impact values can be based on size, color, contrast, or other visual parameters. In addition, indicators can be associated with visual centers based on an apparent center of the indicators as viewed in, for example, activity-specific lighting conditions, or in general daylight illumination, or other illumination.

[0035] While several representative examples are described with reference to team sports, the disclosed meth-

ods and indicator can be applied to other recreational, commercial, occupational, and other activities. Predictive and counter-predictive indicators can be applied to apparel or other items. In some examples, a single object is provided with one or more predictive indicators and/or counter-predictive indicators. These examples are not to be taken as limiting, and we claim all that is encompassed by the appended claims.

We claim:

1. An article, comprising at least one activity-specific dynamic visual indicator.
2. The article of claim 1, wherein the dynamic visual indicator is a counter-predictive indicator.
3. The article of claim 1, wherein the dynamic visual indicator is a predictive indicator.
4. The article of claim 1, wherein the dynamic visual indicator is situated to establish an apparent axis that is tilted with respect to a corresponding actual axis.
5. The article of claim 1, further comprising a second dynamic visual indicator, wherein the first dynamic visual indicator is a counter-predictive indicator and the second dynamic visual indicator is a predictive indicator.
6. The article of claim 5, wherein the article is a team uniform.
7. The article of claim 1, wherein the article is a team uniform.
8. The article of claim 7, wherein the dynamic visual indicator is situated to obscure a hip angle.
9. A method, comprising:
 - selecting at least one activity-specific dynamic visual indicator; and
 - applying the selected dynamic visual indicator.
10. The method of claim 9, further comprising applying the selected dynamic visual indicator to an athletic uniform.
11. The method of claim 9, wherein the dynamic visual indicator is selected based on measured activity-specific responses to the dynamic visual indicator.
12. The method of claim 9, wherein the at least one dynamic visual indicator is a predictive indicator.
13. The method of claim 9, wherein the at least one dynamic visual indicator is a counter-predictive indicator.
14. The method of claim 13, wherein the at least one dynamic visual indicator is associated with an apparent orientation of an object axis.
15. The method of claim 14, wherein the dynamic visual indicator is applied so as to provide an apparent object axis that is tilted with respect to a corresponding actual object axis.
16. The method of claim 9, further comprising selecting and applying a second dynamic visual indicator, wherein the first dynamic visual indicator and the second dynamic visual indicator are selected and applied as a predictive indicator and a counter-predictive indicator, respectively.
17. An article of apparel, comprising:
 - an axis associated with a body axis with the article as worn;
 - a first region in which a first visual indicator is defined;

a second region in which a second visual indicator is defined, wherein the first region and the second region are situated along and on opposite sides of the axis.

18. The article of apparel of claim 17, wherein the axis is associated with a wearer's waist.

19. The article of apparel of claim 18, wherein the first visual indicator has a substantially larger visual impact value than the second visual indicator.

20. The article of apparel of claim 17, wherein an axis defined by a visual center of the first visual indicator and a visual center of the second visual indicator is substantially tilted with respect to the body axis as worn.

21. The article of apparel of claim 17, wherein the axis is associated with a longitudinal body axis, and the first visual indicator has a substantially larger visual impact value than the second visual indicator.

22. An article of apparel, comprising:

a visual indicator situated at a body axis in an as worn position, the visual indicator comprising a first edge that is substantially tilted with respect to the body axis as worn.

23. The article of apparel of claim 22, wherein the first edge comprises a plurality of edge segments that are substantially tilted with respect to the body axis as worn.

24. The article of apparel of claim 22, wherein the visual indicator comprises a second edge that is substantially tilted with respect to the body axis as worn.

25. The article of claim 24, wherein the first edge and the second edge comprise respective pluralities of edge segments that are substantially tilted with respect to the body axis as worn.

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