

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHEJIANG LINGDI DIGITAL TECHNOLOGY CO., LTD.
Petitioner,

v.

CLO VIRTUAL FASHION, INC.
Patent Owner.

Case No. IPR2024-00967
U.S. Patent No. 11,410,355

**DECLARATION OF MUTHU GOVINDARAJ, PH.D.
IN SUPPORT OF PATENT OWNER'S PRELIMINARY RESPONSE
TO PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,410,355**

CLO EX 2001

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I. INTRODUCTION

1. My name is Muthu Govindaraj, Ph.D. I have been retained by CLO Virtual Fashion, Inc., which I may refer to as either the “Patent Owner” or “CLO,” for this *inter partes* review proceeding, which I may refer to as an “IPR.” I understand that the IPR proceeding involves U.S. Patent No. 11,410,355, which I may refer to as “the ’355 Patent” for shorthand. I understand that the claims challenged in this IPR are Claims 1-9 of the ’355 patent.

2. I understand that the ’355 Patent is assigned to CLO.

3. I understand that in this proceeding Zhejiang Lingdi Digital Technology Co., Ltd., d/b/a Lintex, which I may also refer to as the “Petitioner” or “Lintex,” filed a Petition for review of Claims 1-9 of the ’355 Patent.

4. I understand that the above claims are challenged on the following four grounds:

Claims Challenged	Basis	References
1-9	Obvious	Ground 1: EZBRUSH in view of Corel, Thoemmes and Niterra
3 and 8	Obvious	Ground 2: EZBRUSH in view of Corel, Thoemmes, Niterra and TUKATECH

5. I have been asked to provide my objective, independent analysis of the '355 Patent in view of the asserted prior art references cited in the Petition and to provide my opinion regarding the allegations in the Petition.

6. I am not currently, nor have I ever been, an employee of Patent Owner. I am being compensated at a rate of \$250 per hour for my work in conjunction with this IPR. My compensation does not depend on the substance of my opinions nor on the outcome of this proceeding.

II. QUALIFICATIONS

7. I am an expert in the fields of mechanical engineering, textile engineering, software design, flexible material modelling and digital clothing design. More specifically, I have worked in, conducted research in, taught college courses in and consulted with industry in the mechanical, textile, software, apparel, and virtual flexible material and clothing design fields.

8. I am a tenured full professor at Thomas Jefferson University in the School of Design and Engineering in Philadelphia, Pennsylvania. Thomas Jefferson University used to be known as the Philadelphia University, and is one of the relatively small number of universities in the U.S. that offer courses, curricula and degrees in textile engineering, textile design, fashion design, animation and digital media, and user experience and interaction design.

9. Below is a detailed list of my qualifications and expertise in textiles and apparel, as well as mechanical engineering, including computer modeling of physical phenomena, including flexible materials, fabrics and digital clothing. I have also attached, as Appendix A, a recent curriculum vitae that details my educational and professional background.

10. I obtained a Bachelor of Technology (B.Tech) and a Master of Technology (M.Tech) from the University of Madras, India in 1976. After graduating college, I worked as a research and development engineer. Within two years, I was promoted to Deputy Manager of Research and Development at Machinery Manufacturers Corporation, India, a Mahindra Company. I was part of teams that designed and developed textile spinning machinery for Indian and export markets.

11. After working for two years, I applied for and was selected as the only representative from India for an Indo-Czech Scholarship to study advanced mechanical engineering design at the Technical University of Liberec in the Czech Republic, at the time one of the most prominent textile research, design and manufacturing centers in the world. I researched at some of the highly regarded institutions in the Czech Republic in Usti Nad Orlici and Hradec Kralove. In 1982, I obtained my Ph.D. in Mechanical Engineering from the Technical University of

Liberec. I returned to India to continue my work at my previous company. I was involved in implementing mechatronics solutions to improve the performance of the machinery made at the company.

12. In 1986, Dr. Peter Lord, a Distinguished Professor at North Carolina State University, invited me to come to the U.S. and support his work for a consortium of textile mills from the Southern United States. During the next two and a half years, I worked on projects related to automation and electronic process control of textile machinery. I authored or co-authored several journal publications based on this work.

13. In 1989, I joined Cornell University as an Assistant Professor and Director of Industrial Extension in Textiles and Apparel. The position involved teaching, researching, and working with textile and apparel companies in New York State. The Industrial Extension in Textiles and Apparel program was a new program at Cornell University and I served as the inaugural director. I combined my research, teaching, and extension work to find process and product improvement solutions for the apparel industry. I developed both software and hardware solutions. The Cornell Theory Center appointed me to their advisory board in 1989.

14. Around 1989, the apparel computer-aided design field was in its primitive stages, with pattern designs done on two-dimensional CAD (computer-

aided design) systems. While three-dimensional CAD was in use, the method was adopted only in modeling rigid materials. Flexible material modeling required a different approach, and it was computationally intensive. I started work on three-dimensional modeling of flexible materials with initial funding from USDA. I also obtained grants from Digital Equipment Corporation and an apparel CAD company called Investronica.

15. I modelled the drape of textile fabrics using the Finite Element Method (FEM). FEM cannot be directly applied to model flexible materials due to the large deformations that occur when a fabric drapes over an object. Such large deformations result in singularities during the computations. I instead developed software with an iterative, algorithmic method to model fabric drape. My work from 1989-1995 was unique and pioneering, and was selected to feature at the Supercomputing '95 conference in Washington, DC. A news item about the work was featured in Scientific American. Later, other international science magazines including GEO in German and Korean featured news about the work. The work also was published in refereed journals and presented at conferences.

16. Simultaneously, as part of my industrial extension assignment at Cornell, I worked with apparel manufacturing companies in Upstate New York. I introduced the apparel companies to apparel CAD and trained them on using the

systems and software to improve pattern design, grading, marker making, and cutting in their operations. During that time, I became familiar with apparel production processes in several well-known companies such as Sara Lee and Sanyo. I was appointed as an inaugural member of the Center for Manufacturing Enterprise at Cornell University.

17. On the hardware and automation side of apparel, I worked with companies, including Jetsew®, to develop computer and software systems to handle flexible materials like fabrics without human input. The work was published and presented at the Techtextil Conference in Atlanta, GA.

18. As part of my extension work, I assembled a consortium of textile and apparel schools from the Northeast U.S. The effort was supported by the New York State senators at that time as well as by AFL-CIO. Later, the consortium members were invited to join the National Textile Center, a Department of Commerce supported group of institutions to carry out research in textiles and apparel.

19. During my tenure at Cornell University I also developed and taught an undergraduate course in apparel production at the Department of Textile and Apparel, College of Human Ecology.

20. One of the consortium member institutions, Philadelphia College of Textiles and Science, appointed a new dean who invited me to join him in developing

the programs for ABET accreditation at the institution. I joined Philadelphia College of Textiles and Science (now merged with Thomas Jefferson University) in 1995. I continued my virtual fabric drape modeling work at Philadelphia and was funded by the National Textile Center. Progressively I improved my virtual fabric simulation software, including allowing the software to model whole garments, seams and stitches.

21. In 2002, I obtained, along with co-principal investigators from Stanford, Rice and Rutgers Universities, NSF funding for the virtual fabric simulation project. The work resulted in finding ways to model fabric and garment drape in a more precise manner, taking into consideration fabric mechanical properties. In addition to static drape, the model and software allowed users to visualize dynamic drape, the effect of friction between cloth and body or any object, and the effect of wind on the movement of a draped fabric.

22. From 2005-2008, I was funded by the Department of Defense, U.S. Army Natick Soldier Research, Development & Engineering Center Natick, Massachusetts, for using computer modeling to evaluate garment drape, fit, and pressure objectively. My other work related to fabric drape and modeling included developing a device for remotely feeling the texture of a fabric using an augmented

reality computer mouse, a body-borne flexible fabric antenna for soldiers, and a digital twin of a laboratory thermal manikin to evaluate garment comfort.

23. In 2013, I served as the principal investigator for the development of outer layer garments for NASA Z2 space suits. My other research and development work, not related to textiles, fabric and fabric drape, are in the areas of mechatronics, robotics and electric vehicles.

24. During my tenure at Thomas Jefferson University, I have taught undergraduate courses in apparel production in the School of Engineering and Textiles. I have also taught graduate courses in apparel production for textile engineering students. I currently teach (and have for many years) a computer modeling and simulation course for engineering students. The course includes the use of simulation software including Maya®, Solidworks®, and Ansys®. As part of the course, I introduce the students to the use of finite element method to model flexible materials such as fabrics and their deformation, including drape.

III. MATERIALS CONSIDERED

25. I have reviewed the '355 Patent, including the challenged claims, and its prosecution history. I have also reviewed the Petition for *inter partes* review filed by Petitioner, as well as the Exhibits attached, including:

- Ex. 1003: Declaration of Dan Perreault
- Ex. 1004: EZBRUSH

- Ex. 1005: Corel
- Ex. 1006: U.S. Patent No. 6,346,943 (“Thoemmes”)
- Ex. 1007: TUKATECH
- Ex. 1009: Certified English Translation of Japanese Patent Pub. No. JP2005-309874 (“Niterra”)

26. I have also reviewed various other sources cited within this Declaration.

27. In forming my opinions, I have considered the materials listed above and any documents cited in this declaration. I have also relied on my own education, knowledge, training and experience that are relevant to the ’355 Patent.

28. I have also considered the understanding of a POSA around the time of the invention the ’355 Patent.

IV. LEGAL PRINCIPLES

29. I am not an attorney and will not offer opinions on the law.

30. In forming the analyses and conclusions expressed in my declaration, I have applied the legal principles described in the following paragraphs, which were provided to me by counsel for the Patent Owner.

A. Priority

31. I understand that a patent may claim the benefit of the filing day of an earlier filed application if the earlier filed application provides adequate disclosure of the patent’s claims. I understand that the disclosure requirement is satisfied if a

POSA could clearly conclude that the inventor invented the claimed subject matter as of the earlier filing date sought. I understand that the earlier filed application does not need to describe the claimed subject matter in precisely the same terms as found in the claims at issue.

B. Anticipation

32. I have been informed that a patent claim is invalid as anticipated under 35 U.S.C. § 102 if each and every element of a claim, as properly construed, is found either explicitly or inherently in a single prior art reference. Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes the claimed elements, it anticipates.

33. I have been informed that a claim is invalid under 35 U.S.C. § 102(a) if the claimed invention was known or used by others in the U.S., or was patented or published anywhere, before the Applicant's invention. I further have been informed that a claim is invalid under 35 U.S.C. § 102(b) if the invention was patented or published anywhere, or was in public use, on sale, or offered for sale in this country, more than one year prior to the filing date of the patent application (critical date). And a claim is invalid, as I have been informed, under 35 U.S.C. § 102(e), if an invention described by that claim was described in a U.S. patent granted on an application for a patent by another that was filed in the U.S. before the date of invention for such a claim.

C. Obviousness

34. I have been informed that a patent claim is invalid as “obvious” under 35 U.S.C. § 103 in light of one or more prior art references if it would have been obvious to a person of ordinary skill in the art at the time of the alleged invention (“POSA” or “POSITA”), taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any so called “secondary considerations” of non-obviousness, which include “long felt need” for the claimed invention, commercial success attributable to the claimed invention, unexpected results of the claimed invention, skepticism of others, failure by others to achieve the claimed invention, and “copying” of the claimed invention by others.

35. I have been informed that a claim can be obvious in light of a single prior art reference or multiple prior art references. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason that would have prompted a POSA to modify the single prior art reference, or combine two or more references, in a manner that provides the elements of the claimed invention. This reason may come from a teaching, suggestion, or motivation to combine, or may come from the reference(s) themselves, the knowledge or “common sense” of a POSA, or from the nature of the problem to be solved, and this reason may be explicit or implicit from the prior art as a whole.

36. I have been informed that, under the law, the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand it is improper to rely on hindsight in making the obviousness determination.

37. I also understand that, under the law, there must have been a reasonable expectation of success in combining references. In other words, a party seeking to invalidate a patent based on obviousness must demonstrate that both (a) a POSITA would have been motivated to combine the teachings of the prior art references and (b) the POSITA would have had a reasonable expectation of success in doing so.

D. Claim Construction

38. I understand that claim construction is a matter that will be decided by the Board presiding over this IPR. I understand that the relevant inquiry in claim construction is the question of how a POSA would have understood the claim terms at the time of the earliest priority date, in light of the patent specification, the prosecution history, and any other relevant intrinsic and extrinsic evidence. On that note, I understand that it is permissible and sometimes helpful to use extrinsic evidence such as dictionaries, treaties, experts and the like to ascertain what a person of ordinary skill in the art would understand what a claim term means.

V. BACKGROUND OF THE TECHNOLOGY

39. The global apparel market is valued at around 1.8 trillion dollars (Ref. Statista). Almost every country in the world has some form of apparel production, although most apparel is currently produced in Asia. In the case of raw material that is fabric, the apparel production process consists of pattern design, grading (for various sizes), marker making (laying out patterns to cut fabric), fabric spreading, cutting, and sewing. The last process, sewing the garment, has mostly remained a manual process, with sewers putting the garment together. While in many industries one person would look after several machines, in garment construction it is still a one person, one machine operation.

40. The development of a garment starts with creating patterns to cut fabrics. This process of creating patterns is done in two ways. In the draping method, a surrogate fabric such as muslin, is placed on a mannequin (a form) and adjusted for drape. Once the designer achieves the look he or she wants, the muslin is taken out, spread flat and patterns are drawn on paper.

41. In the second method, pre-drawn patterns (or slopers) are available for standard garments from commercial publications in books or online. If desired, the slopers can then be modified, for example to convert a regular sleeve to a puffed one. The draping method is more commonly used in the couture and fashion garment

industry. The sloper method is used in the design of commodity garments such as blouses, pants, skirts, etc.

42. Beginning in the 1980s, computer-aided design (CAD) software was introduced to draft two-dimensional drawings based on measurements. In the beginning, CAD software was used in the engineering industry, mostly in mechanical and civil fields. In the engineering industry, there was already a well-established practice of viewing objects in three orthogonal views (plan, elevation, and end view) and, if required, an isometric view (an engineering three-dimensional view without the perspectives of realistic vision).

43. The above method of visualizing objects is not suitable for garment construction. The reason is the unique set of qualities of textiles. Fabrics are flexible materials and assume draped shapes when placed over an object. A good example is a tablecloth that gracefully folds over the corners of a table. An artist can draw the shape but cannot be represented by a draftsman using geometrical construction techniques.

44. However, flat garment patterns using the sloper or drafting method can be constructed using CAD and used for fabric cutting. Visualization of the garment in 3D was not part of the process. The early apparel CAD software was used by pattern makers purely as a drawing aid to draft garment patterns on computer screen.

45. Beginning around the 1990s, 3D CAD systems, both software and hardware, became available. The early 3D CAD systems could construct, render and real time manipulate objects in 3D on the computer screen. The systems found early adapters in the entertainment and movie industry. These 3D CAD systems were later developed to have the capability to model flexible materials such as fabrics, hair and even water, smoke, etc.

46. The 3D CAD models visualized by the above-mentioned systems were not exact, but were sufficient to realistically represent flexible materials for movies and video games. Later, physics based animation principles were applied to make the visualization more realistic. The apparel industry did not adopt the early 3D CAD systems as they were not helpful in pattern development.

47. Around 1995, researchers in academic institutions succeeded in developing fabric drape models that were based on finite element method (FEM) principles. The FEM based models precisely represented the fabric mechanical properties and collision detection algorithms to render the draping of cloth. However, FEM based models are computationally intensive and require qualified people to work with the computer programs.

48. The main mechanical characteristics of textile fabrics are the tensile, shear and bending rigidities and also the thickness and density. These characteristics

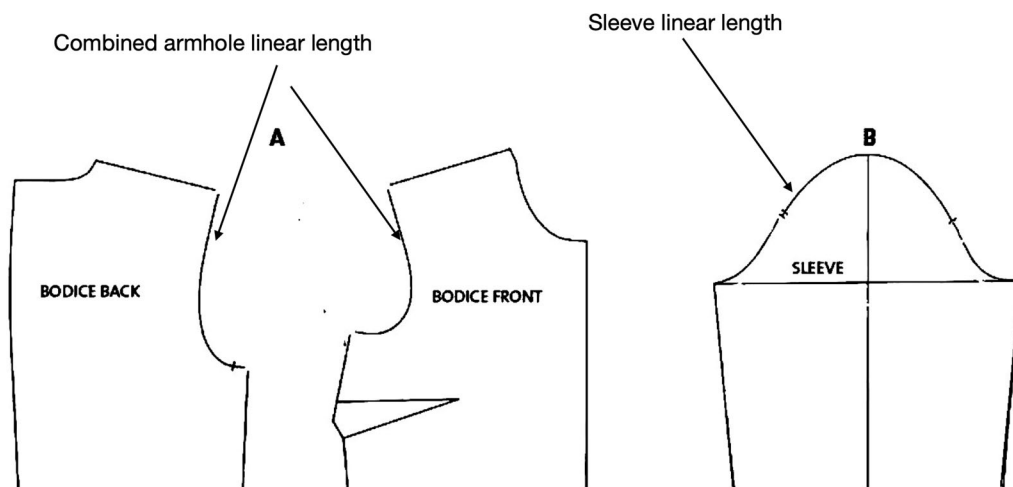
can be exactly represented in FEM models of fabric drape. However, in graphics models, based chiefly on particle cloud-based systems, it is not possible to represent precise mechanical characteristics. Therefore, certain simplified relations representing the mechanical characteristics were adopted. Most currently available apparel 3D CAD systems use the graphics models described above.

49. Using the graphics 3D apparel CAD systems, one can construct flat patterns and place them on a virtual mannequin to obtain the draped look. Conversely, it is also possible to manipulate pieces of fabric in 3D space on a virtual mannequin and then flatten the pieces to obtain flat patterns.

50. Flat patterns are used to construct a 3D garment in apparel construction. This process is different from, say, creating the body of a car from flat steel sheets. There is a difference in, among other things, ‘drape’ and ‘fit’. A good example is a tennis ball with a fabric fitted’ over a sphere. On the other hand, a T shirt is ‘draped’ over a human body.

51. The ability of a fabric to conform to the shape of the object it is laid on, that is ‘drape’, needs to be modeled to create computer models of 3D garments. Modern apparel CAD systems have been developed in continuing to address the problem of virtually draping garments on virtual mannequins. The figure below is an example. The combined linear length of the armhole in a flat pattern and the

linear length of sleeve are identified by the arrows. The sleeve is fitted to the front and back bodice pieces by a sewer using a sewing machine. The two lengths are not exactly equal. The sleeve linear length is slightly longer than the combined bodice armhole length. This difference in length is introduced to give the sleeve a three-dimensional shape to drape over the shoulder. When the sewer sews the sleeve with the bodice front and back armhole, they feed the two fabric pieces to the sewing machine at different stretch, so that the pieces match after sewing. This type of nuances occurs in other parts of garment flat pattern design.



52. Thus, there must be an ability in CAD pattern design software to match two segments on two different patterns or pieces that may not have the same shape or have exactly the same linear segment length.

53. In using 3D CAD systems to create virtual clothing, a method of “free sewing” may be used in which a user selects two segments of fabric to be sewn

together, and can adjust the length of the segments. If a user intends to adjust the two segments to be the same length, extreme accuracy is required when adjusting the length of the segments through the input device, *e.g.*, mouse. EX1001, 1:35-39. However, the imprecise nature of mouse-drawing may make this difficult. For example, a user might intend to set a point 15 cm from the starting point, but the actual clicked point might be 15.07 cm. This level of inaccuracy could accumulate and lead to significant production issues. Additionally, wrinkles may be formed in the fabric two pieces of fabric are sewn together that have different length. EX1001, 6:16-19; 1:46-49; 7:35-38.

VI. PERSON OF ORDINARY SKILL IN THE ART

54. I understand that Petitioner argues that a POSA would have had “a minimum of a bachelor’s degree in an engineering, computer science, graphic design, or a related field plus 2-3 years of work and/or research experience in the field of computer aided design (CAD) software.”

55. I disagree with this characterization of a POSA because it does not adequately account for the nature of 3D clothing design which general CAD knowledge would not teach, as I have described above. General CAD software is not suitable to solve the intricacies of virtual clothing design, such as converting a 2D fabric into a “draped” 3D clothing article. The types of problems encountered in the art would include creating seams and sew lines, and understanding flexible material

properties such that when the clothing is draped, no wrinkles are created. EX1001, 1:22-59. As I explained above, a good example of this is a tablecloth that gracefully folds over the corners of a table; an artist can draw the shape of the 2D tablecloth, but cannot accurately represent how it would look draped over the table using geometrical construction techniques. This is because the draping of the tablecloth depends on the material used (e.g., type, thickness, etc.), gravity's impact on the tablecloth, the amount of material that hangs over the table, and other issues. These are all types of factors that are taken into consideration by 3D clothing design software, but not general CAD software. The conversion of 2D fabric into 3D clothing (i.e., draping) is a specialized process that static, generic CAD software is not suited for.

56. Therefore, a POSA to which the '355 Patent pertains would have had a minimum of a bachelor's degree in mechanical engineering, textile engineering, computer engineering, computer science, graphic design, or an equivalent degree, with at least 2-3 years of experience in software design for the creation of digital or virtual clothing.

VII. OVERVIEW OF THE '355 PATENT

57. The '355 Patent discloses a method and apparatus for creating digital clothing comprising free sewing 2D digital patterns together to create 3D digital clothing in a way that more accurately aligns the sewn-together portions of digital

patterns to avoid wrinkles and other imperfections, and ensuring proper draping of the clothing. EX1001, Abstract; 1:66-2:8.

58. Based on my reading of the '355 Patent and my understanding of the field, clearly the '355 Patent's inventors recognized many difficulties in the prior art. For example, prior to the '355 Patent, when trying to virtually free sew together two segments from two different digital patterns, users found it difficult to match the lengths of these segments. *Id.* at 1:43-49. If one segment is larger or smaller than the other segment, the 3D virtual cloths may have wrinkles, bunching or other clothing defects. *Id.* And this can be further complicated by the fact that different fabrics have different properties. For instance, some which may stretch well and some which may not, some drape or fold differently, etc. *Id.* at 1:43-49; 10:13-24. So even if the same length, sewing of segments or seam lines from different patterns together can create undesirable wrinkles or other clothing imperfections, depending on the material selected. *Id.* Matching of the lengths of segments on digital fabric patterns with differing properties such as flexibility or the ability to stretch requires the software to accurately account for length and material or fabric. *Id.*

59. A different problem existed if two segments need to have different lengths to create intended clothing effects like bunching, ruffles or wrinkles. A user is required to recognize how long or short the segments were during free sewing, a

difficult task, particularly when the segments to be sewn together have different shapes. *Id.* at 1:50-59. Virtual clothing software users were required to iterate designs, checking the 3D rendering after identifying seam lines to be free sewn together, and then adjusting the segments, then checking the 3D rendering, then adjusting the segments, etc. This takes valuable time, and that time is particularly valuable when users and designers are under project deadlines, or when a virtual clothing design forms the basis or is a prerequisite for further clothing design or animation, which is often the case in the clothing design and animation industries.

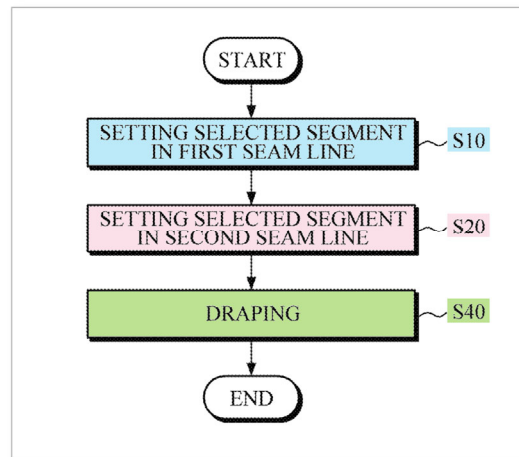
60. Additionally, prior virtual clothing software provided users with no desired notice or warning that lengths of two segments to be virtually free sewn together are different so they can adjust the segment lengths quickly and accurately during the process of free sewing. EX1001, 1:43-59. Virtually free sewing two patterns together along seam lines that are improperly matched leads to errors and increased design time. For example, before the '355 Patent, a user would typically create a desired length of a first sew seam, then create a desired length of a second sew seam, then either eyeball their differences or “guess and check” whether a newly-created second sew seam was of similar length.

61. The '355 Patent's digital clothing program allows a user to more accurately and efficiently align the sewn-together segments to avoid wrinkles and

other clothing defects. The claimed invention allows a user to quickly and easily adjust the length of one digital pattern's line lengths to match another's during free sewing. EX1001, 1:63-65. The claimed method and apparatus display the differences in the length of the seam lines or segments on different digital patterns to be virtually free sewn together dynamically in real time as the user is selected and configuring the length of the second seam line segment as compared to first. *Id.* at 1:66-2:3. The claimed invention also provides a user with a warning when the difference in length of segments from two digital 2D patterns to be free sewn together is too large or too small, depending on inputs such fabric type and desired clothing style that may dictate when segments lengths are substantially the same to accomplish the user's purpose. *Id.* at 2:4-8. The '355 Patent allows users to quickly and efficiently virtually free sew digital patterns together without wrinkles or other clothing imperfections, or to specifically add wrinkles for desired aesthetic effects. *Id.* at 6:11-21.

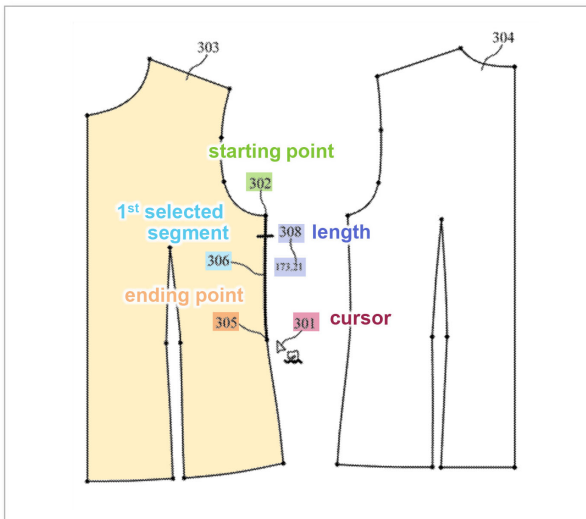
62. The '355 Patent's digital clothing simulation program starts with two 2D virtual fabric patterns that may be stored in the memory of a computer. EX1001, 4:30-39; FIGS. 3-4. FIG. 1 below outlines the general process, whereby a user first sets a selected segment in a first seam line of a first digital pattern, next sets a selected segment in a second seam line of a second digital pattern, and then drapes the 2D

patterns to generate 3D digital clothing. *Id.* at 4:30-38. The selected segments are set in pre-set seam lines, which are (1) the outlines of the patterns (*see* Figs. 3-9, Col. 8:5-12), or (2) pre-set seam lines internal to the pattern (*see* Figs. 12(b), 12(c), Col. 11:13-27).

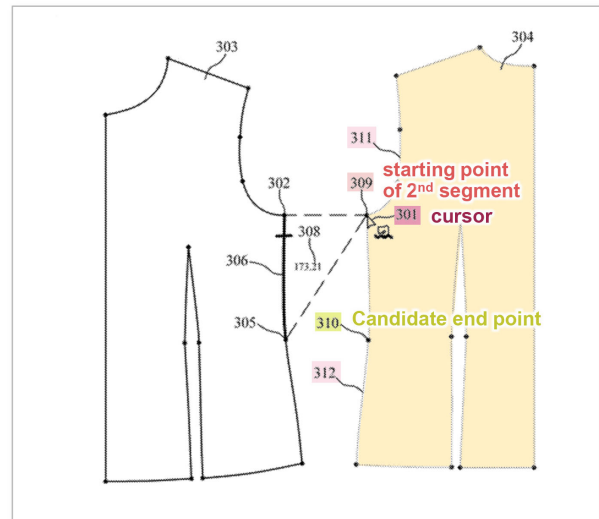


EX1001, FIG. 1 (annotated)

63. More detailed examples are shown in Figs. 3-9 of the patents. As illustrated in Fig. 4 below, a user first sets a starting point 302 and an ending point 305 on the first pattern 303 to define a first selected segment 306. EX1001, 8:17-44. The computer program can determine and display the length 308 of the first selected segment 306.



EX1001, FIG. 4 (annotated)

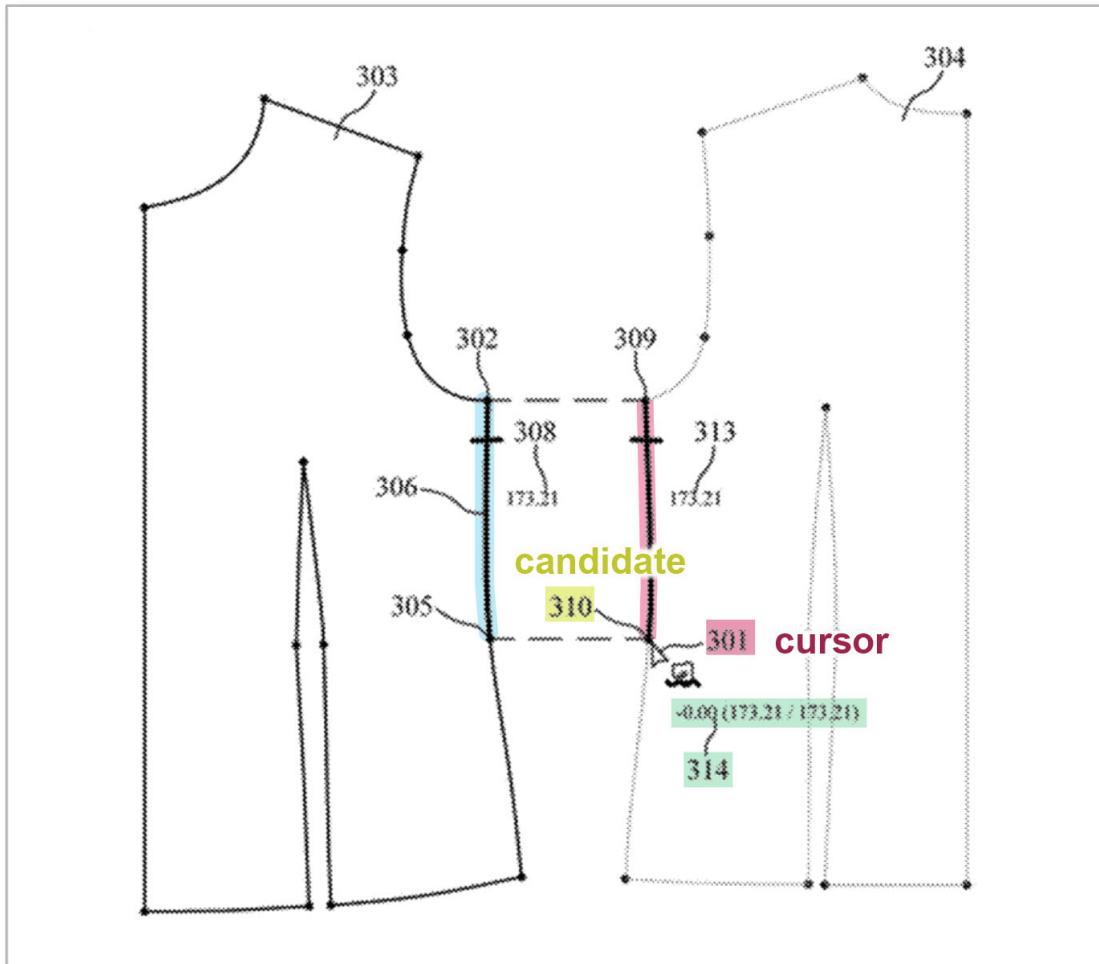


EX1001, FIG. 6 (annotated)

64. As illustrated in FIG. 6 above, the user may then select a starting point 309 on the seam line of the second pattern, and depending on the position of the cursor, can identify a second segment 311 or 312 of the second digital pattern 304. EX1001, 9:4-28. Based on the cursor 301 position (here identifying second segment 312), the program displays a candidate ending point 310 on the second segment that makes a second selected segment — no matter its shape — the same length as the first selected segment. *Id.*

65. The '355 Patent's program can determine and display to the user a "difference value" representing difference in length between the first selected segment and the second selected segment. As is illustrated in FIG. 7 below, if the distance from the cursor 301 to the candidate ending point 310 is within a particular range selected by the user, the cursor 301 may be moved to the candidate ending

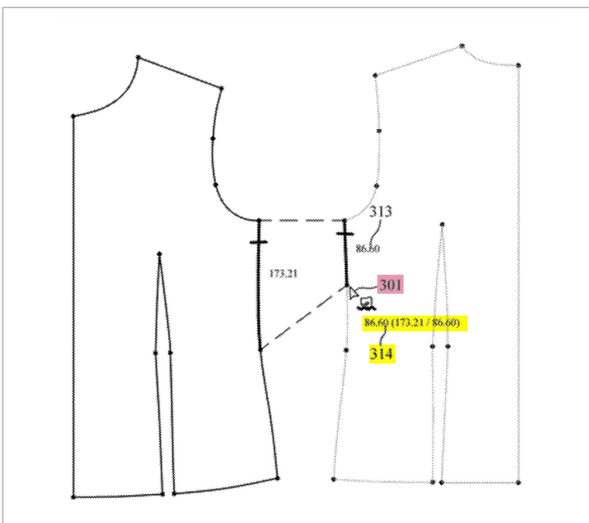
point 310 on the second selected segment to allow the user to set the second selected segment to be the same length as the first selected segment 306. EX1001, 6:50-62, 9:38-48. The difference value 314 is shown as 0.00 in FIG. 7 (illustrated in green below). The user does not have to select the candidate ending point as the ending point for the second selected segment. Before the user selects the ending point for the second selected segment, the user can move the cursor around. Once the user moves the position of the cursor, the length of the “line” on the second segment is changed accordingly. *Id.* The length of the “line” on the second segment is dictated by the current cursor position – measured from starting point on the second segment to the point on the second segment that is closest to the cursor position. *Id.* at Col. 9:40-49.



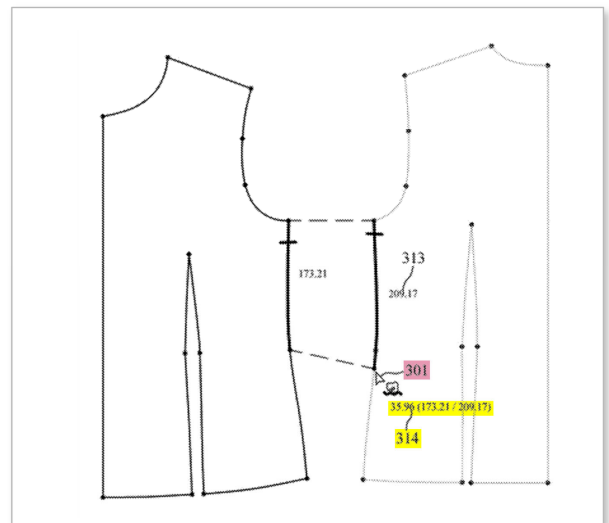
EX1001, FIG. 7 (annotated)

66. Figures 8 and 9 (shown below) demonstrate instances where the user moves the cursor such that the second selected segment is either shorter (FIG. 8) or longer (FIG. 9) than the first selected segment 306. FIG. 8 shows cursor 301 next to the second segment 313. Because the cursor is positioned in a location short of the candidate ending point of the second segment, the program determines the difference value between the lengths of the first segment and second segment where

the length of the second segment is determined by connecting the starting point on the second selected segment to a point that is on the second segment that is closest in distance to the current cursor position. *Id.* at 9:59-10:2. FIG. 9 is similar, except that cursor 301 is positioned beyond the candidate ending point of the second segment. The program determines the difference value between the lengths of the first segment and second segment, where the length of the second segment is determined again by connecting the starting point of the second segment to a point that is on the second segment and this is the closest in distance to the current cursor position. *Id.* at 10:25-35.



EX1001, FIG. 8 (annotated)



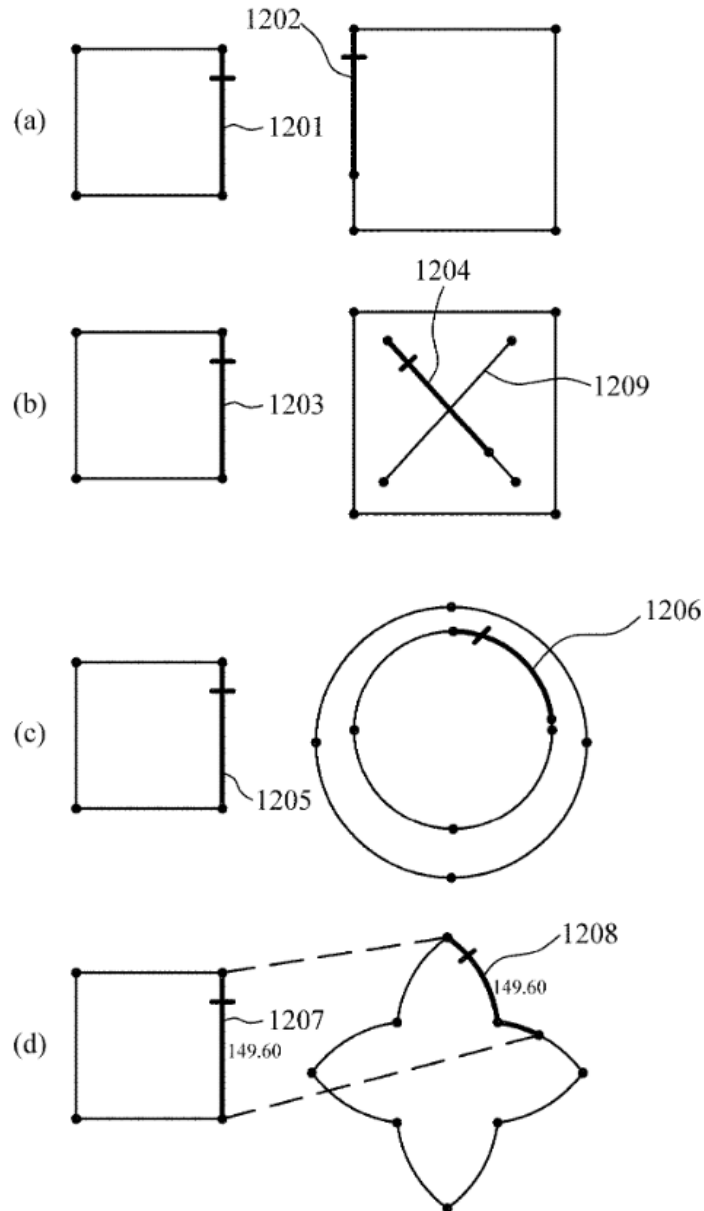
EX1001, FIG. 9 (annotated)

67. The '355 Patent teaches that when measuring whether the first selected segment is the same length as the second selected segment, the program accounts for factors such as the type of fabric. The '355 Patent explains and provides a similar

example in numerous locations: “[f]or example, knit and chiffon stretching well do not create wrinkles if the difference between the first and second selected segments is lower than one inch. Cotton and denim not stretching well may not create wrinkles if the difference between the first and second selected segments is lower than one centimeter.” *Id.* at 10:15-25; 10:48-57; 14:15-24. Thus, there is a range or tolerance that determines whether the length of the second selected segment is the same as or different than the first selected segment. The program may provide a warning sign to the user in various form such as a display or color change, for example, when the first and second segments are different in length, even when the shapes and lengths of the segments look the same at first blush. *Id.* at 9:50-58; 10:13-15, Col. 10:40-48.

68. When creating digital clothing from 2D patterns, the shapes of the first and second segments do not need to be the same. As illustrated in Fig. 12 below, the segments may take any number of shapes, but the program is still able to ensure that the user is able to match the lengths of the first and second segments to proper fit to eliminate wrinkles or other imperfections, create 3-dimensional virtual clothing and account for the draping of virtual clothing. *Id.* at 11:7-35. FIGS. 12(b) and 12(c) also illustrate how a user pre-sets internal seam lines (*i.e.* “x” internal seam

lines 1204, 1209 in 12b; internal circle seam line in 12c) that a user can ultimately choose as second selected segments for virtual sewing.



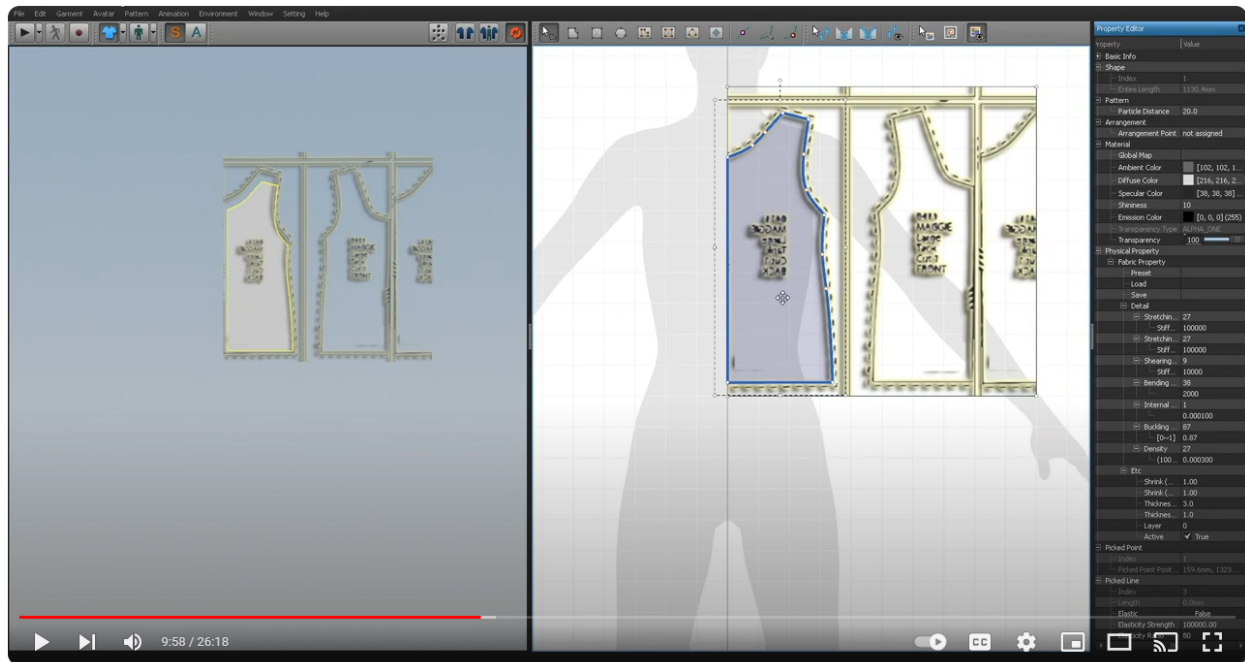
EX1001, FIG. 12

VIII. OVERVIEW OF THE PRIOR ART

69. The IPR Petition sets forth various Grounds for why the claims of the ‘355 Patent would have been obvious in view of the various prior art references that I overviewed above. I disagree with these proposed Grounds for at least the reasons set forth below.

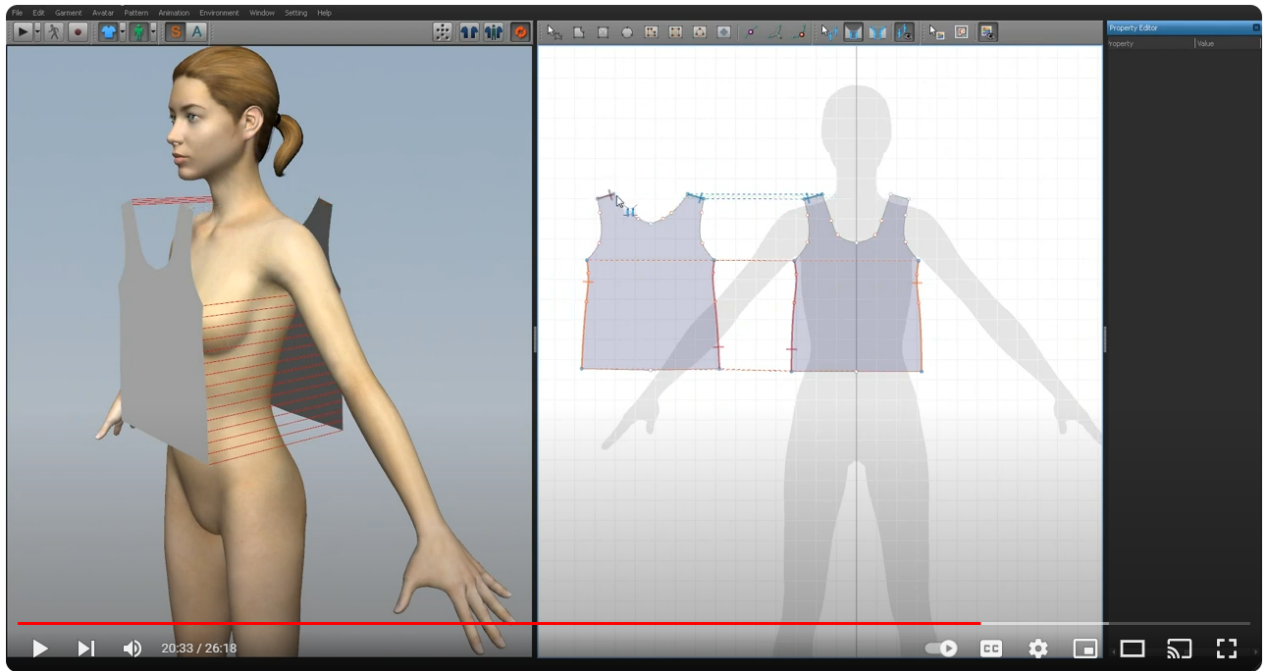
A. EZBRUSH

70. EZBRUSH (EX1004) is a YouTube video showing the use of Patent Owner’s “Marvelous Designer 2” 3D CAD software program for creating virtual clothing. To create a virtual clothing item, the user first selects a pattern and then traces over the pattern. In doing so, the user can point and click the mouse at various spots along the underlying pattern to create line segments that can be sized and shaped to a desired fit on the 2D avatar. EX1004, 1:16-18:30.



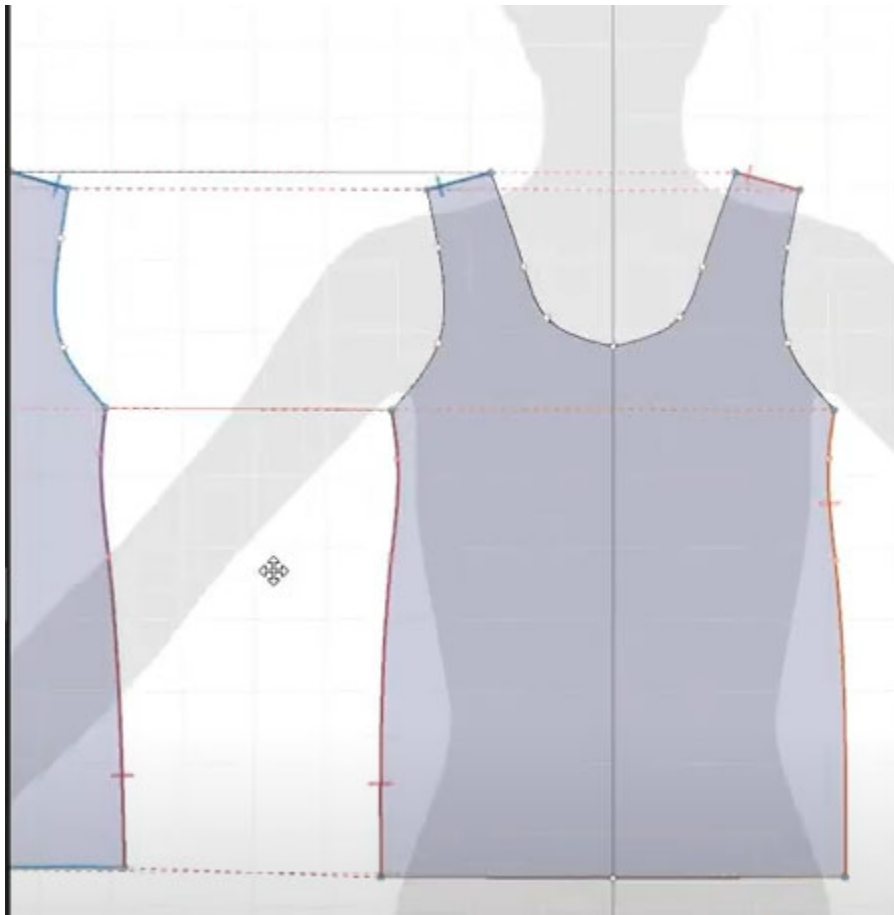
EX1001, 9:58.

71. Once the patterns are traced and mirrored to create a front and back of the shirt, the user can select any of the line segments (of various sizes and shapes) to be sewn together. For example, in the screenshot shown below, the sides of the shirt (under the armpit) are sewn together, and the tops of the shirt (over the shoulder) are sewn together:



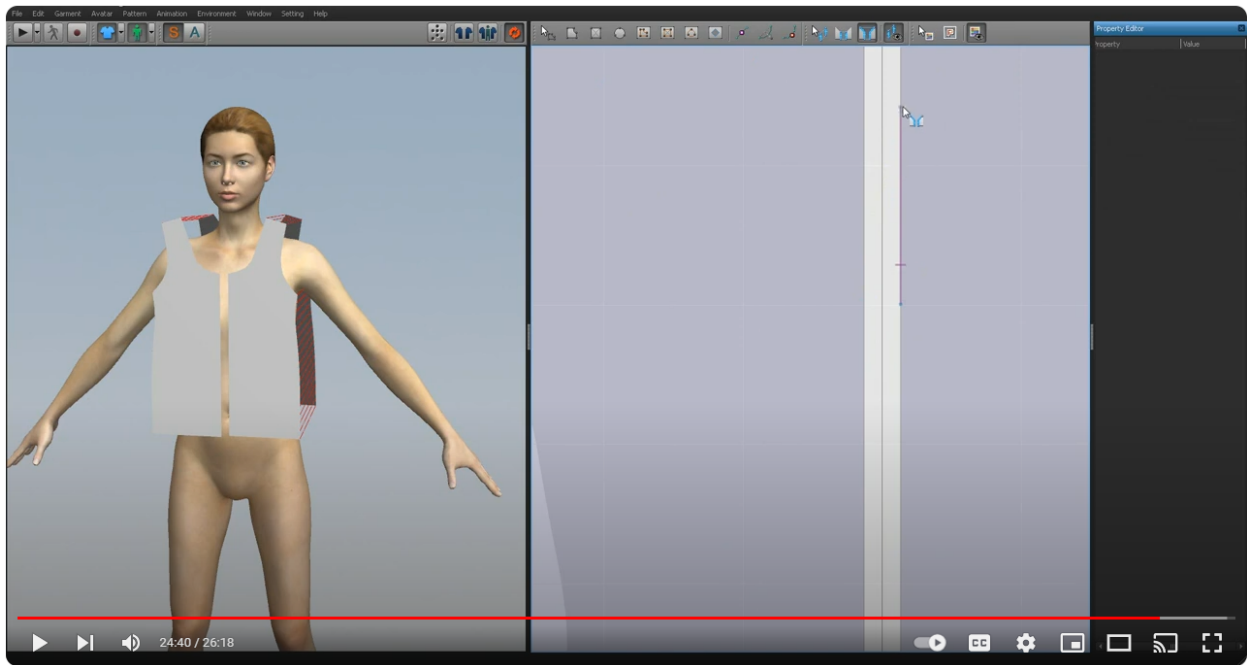
EX1004, 20:00-20:50

72. Note that the seams being sewn together are not vertical lines, horizontal lines, and are not even horizontally aligned:



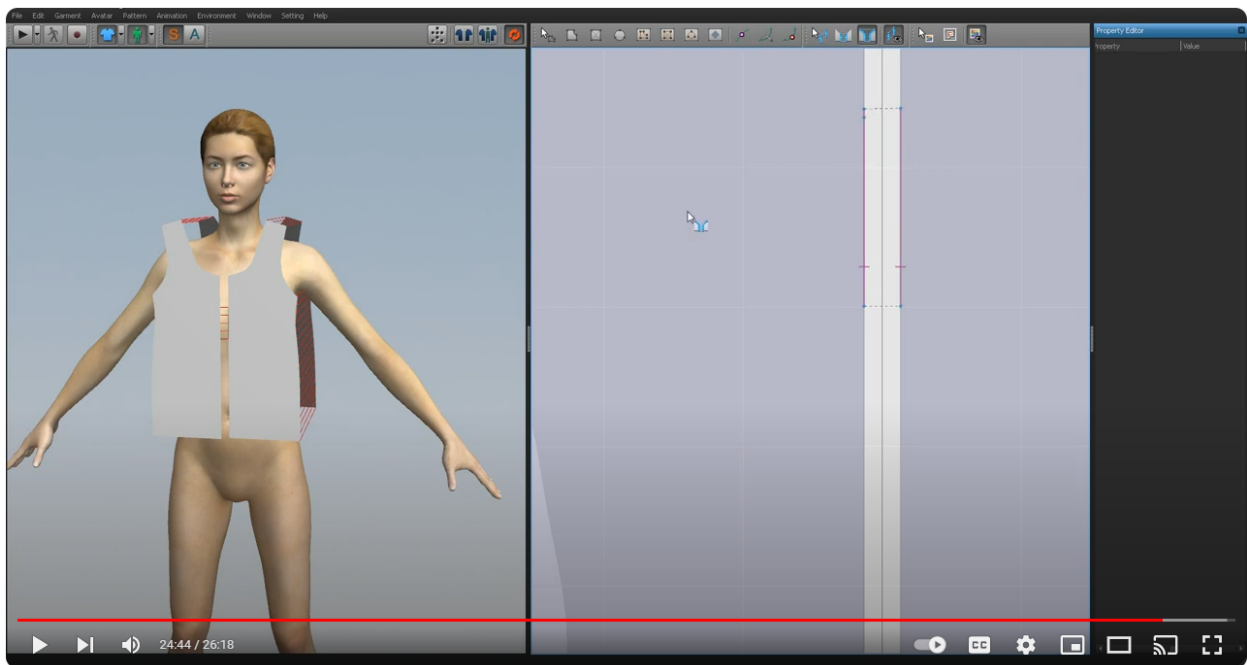
EX1004, 21:56

73. This software also shows an example of “free sewing” two segments of the shirt together. EX1004, 22:42-26:13. In EZBRUSH, the user creates a first sew segment on the right side of the fabric by pointing and clicking two points:



EX1004, 24:40

74. The user then repeats the same point-and-click procedure on the left side of the fabric:



EX1004, 24:44

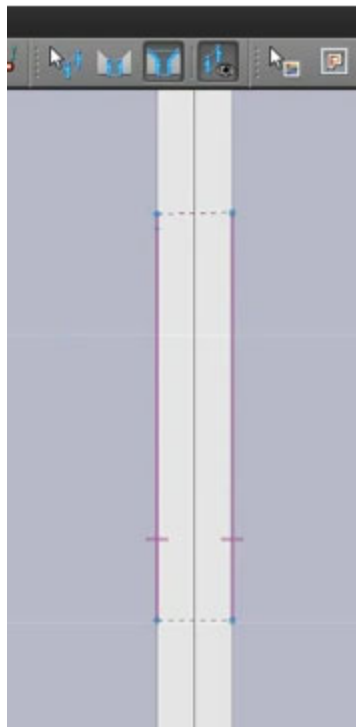
75. These two created segments are then sewn together, and the fabric is draped over the avatar with the sewn segments shown in the front of the shirt:



EX1004, 24:51

76. Note the trial and error process here – there are no suggested points for the user to click and create these seams, no segment lengths displayed, and no indicators as to when the segment lengths match for a particular fabric or user style or clothing preference. The user is free to point and click anywhere on the seam lines of the first and second patterns. The user must iterate designs and segment lengths in order to ensure proper segment size and configuration. The two seams may not be identical in length, or have different but known length desired by a user.

For example, in the screenshot below, the upper points of each segment are not perfectly aligned (*i.e.*, the dashed line connecting the two top points is slightly askew from horizontal). For example, in the screenshot below, the upper points of each segment are not perfectly aligned (*i.e.*, the dashed line connecting the two top points is slightly askew from horizontal).



EX1001, 24:51

77. EZBRUSH does not display a candidate end point on the second segment to make length of second selected segment substantially equal to the length of the first selected segment. The user just guesses. EZBRUSH does not display the length of the line between starting point and the present point on the second segment, or the difference value between the length of the first selected segment and

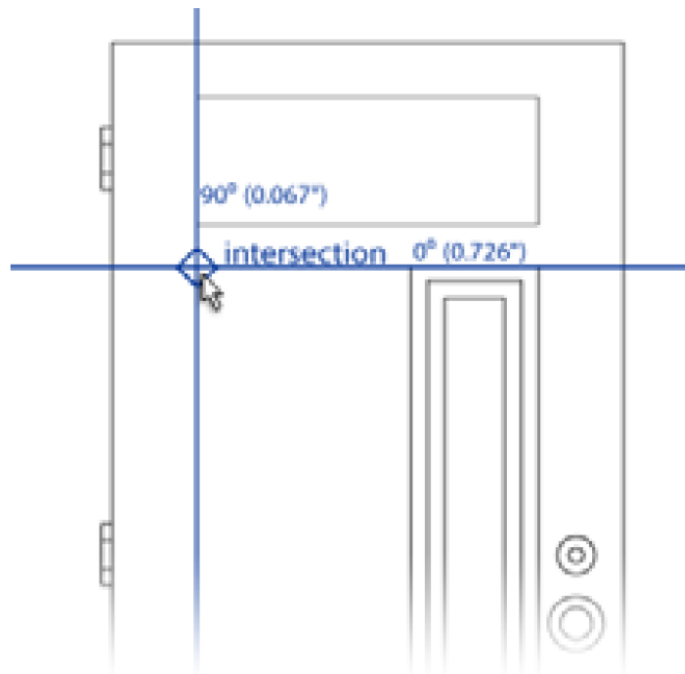
the length of the second line. There is no warning when the lengths of first selected segment is substantially different than the length of the second selected segment. EZBRUSH does not even teach that doing so has the potential to create wrinkles or other imperfections in the 3Dvirtual clothing. In fact, EZBRUSH is completely silent regarding the difficulties of not making the segments equal in length, and gives no tools to help a user to do so.

78. Indeed, there are many instances in designing virtual clothing where the seam lines on a first digital pattern are different in shape, size, configuration or dimension than the seam lines on a second digital pattern. Even when they look the same, it is common for a user to be unable to discern differences on a computer screen. *Id.* It is important that the program provide the user with an indication of when the first and second selected segments are substantially the same, which determination is based on not only segment length, but factors such as type of fabric (different fabrics stretch, flex and drape differently) and user design or draping preferences (for instance, tight fitting versus loose fitting design, significant ease versus little ease, wrinkles versus no wrinkles, bunching versus no bunching, etc.).

B. Corel

79. Corel (EX1005) is a publication describing a Corel DESIGNER software program. Corel describes vertical and horizontal “dynamic guides” that aid the user in aligning lines relative to one another in creating static objects such as, for

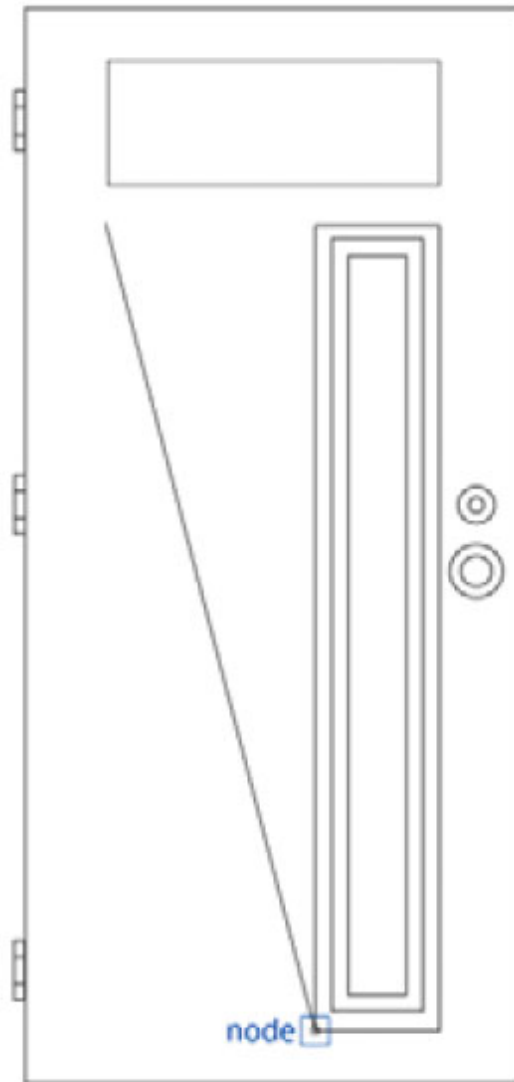
example, door panels for doors. EX1005, p.10. These dynamic guides extend out previously-created line segments to aid a user in creating a new line that aligns with a previously-created line. In the screenshot below, a blue vertical dynamic guide extends out the left-most line of the upper door panel, and a blue horizontal dynamic guide extends out the upper-most line of the right door panel. The intersection of these two lines can be selected by the user as the upper-left point of a new, left door panel.



EX1005, p.11

80. But this is just the starting point of a second line. Petitioner failed to include in its Petition the next, intermediate step in Corel's sequence showing what

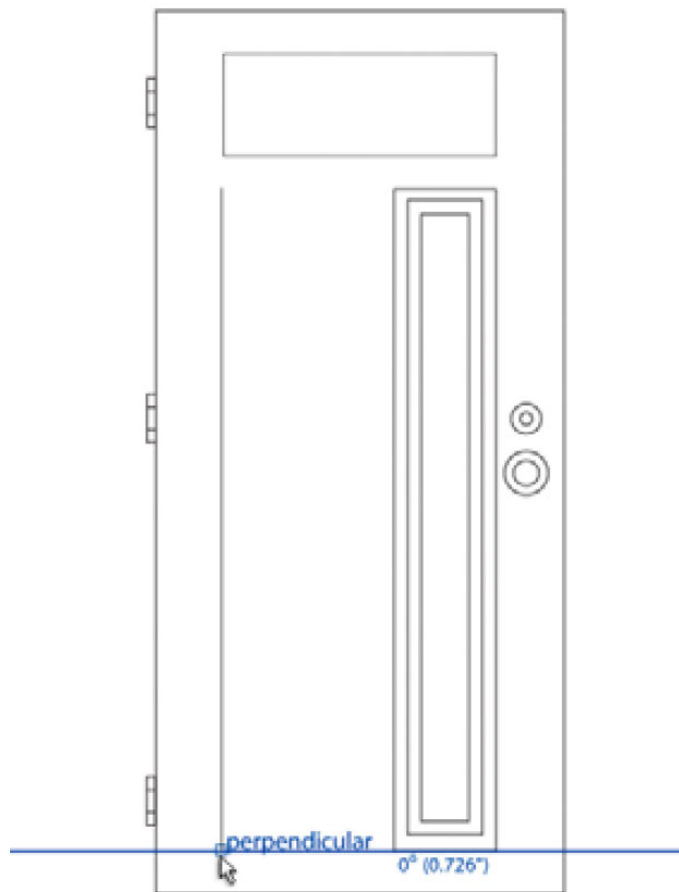
happens after a user selects a starting point for a second line. As shown below, there is no (i) pre-existing second segment or seam line, (ii) second segment or seam line that a user cursors near to display a present point on the second segment, (iii) candidate ending point on the second segment for the second selected segment, (iv) measurement of the length of a line on the second segment and the length of a first selected segment, or (v) any comparison of a length of second line to a first selected segment. The user is simply trying to find the horizontal coordinate of the bottom edge of the first door panel. This is not close to the same thing, and for good reason. Corel is a CAD program intended to match coordinates of an existing shape, not software for virtual clothing design that is attempting to free sew together two segments from two seam lines on two different, pre-existing patterns.



EX1005, p.11

81. In fact, the entire second line is moving with the cursor. The cursor is certainly not triggering a “present point” on a (non-existent) second seam line segment that is closest to the cursor position. The last image shown in the cited portion of Corel (below) merely shows a user dragging the cursor to a new location that is the intersection of a horizontal and vertical dynamic guide. That intersection

point is only displayed if the user positions the cursor on or very near the correct horizontal coordinate, and on or very near the correct vertical coordinate. *Id.* If the user fails to do either, there is no intersection point. However, there is still no candidate ending point displayed on a pre-existing second seam line segment when the user sets a starting point on the second segment.



EX1005, p.11

82. Additionally, Corel is requires straight, linear lines. Corel is not related to or contemplated for digital clothing design. Curved, sinuous, uneven or non-

linear seam lines dominate most digital patterns. Corel could not determine an intersection point. Additionally, digital clothing design requires a user to match seam lines for free sewing two non-matching digital patterns together. So merely duplicating the shape of a line, a horizontal coordinate or a vertical coordinate as taught by Corel does not work.

C. Thoemmes

83. Thoemmes (EX1006) is a U.S. Patent directed to “implementing a relative polar angle snap tool.” EX1006, Abstract. Thoemmes “relates to computer-implemented systems and methods for drawing images, and in particular to a computer-aided drafting tool for drawing lines at pre-settable angles from an existing linear entity and at pre-settable distances from pick points on the existing linear entity.” *Id.*, 1:24-29.

84. Thoemmes does not disclose or contemplate a second segment, displaying a candidate on the second segment or showing how length of the second segment changes in real-time as the cursor moves, or displaying an indication of whether the first and second segments are substantially the same such that they fall within an acceptable tolerance for sewing them together to either avoid wrinkles or other clothing imperfections, or intentionally add wrinkles or garment gathering if desired by the user. And for good reason. Thoemmes was not and is not intended

to address free sewing two patterns together to create 3D clothing in virtual clothing design. It is simply a program for drawing lines with a particular angle and length.

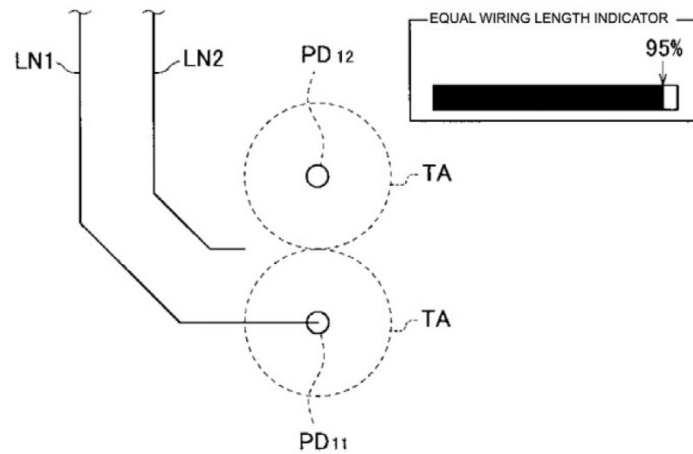
D. Niterra

85. Niterra (EXs.1008-1009) is a Japanese patent publication directed to a CAD system designing for electronic circuit boards. EX1009, [0001]. This reference has nothing to do with virtual clothing design, and does not appreciate or contemplate the challenges, problems faced, intricacies and necessary solutions of designing virtual clothing. Niterra's CAD system allows a user to design and visualize the wirings of an electronic circuit board before manufacturing.

86. In electronic circuit boards, electrical wirings transmit signals from one part of the circuit board to another part of the circuit board. To complete the electrical connection, the terminal ends of each wire are connected to pads. *Id.*, [0008]. Niterra explains a type of electrical wiring construction called "differential wiring," where a user drafts two electrical wirings separately and individually. EX1009, [0004]. And, "[i]n differential wiring, it is important to make the difference in length between the two wirings as small as possible so that the difference in signal arrival time is within an allowable range." *Id.*, [0005]. Said another way, "there is a need to equalize the wiring length in differential wiring as much as possible." *Id.*, [0008].

87. Because the difference in the length of these two wiring lines is important, Niterra's invention involves calculating and displaying the difference in length of the two wirings. *Id.*, [0007]; see also [0008]-[0016] (“[w]ith the present invention,... the difference in wiring length (amount of wiring length deviation) is calculated,” “wiring length deviation information” is “generated” so that “the length of wiring... can easily be individually read (calculated) and the differences in length can be easily be compared. This eliminates the need to individually check the wiring lengths when checking differential wiring lengths.”)

88. As an example, Niterra's FIG. 29 shows two electrical wiring lines LN1, LN2, being drafted by the user, along with an “equal wiring length indicator” that indicates the ratio of the length of the second wiring LN2 to the first wiring LN1. *Id.*, [0069]. So, as the second wiring LN2 is drawn extending closer to the length of the first wiring LN1, the equal wiring length indicator would approach 100%.



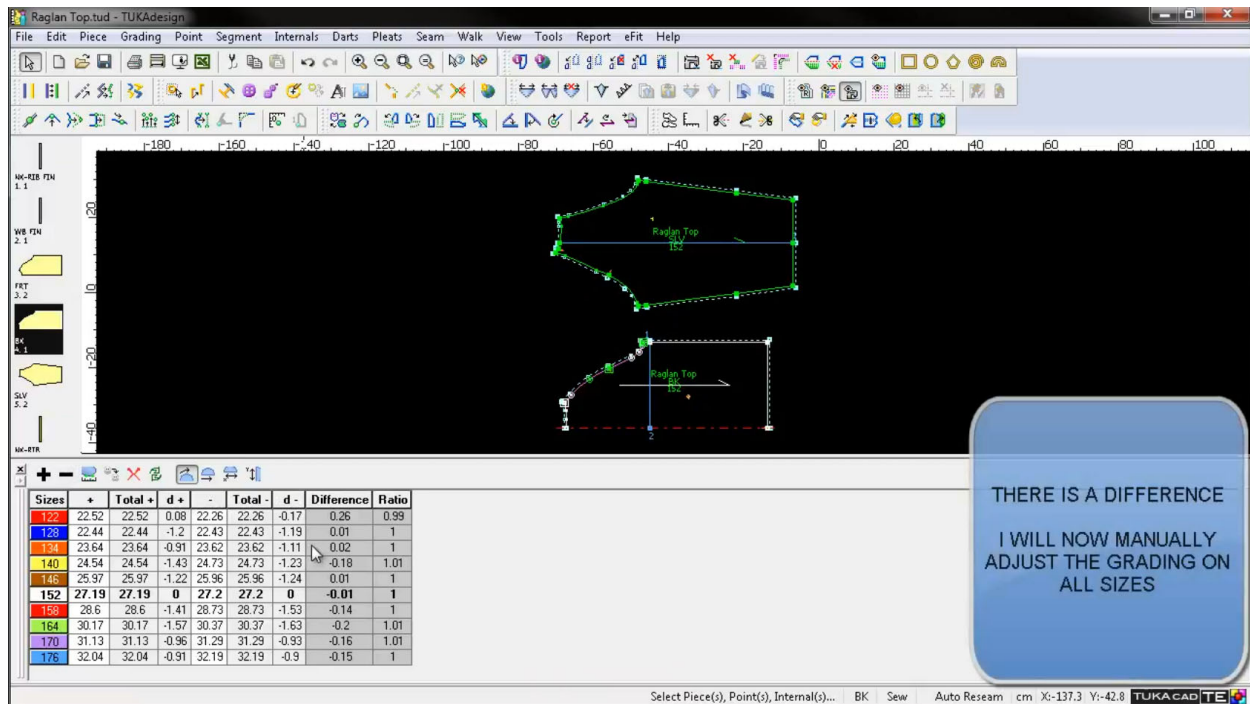
EX1009, FIG. 29

89. This tool allows the user to draw the second wiring LN2 and connect it to the pad PD₁₂ (to create the electrical connection) while monitoring its length relative to the first wiring LN1. Id., [0069]. Notably, and as will be explained further below, a user would not draw the second wiring LN2 to extend beyond the second pad PD₁₂. Doing so would create excess wiring that is unnecessary because the electrical connection is already completed when the second wiring LN2 is connected to the second pad PD₁₂. And, if a user were to attempt to draw the second wiring LN2 to extend beyond the second pad PD₁₂, Niterra’s “equal wiring length indicator” would not provide sufficient information because the indicator only goes up to 100%; the indicator cannot go beyond 100% if the second wiring LN2 is drawn to travel past the second pad PD₁₂ (which a user would not even do in the first place).

In such a situation, the equal wiring length indicator would likely either stay at 100% or would malfunction.

E. TUKATECH

90. TUKATECH is a YouTube video showing a TUKAcad software program directed to “grading” of clothing, or adjusting the size of the same garment so it can be offered in different sizes (*i.e.*, S, M, L, XL, etc.). It is not directed to free sewing 2D digital garment patterns together to create 3D virtual clothing that is draped or modelled. The short video showing use of the TUKATECH software shows a user comparing the length of two different pre-set segments of different garment patterns. The user selects two previously-created line segments on the patterns, and a table is displayed that shows the difference in length between those two selected segments. The table shows the difference in lengths of selected pre-set line segments.



EX1007, 0:10-0:30

91. Tukatech's measurements do not inform the user of the length of the first or second segments as they are being formed; do not provide a comparison of the length of a second segment on a second pattern that is to be free-sewn to a first segment on a first pattern; are not based on real-time movement of the cursor; and do not assist the user in selecting a second segment that is substantially the same length as the first selected segment. The displayed difference values in TUKATECH do not change as a user moves the cursor, but rather must be re-calculated every time a user adjust the length of a segment.

IX. ANALYSIS OF THE IPR GROUNDS

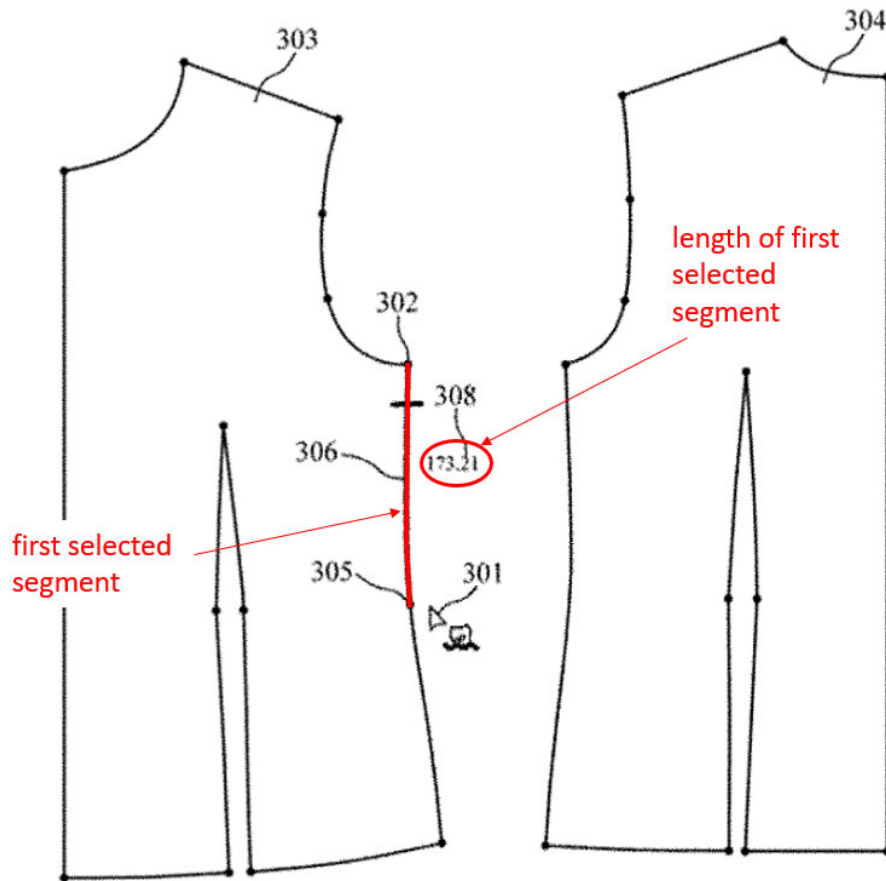
92. The IPR Petition sets forth various Grounds for why the claims of the '355 Patent would have been obvious in view of the various prior art references that I overviewed above. I disagree with these proposed Grounds for at least the reasons set forth below.

A. Petitioner's Proposed Combination Fails to Satisfy Elements [1.5] and [6.5]

1. Corel Does Not Teach a "Candidate Ending Point" That Is "On The Second Segment"

93. Elements [1.5] and [6.5] require displaying a "candidate ending point" on the second segment that would make a length of the second selected segment substantially equal to a length of the first selected segment.

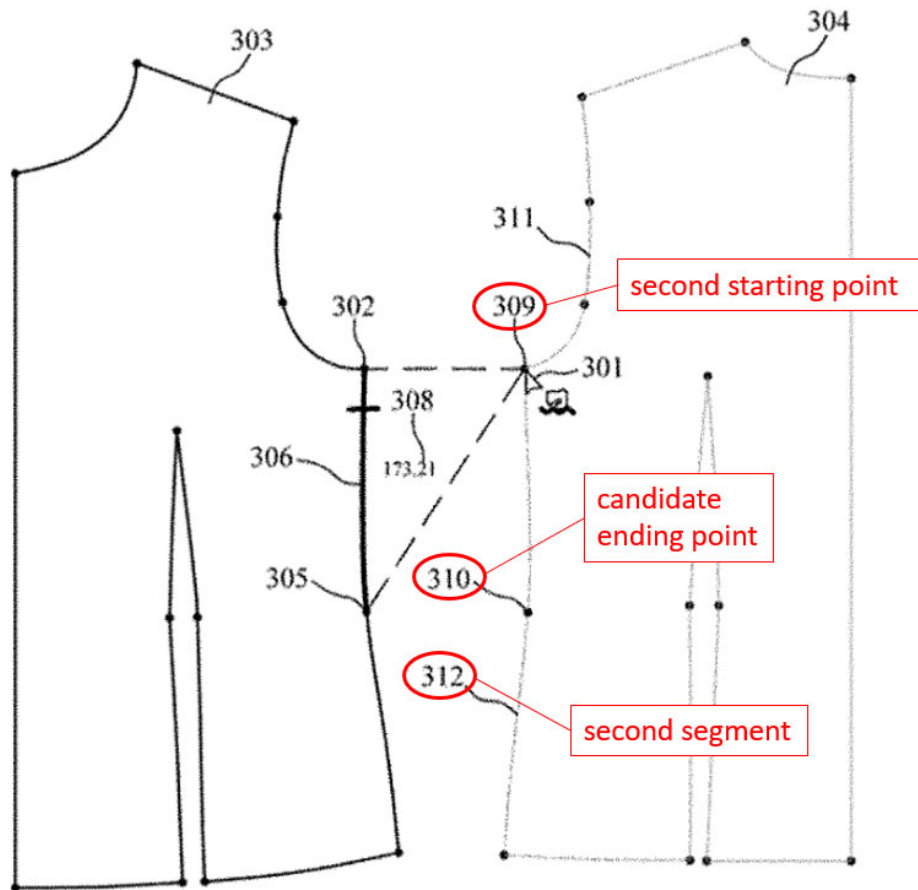
94. In the '355 Patent, once a user has created a first selected segment 306, the length 308 of the first selected segment 306 is determined and displayed. Below I have annotated FIG. 4 to highlight these.



EX1001, FIG. 4 (annotated)

95. Then, once the user selects a second starting point 309 for a second selected segment, as illustrated in FIG. 6 below, “a point is displayed as the candidate 310 for the ending point of the second selected segment, wherein the point ... makes the second selected segment the same as the length of the first selected segment along the second segment that includes the input starting point 309, wherein the second selected segment is made by connecting the input starting point 309 to [the candidate ending point 310].” EX1001, 9:10-19. And, as required by Elements [1.5] and [6.5], the candidate ending point 310 is “on the second segment” 312. This is

logical and clear, as the candidate ending point 310 must be on a seam line of the second pattern to allow the second pattern to be free sewn to the first pattern along seam lines in both patterns.



EX1001, FIG. 6 (annotated)

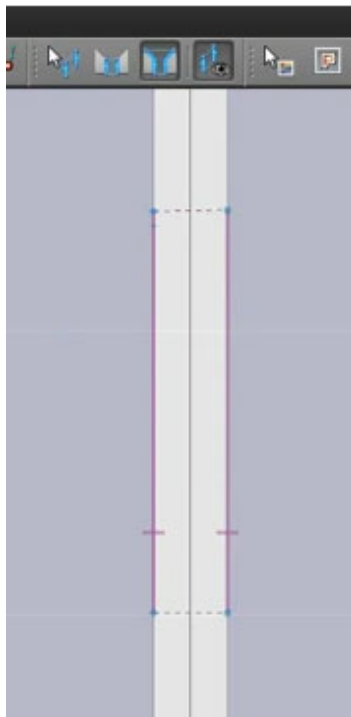
96. The location of the candidate ending point 310 (and thus a candidate length of a second selected segment) is beneficial in avoiding wrinkles in the fabric: “If the lengths of the first and second selected segments are not the same, wrinkles are created on the selected segment with the longer length, thus making aesthetic

effects.” EX1001, 6:16-19. Moreover, any difference in length of the sewn-together segments can be amplified depending on the type of material: “knit and chiffon” might “not create wrinkles if the difference between the first and second selected segments is lower than one inch.” *Id.*, 7:46-49; 10:19-22; 10:51-54; 14:17-19. This one-inch threshold might be as low as “one centimeter” for fabrics (such as cotton and denim) that do not stretch well. *Id.*, 7:47-49; 10:21-23; 10:53-55; 14:20-23.

97. The candidate ending point is particularly beneficial for sewing together segments having different shapes. In such situations, it may be difficult for a user, without aid, to determine how long the second selected segment should be to match the length of the first selected segment. FIG. 12 shows four such examples. “[T]he first and second selected segments may be sewn together even if each of the first and second segments has the different shape e.g., a straight line and a curved line.” EX1001, 11:25-28. Note that in the case of FIG. 12(d), even though the shapes of the two segments 1207, 1208 being very different shapes, the candidate ending point on the second segment 1208 would assure the length of the first and second selected segments remains equal (i.e., the length of each line being displayed in this example as 149.60)

98. EZBRUSH does not teach the concept of displaying a candidate ending point to allow a user to easily create two segments having equal length, and the

Petitioner does not argue so. For example, as exemplified by the screenshot below, EZBRUSH is a very manual process without aids, so that even when the user in the YouTube video attempts to make line segments of somewhat equal length, the upper points of each segment are not perfectly aligned (*i.e.*, the dashed line connecting the two top points is slightly askew from horizontal).



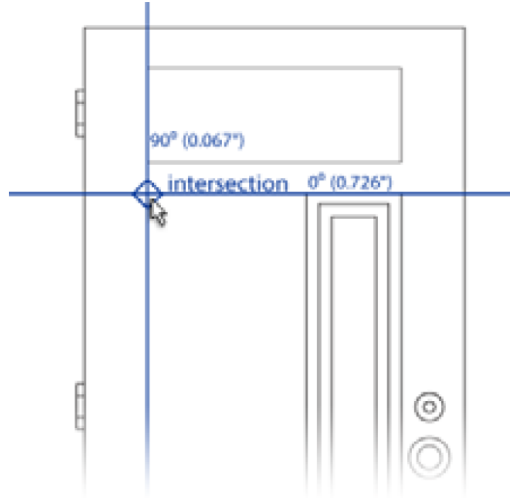
EX1001, 24:51

99. Petitioner turns to Corel for this limitation. However, this reliance on Corel is misguided. In particular, the Petitioner’s supposed “candidate ending point” is merely the end of a line that the user is *currently drawing* with his or her cursor;

it is not a candidate ending point on an *already-existing* “second segment,” which is required by the claims¹.

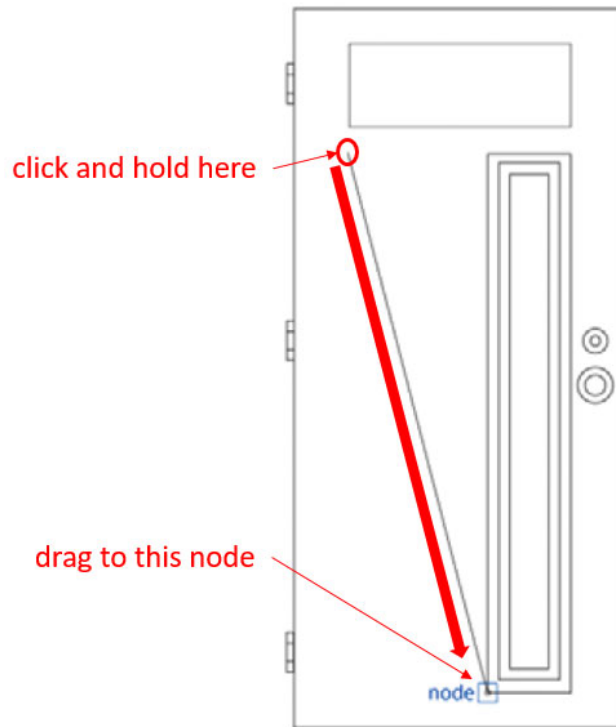
100. As explained in Section VIII *supra*, Corel teaches “horizontal and vertical dynamic guides” (shown in blue below) that extended guidelines that aid a user in aligning points horizontally/vertically with other points or segments. These dynamic guides can be displayed by the following actions taken by the user: “Point [the cursor] to the upper-left node of the right panel and move the pointer to the left to display a horizontal dynamic guide” and then “Point to the lower-left corner of the top window, and move the pointer downward to display a vertical dynamic guide.” EX1005, p.11. When this is performed, the following dynamic guides are displayed:

¹ Claims 1 and 7 requires displaying the candidate ending point “*on the second segment*,” and part of this already-existing “second segment” is being selected as the “second selected segment.”



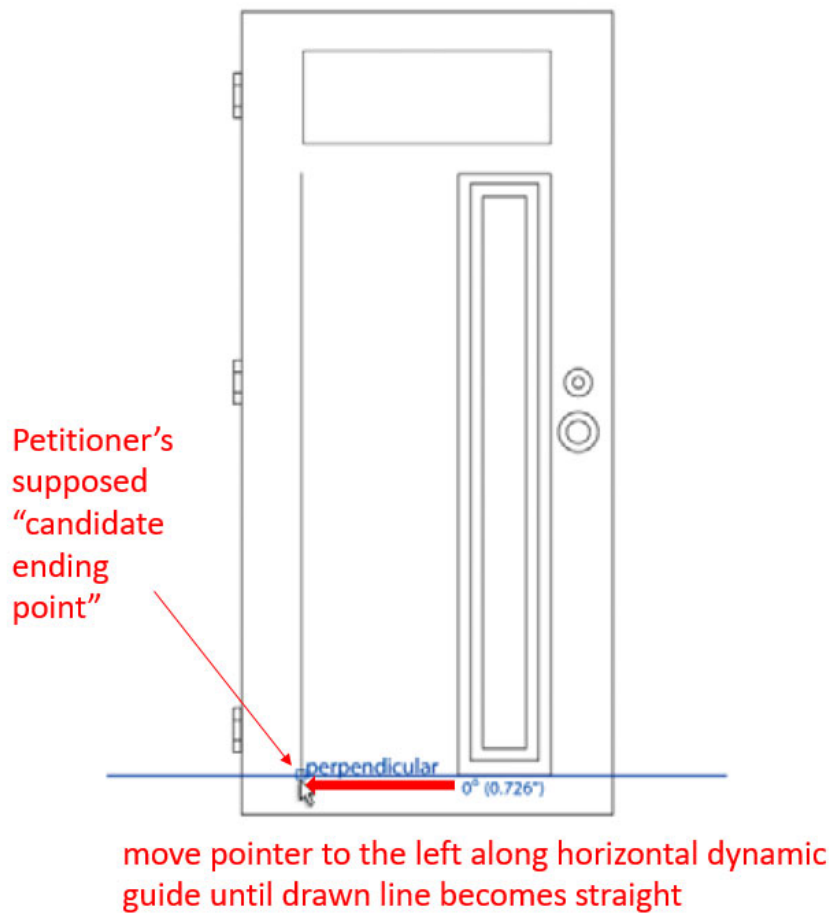
EX1005, p.11

101. The user then clicks and holds the mouse button to select this as the beginning of a line segment. *Id.* While holding the mouse button, the user “drag[s] downward to the lower-left node of the right panel” as shown by the red arrow below:



EX1005, p.11 (annotated)

102. The user “then move[s] the pointer to the left to display a horizontal dynamic guide,” and “then “release[s] the mouse button” when the drawn line “becomes straight” as shown below:



EX1005, p.11 (annotated)

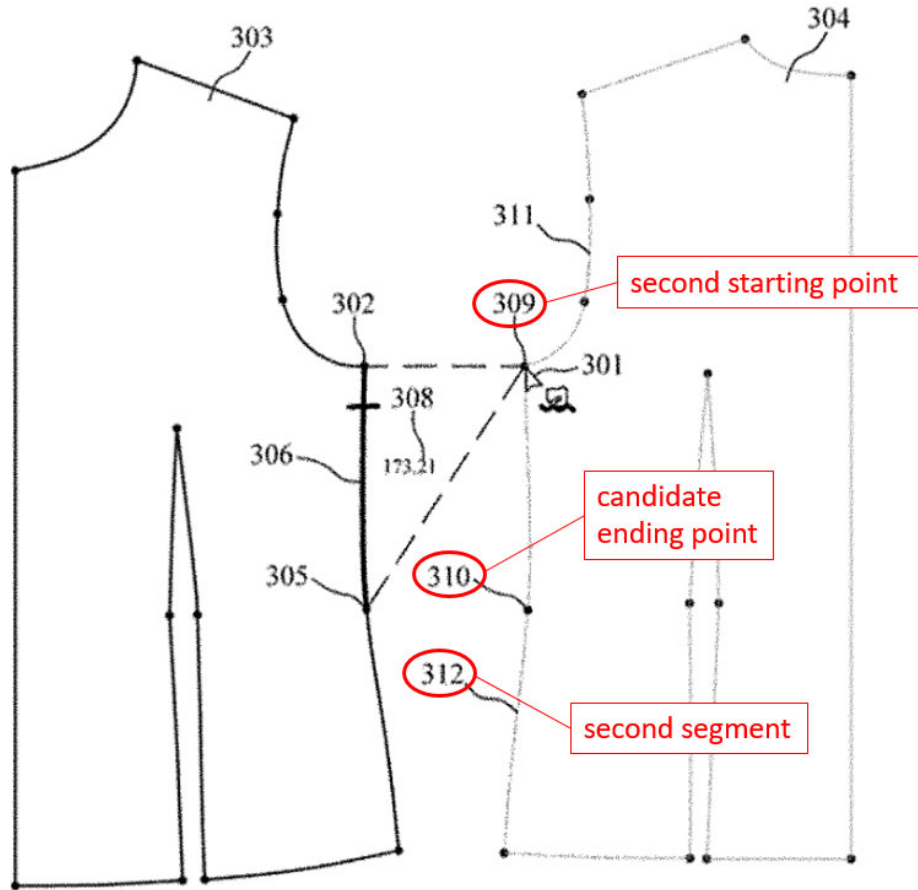
103. The point at which the mouse button is released is labeled by Petitioner as the “candidate ending point” to satisfy the Elements [1.5] and [6.5]. Petition, p.65. However, this supposed “candidate ending point” is merely an end of a line that is *currently being drawn* by the user based on the user’s cursor movement. It is not a point on an *already-existing* “second segment” which is required by the claims.

104. Corel's deficiencies are massive and significant. Even after a user selects a starting point for a new line, (i) there is no pre-existing second segment or seam line, (ii) there is no second segment or seam line that a user cursors near to display a present point on the second segment, (iii) there is no candidate ending point on the second segment for the second selected segment, (iv) there is no measurement of the length of a line on the second segment and the length of a first selected segment, and (v) there is no comparison of a length of second line to a first selected segment. The user is simply trying to find the horizontal coordinate of the bottom edge of the first door panel. This is not close to the same thing setting a candidate ending point on a second segment. Additionally, the entire second line is moving with the cursor. The cursor is certainly not triggering a "present point" on a (non-existent) second seam line segment that is closest to the cursor position. The last image shown in the cited portion of Corel (shown below) merely shows a user dragging the cursor to a new location that is the intersection of a horizontal and vertical dynamic guide. That intersection point is only displayed if the user positions the cursor on or very near the correct horizontal coordinate, and on or very near the correct vertical coordinate. If the user fails to do either, there is no intersection point. However, there is still no candidate ending point displayed on a pre-existing second seam line segment when the user sets a starting point on the second segment. This

logically follows from the fact that Corel is a CAD program intended to match coordinates of an existing shape, not software for virtual clothing design that is attempting to free sew together two segments from two seam lines on two different, pre-existing patterns.

105. Additionally, Corel requires straight, linear lines. It is a static CAD tool, whereas the '355 Patent is very much dynamic. Corel is not related to or contemplated for digital clothing design. Curved, sinuous, uneven or non-linear seam lines dominate most digital patterns. Corel is not designed to, and could not, determine an intersection point for these types of patterns; it would only work for purely horizontal and/or vertical lines. Additionally, digital clothing design requires a user to match seam lines for free sewing two non-matching digital patterns together. *Id.* So merely duplicating the shape of a line, a horizontal coordinate or a vertical coordinate as taught by Corel does not work.

106. The '335 Patent's Figures are consistent with the claims: the "candidate ending point 310" is on "second segment 312." This makes sense because the system works to identify a candidate ending point for a sew seam on an already-existing segment of fabric.



EX1001, FIG. 6 (annotated)

107. In contrast, as shown in the images of Corel above, the Petitioner’s supposed “candidate ending point” is not on any *already-existing segment*. It is merely the end of a line segment that is currently being drawn by the user.

108. Additionally, displaying a candidate end point on the second seam line likewise allows the user to design with increased speed, efficiency and simplicity as the user knows the point that must be selected in order to match the first and second

seam lines in the first and second digital patterns based on fabric type and other user clothing design preferences.

2. A POSITA Would Not Have Been Motivated To Modify EZBRUSH To Incorporate Corel's Dynamic Guides

109. In view of this, a POSITA would *not* have been motivated to modify EZBRUSH's CAD system in a manner that implements Corel's horizontal and vertical dynamic guides, and would *not* have any reasonable expectation of success in doing so.

110. For one, the EZBRUSH video depicts a user sewing together two sew segments that are not only both vertical, but also have starting and ending points that are horizontally aligned with one another. However, a POSITA would understand that it is extremely common for a user to sew together two sew segments that are not vertical, and do not have starting and ending points that are aligned.

111. As a simple example, below is an image from a pattern making book for fashion design. The below image shows the well-known nature of sewing together a back of a shirt to a front of a shirt at the armhole. Here, the length of each of the front and the back of the armhole is not only different in length to give some flexibility in the fabric, but neither the beginning points nor the ending points of each sew seam at the arm hole are aligned:

Figure 1b

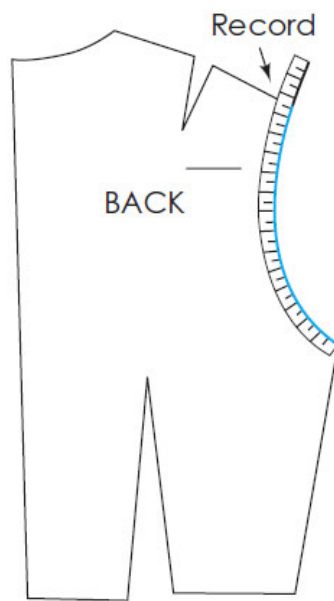
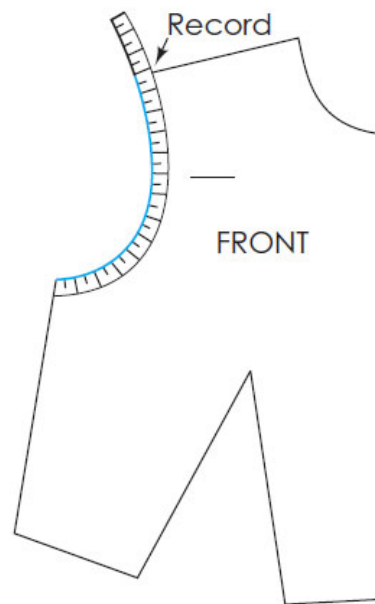


Figure 1c

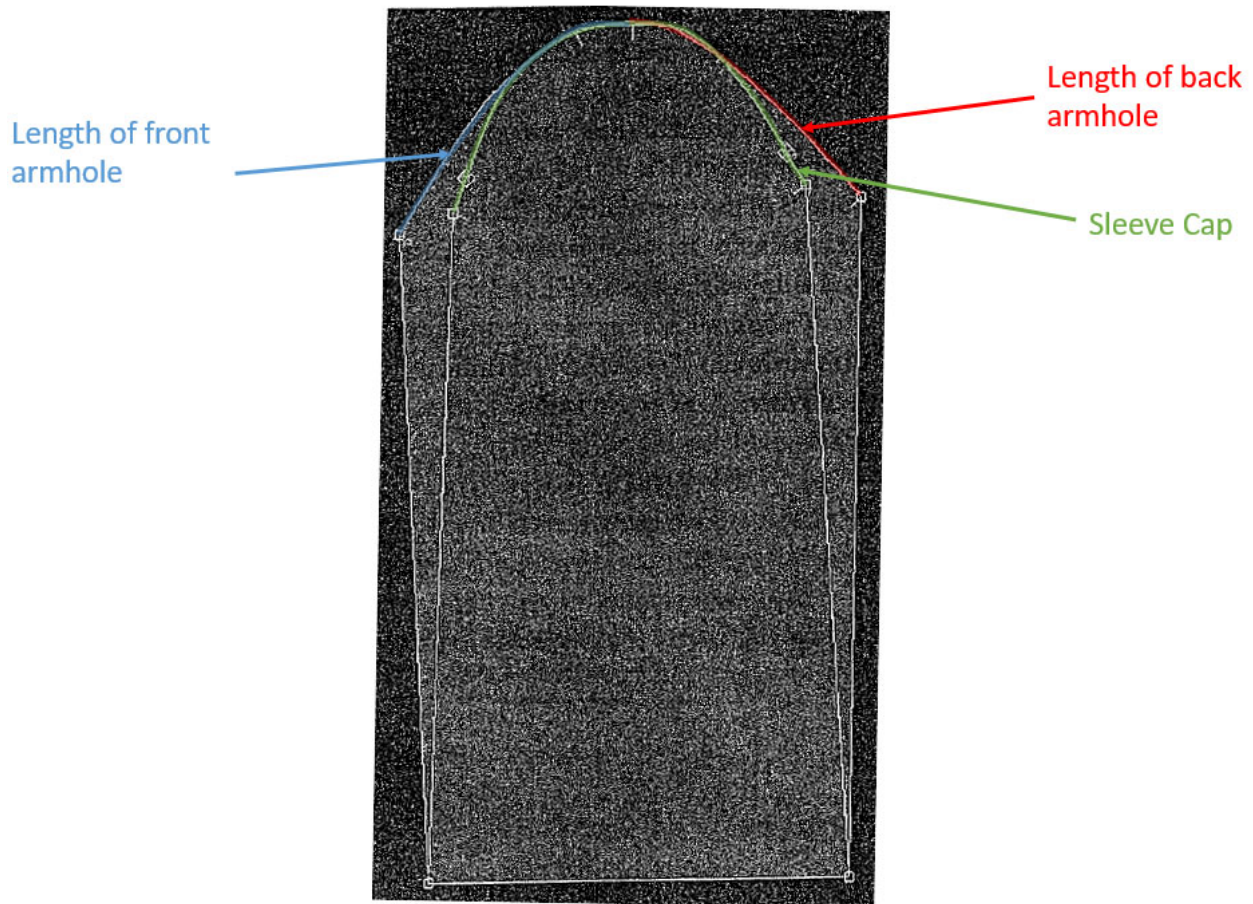


EX2002 at p.5

112. Of course, a POSA would take these understandings of general clothing pattern design and incorporate into the virtual garment design software when designing the pattern on-screen.

113. As another example, below is an image from another text that is specific to 3D CAD software. Here, I have labeled the three main components: the length of the front armhole from the front fabric material, the length of the back armhole from the back fabric material, and the length of the sleeve cap. These are sewn together. However, notice how the end points of the sleeve cap are not horizontally aligned with the end points of either the front armhole or the back armhole. This is due to the nature of common clothing pattern design in making sleeves – the shape of the

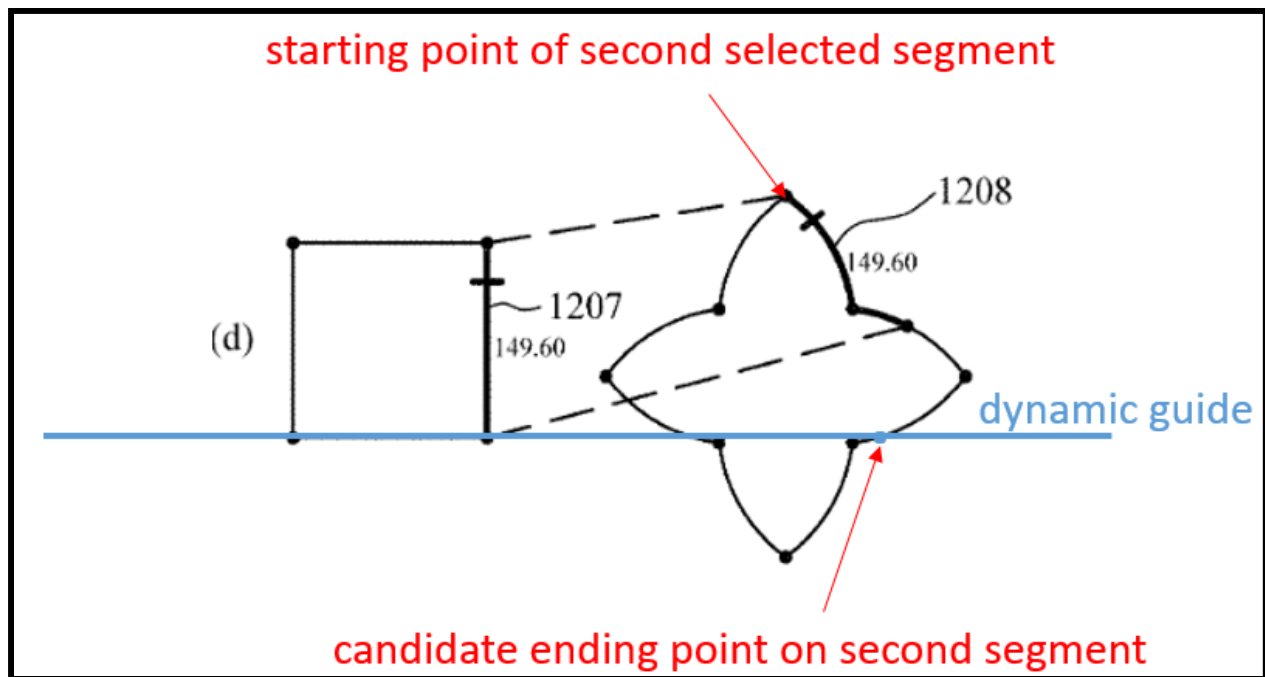
sleeve at the armpit is typically differently shaped than the armholes on the front and rear of the shirt fabric.



EX2003 at p.4 (annotated)

114. In short, it is common knowledge of a POSA that depending on the clothing being designed, it is very common to have starting points and ending points of sew segments that are not aligned in either horizontal direction or vertical direction. In such situations, Corel would be of no help.

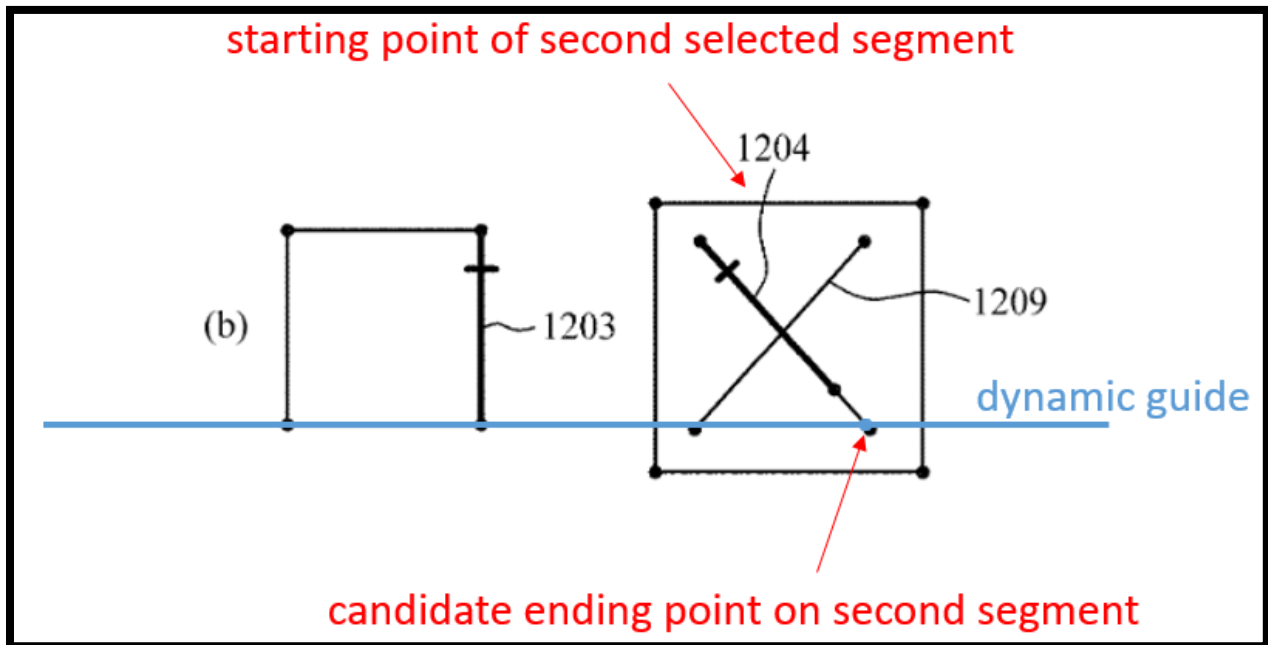
115. The '355 Patent in fact confirms this. Take FIG. 12(d) of the '355 Patent, for example. Here, the user desires to sew together a first selected segment 1207 and a second selected segment 1208. Notice how the starting points and ending points of both selected segments 1207, 1208 are not horizontally aligned, and the shapes of the two selected segments 1207, 1208 differ. If Corel's teachings were implemented, a horizontal dynamic guide (blue) would extend horizontally from the ending point of the first selected segment 1207 to aid the user in determining an ending point for the second selected segment 1208, as shown below. The candidate ending point for the second selected segment 1208 would be at the intersection of the dynamic guide and the second segment 1208. However, due to the curved nature of the second selected segment 1208, the suggested ending point for the second selected segment 1208 would have a length ***much larger*** than the length of the first selected segment 1207. Below I have labeled Corel's "dynamic guide" onto FIG. 12(d) of the '355 Patent to illustrate where the candidate ending point would appear, given the teachings of Corel.



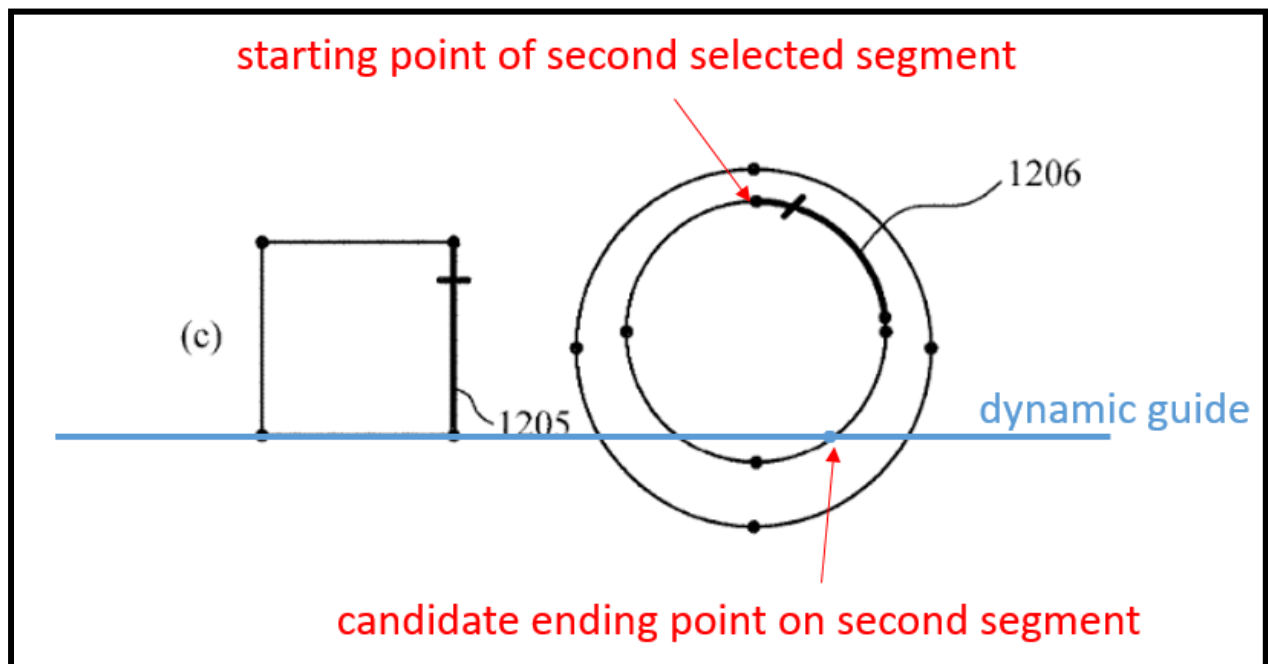
EX1001, FIG. 12(d) annotated

116. In fact, movement of the horizontal dynamic guide to *any* location would not help the user to determine where the ending point on the second selected segment 1208 should be in order to maintain an equal length as the first selected segment 1207.

117. The same holds true for the other images in FIG. 12. In both FIGS. 12(b) and 12(c) shown below, Corel's dynamic guide would not provide any candidate ending point on the second segment that would yield a second selected segment 1204/1206 to be equal in length to the first selected segment 1203/1205, respectively.

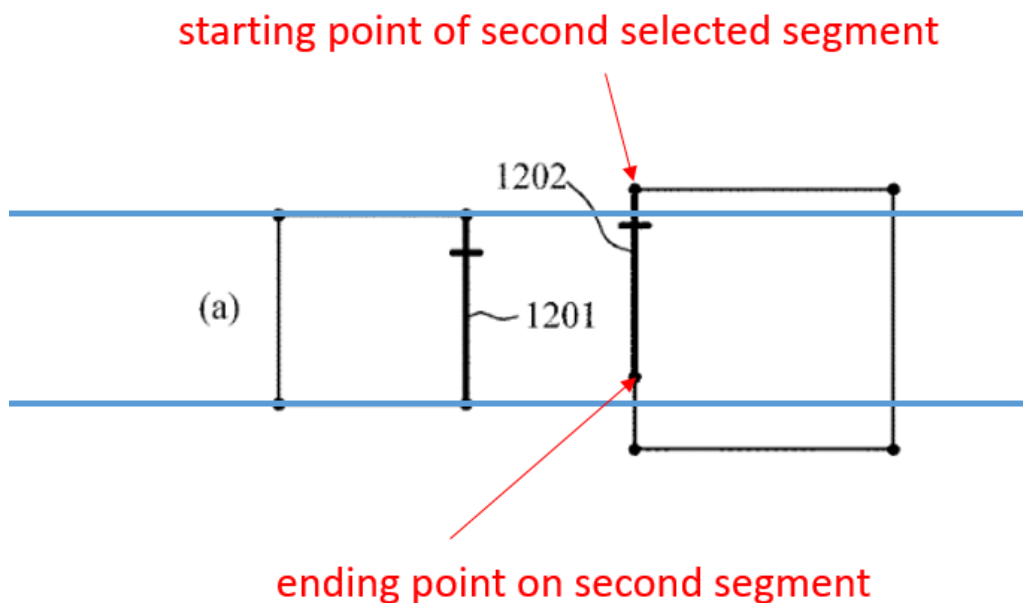


EX1001, FIG. 12(b) (annotated)



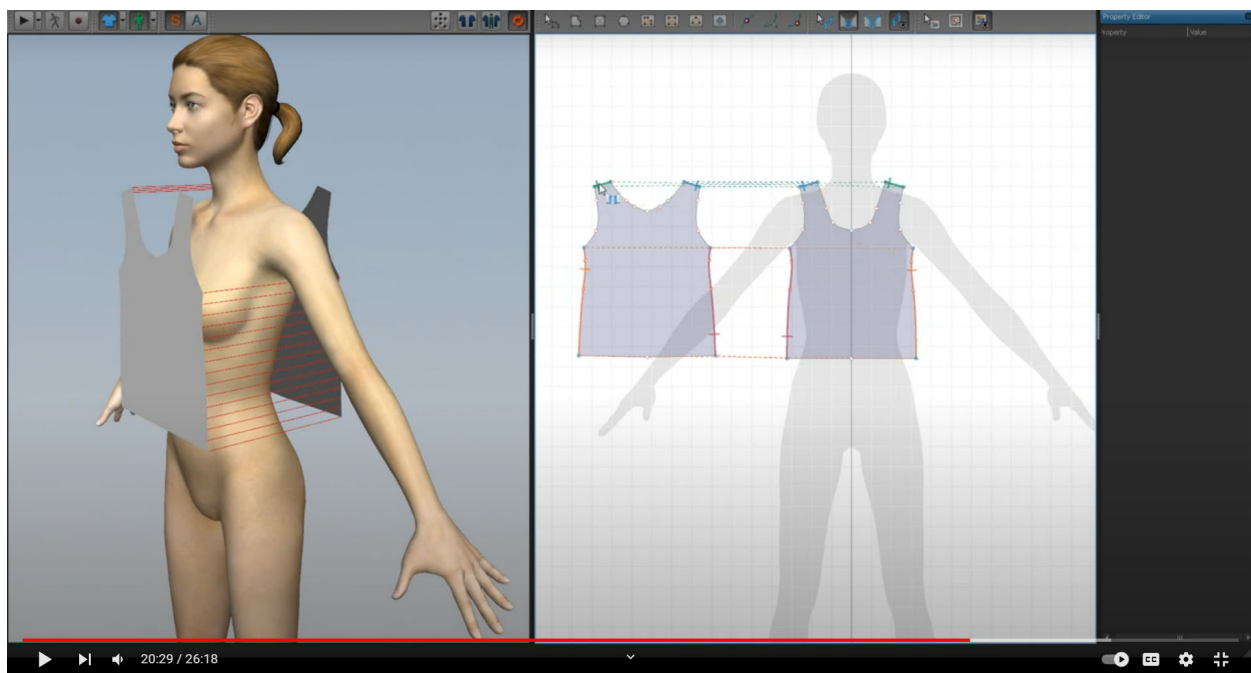
EX1001, Fig. 12(c) (annotated)

118. Even if both the first and second segments are purely vertical, *any time* the starting points of the first and second selected segments are not perfectly aligned, Corel's dynamic guide would be useless. This is because Corel's dynamic guides are for vertically or horizontally aligning two points. The '355 Patent's FIG. 12(a) demonstrates this. As shown below, after a first selected segment 1201 is selected, the user selects a starting point of the second selected segment 1202 that is not horizontally aligned with the starting point of the first selected segment 1201. Therefore, the horizontal guides (when aligned with either the top or bottom of the first selected segment 1201) would provide the user with no help in determining where the ending point for the second selected segment 1202 should be in order to create equal-length segments.



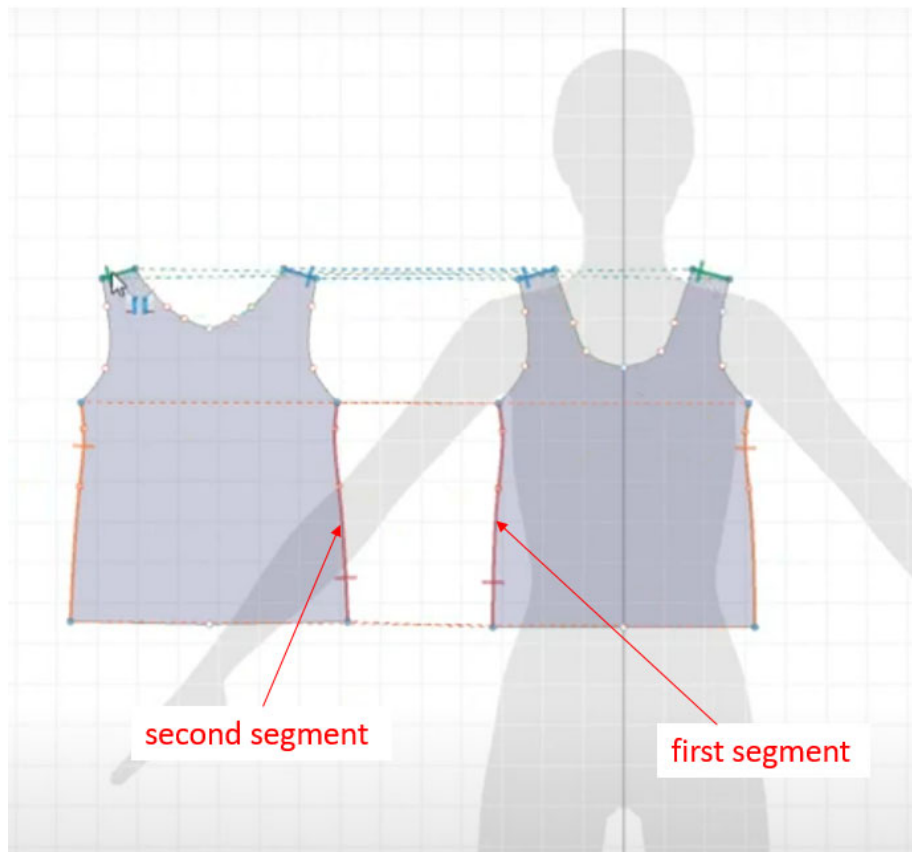
EX1001, Fig. 12(a) (annotated)

119. These same problems would be present if Corel's teachings were combined with the Marvelous Designer software that is the subject of the EZBRUSH video. Petitioner conveniently selects a portion of the EZBRUSH video that has purely vertical sew segments in order to portray the idea that adding the horizontal dynamic guides of Corel would be beneficial to the Marvelous Designer software. However, if Corel was applied to other sew segments shown in EZBRUSH, the horizontal guidelines would be of no help. Consider, for example, the below screenshot in which a front of a shirt being sewn to a back of the shirt:



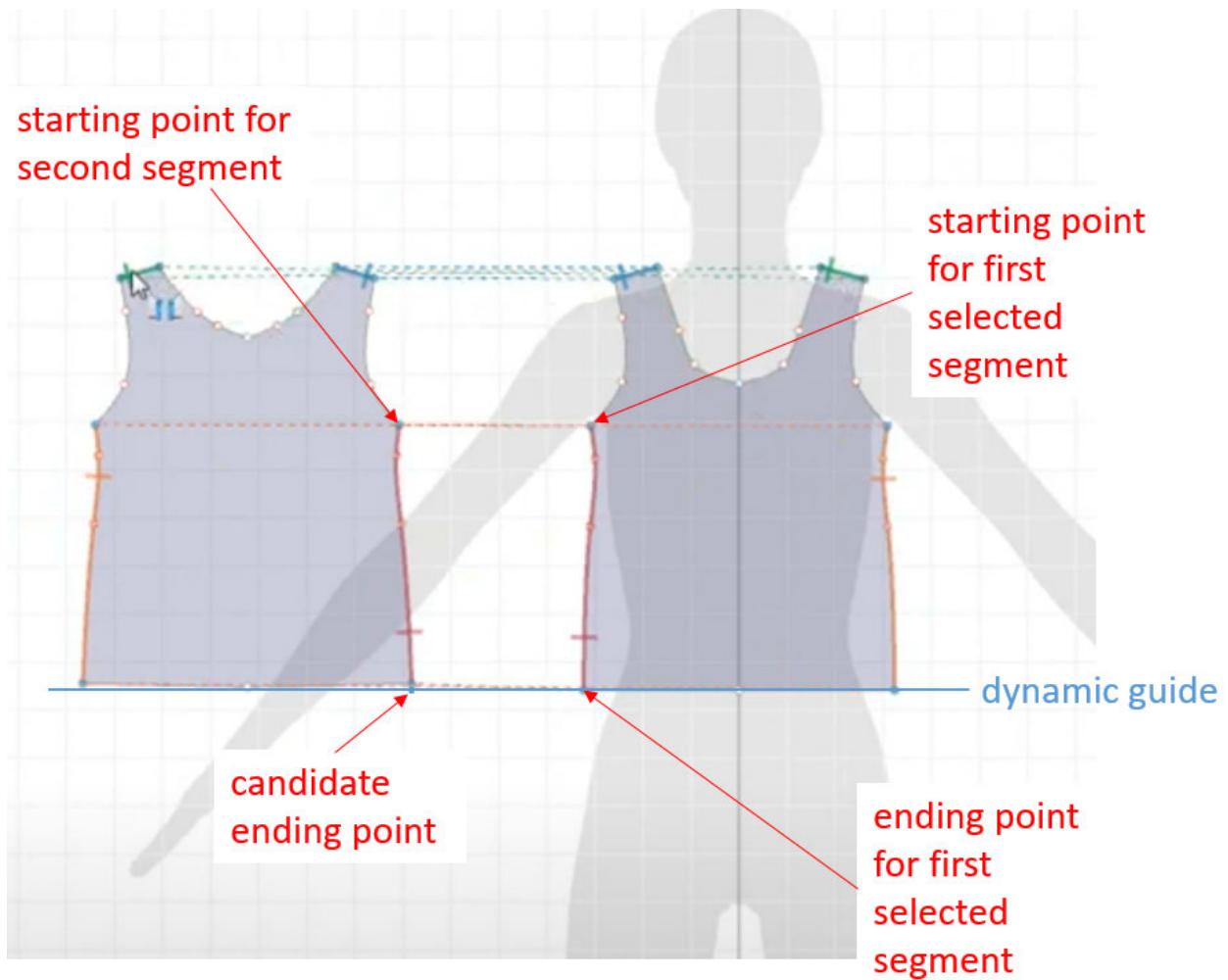
EX1004, 20:29

120. Notice how the first and second segments on the front and back of the shirt to be sewn together are not identical in shape.



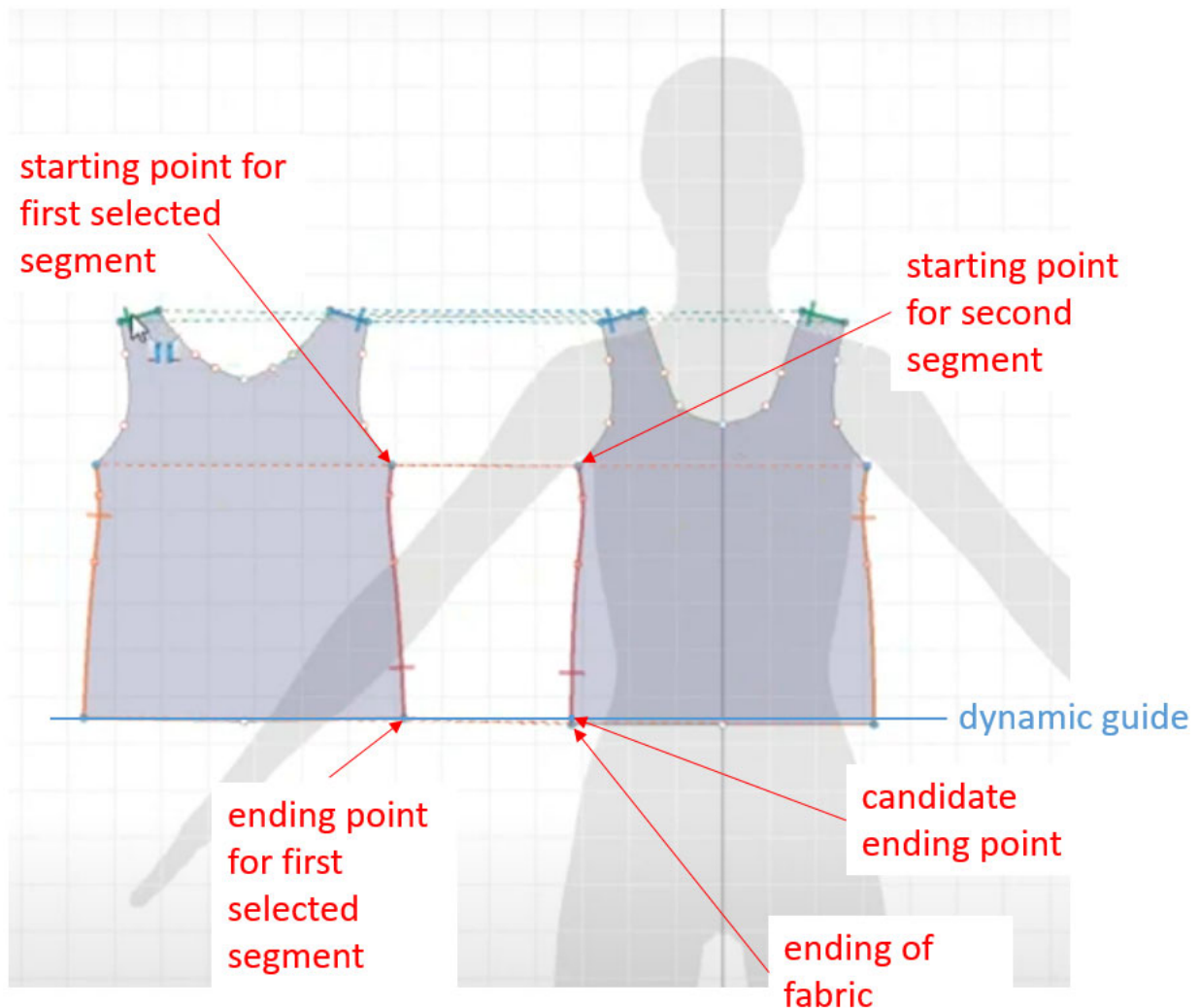
EX1004, 20:29 (annotated)

121. If a user selected the starting point and ending point for the first selected segment as shown below, Corel's horizontal dynamic guide would extend through the ending point of the first selected segment. This would lead to a candidate ending point that is ***not even on the fabric***. This is due to the first and second segments not being of identical length, size, or shape.



EX1004, 20:29 (annotated)

122. The same would happen if the first and second segments were reversed. If a user selected the starting point and ending point for the first selected segment as shown below, Corel's horizontal dynamic guide would lead to a candidate ending point that is well above the bottom of the fabric, thereby leaving a significant, undesirable amount of fabric that is not sewn to anything.



EX1004, 20:29 (annotated)

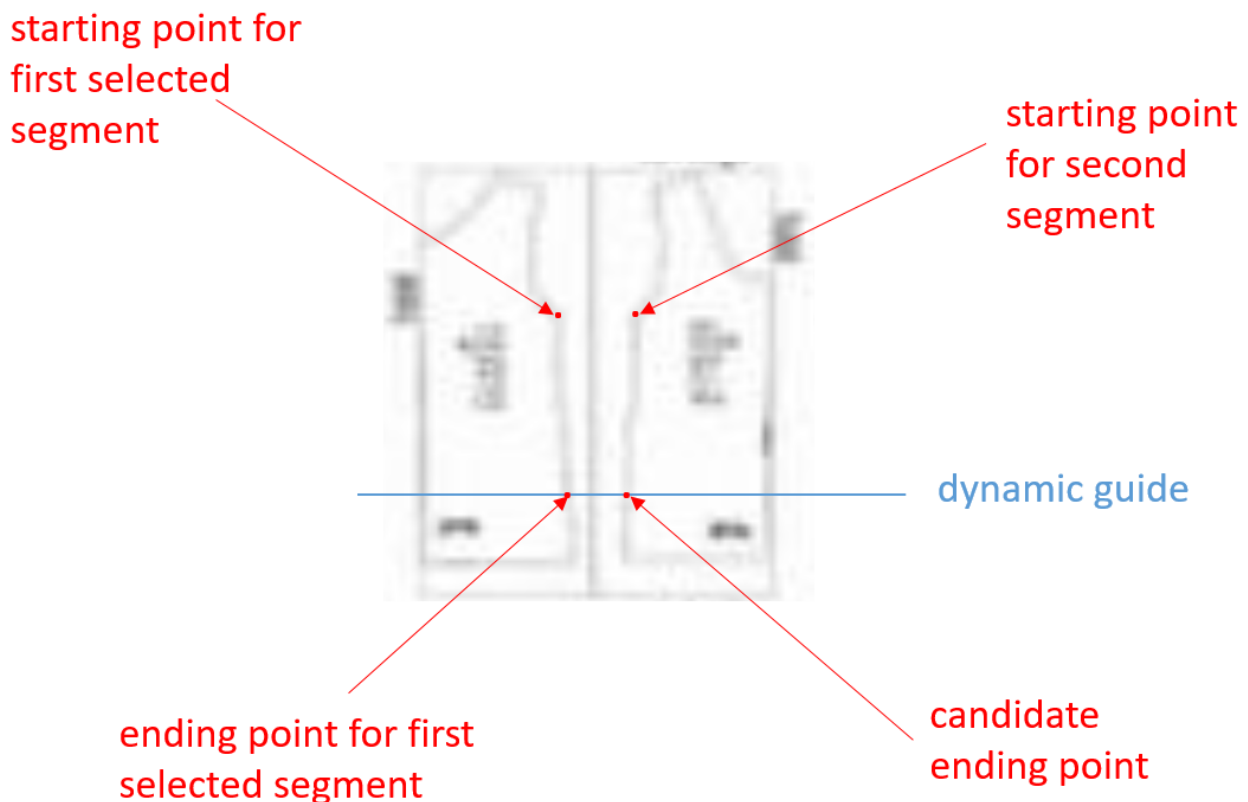
123. The same would happen if other patterns are selected to be sewn together. The Petition acknowledges that one of several types of patterns can be selected. Petition, pp.22-23. Notice how many of these patterns (highlighted in red) have first and second sew segments that are not identical in shape. Because these first and second segments are not purely vertical and are not identical in shape, Corel's horizontal dynamic guideline would therefore *not* suggest a candidate

ending point that would make the second selected segment equal in length to the first selected segment.



Petition, p.23; EX1004, 1:16-1:45 (annotated)

124. Take one of these patterns as an example. Assume a user wishes to sew part (but not all) of the side of the shirt to create a “flared” look at the bottom of the shirt. The user would select the starting point and ending point of the first segment as shown, as well as a starting point for the first segment. Corel’s horizontal dynamic guide, if implemented here, would display a candidate ending point that is horizontally aligned with the ending point for the first selected segment. However, this candidate ending point would yield a second selected segment that is *not* equal in length to the first selected segment due to the first and second selected segments having different shapes.



EX1004, 1:16-1:45 (annotated)

125. Therefore, a POSITA would not have a reasonable expectation of success in implementing Corel's dynamic guides into the EZBRUSH's clothing software because it would only be helpful if and when the first and second selected segments are the same shape with horizontally-aligned starting points. Simple, static CAD software for right angles and parallel lines (such as Corel) would not lead to a reasonable expectation of success in displaying a candidate ending point for seam lines that are different shapes and/or have starting points that are not horizontally aligned.

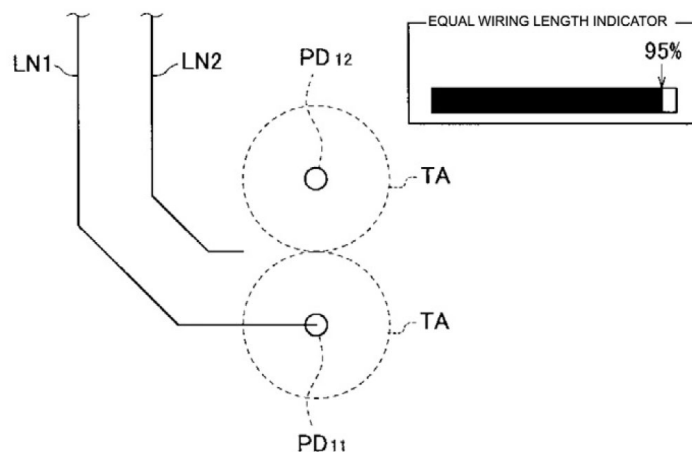
126. Based on all of this, it is clear that a POSA would not have any reasonable expectation of success in incorporating Corel's dynamic guides into the EZBRUSH's software. Doing so would not give the user with a candidate ending point that makes the first and second selected segments equal in length unless the two sewn seams were perfectly vertical and had starting and ending points that were aligned, which is very often not the case when sewing clothing.

B. Modifying The EZBRUSH-Corel-Thoemmes Combination Based On Niterra Renders the Combination Inoperable

127. It is my understanding that the Petition argues that it would have been obvious to implement Niterra's "equal line length indicator" into the EZBRUSH-Corel-Thoemmes combination in order "to inform the operator that the amount of [line] length deviation" between two indicated line segments "has deviated from an

acceptable value.” Petition, pp.45-46. This is incorrect. If Niterra’s “equal line length indicator” were to be included into the EZBRUSH-Corel-Thoemmes combination, the result would be an inoperable system. I will explain below.

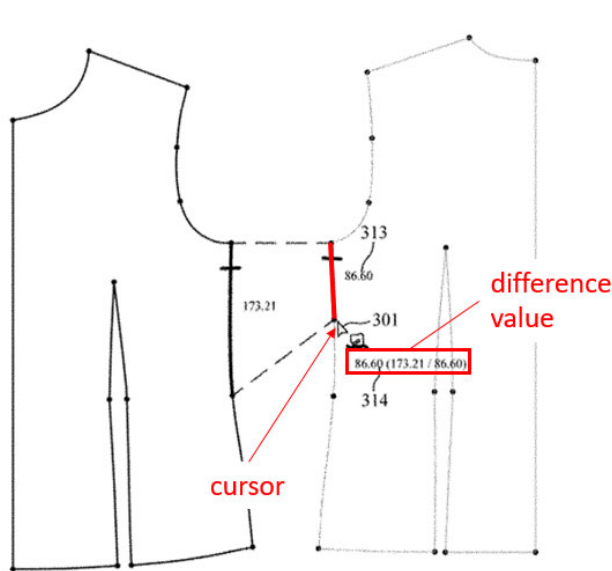
128. As explained above in Section III, Niterra’s “equal wiring length indicator” (shown below) is an aid for a user during drafting of electrical wiring LN2. More specifically, the equal wiring length indicator allows the user to draw the second wiring LN2 and connect it to the pad PD₁₂ (to create the electrical connection) while monitoring its length relative to the first wiring LN1. *Id.*, [0069]. So, as the second wiring LN2 is drawn extending closer to the length of the first wiring LN1, the equal wiring length indicator would approach 100%.



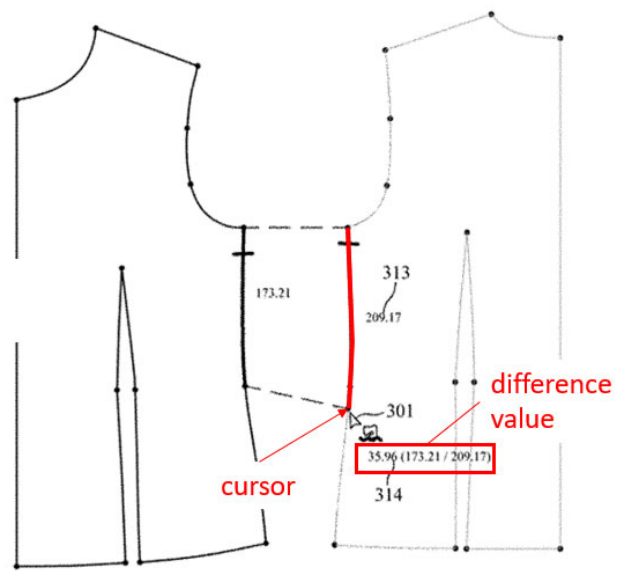
EX1009, FIG. 29

129. In Niterra, as I explained above in my summary of Niterra, a user would not draw the second wiring LN2 to extend beyond the second pad PD₁₂. Doing so

would create excess wiring that is unnecessary because the electrical connection is already completed when the second wiring LN2 is connected to the second pad PD₁₂. In contrast, the '355 Patent is specifically suited for drawing a second line segment that is either shorter or longer than a first line segment. Figures 8 and 9 (shown below) demonstrate instances where the user moves the cursor such that the second selected segment is either shorter (FIG. 8) or longer (FIG. 9) than the first selected segment 306. Note how the difference value 314 is shown in both instances. EX1001, 9:59-10:2; 10:25-37.



EX1001, FIG. 8 (annotated)



EX1001, FIG. 9 (annotated)

130. Unlike the '355 Patent, a user in Niterra would not draw the second wiring LN2 to travel either shorter or beyond the pad PD₁₂. As explained above, doing so would be an unnecessary waste of wiring. As such, Niterra's "equal wiring

length indicator” is incapable of displaying the difference between the length of the wiring LN1/LN2 when the second wiring LN2 is greater than the first wiring LN2, or extends beyond the pad PD₁₂. Niterra’s “equal wiring length indicator” only goes up to 100%. If a user were to draw the second wiring LN2 to extend beyond the pad PD₁₂ (which he/she would not), nothing in Niterra teaches or suggests exactly what would happen to the equal wiring length indicator. It would either stay at 100%, or would not provide sufficient distance information, or would malfunction. This would lead to an inoperable outcome if incorporated into the EZBRUSH-Corel-Thoemmes combination. If an EZBRUSH user were to draft the second line segment to have a length that exceeds the first line segment, Niterra’s indicator would either stay at 100%, or would not provide sufficient distance information, or would malfunction.

C. Niterra Does Not Teach Two Different Colors, a Requirement of Elements [1.8] and [6.8]

131. Elements [1.8] and [6.8] are directed to displaying two different colors, depending on the difference between the lengths of the first and second segments. (“wherein, when the second length is substantially equal to the first length, at least one of the first length, the second length and a difference value between the first length and the second length is displayed in a first color, and wherein, when the second length is substantially different from the first length, at least one of the first

length, the second length and the difference value is displayed in a second color, the second color being different from the first color.”)

132. Niterra states: “the pattern or color of the wiring length indicator displayed on the monitor, or a combination of the two, may be used to inform the operator that the amount of wiring length deviation has deviated from an acceptable value.” EX1009, [0069]. In short, “color... may be used” by Niterra’s equal wiring length indicator. This simple disclosure that “color may be used” does not mean that the color of the equal wiring length indicator *changes*, which is required by claims 5 and 11.

133. Nothing in the cited prior art (or Mr. Perreault’s declaration) provides evidence that changing colors based on relative lengths of line segments was known in the art. It would be a leap to conclude that Niterra’s statement that “color may be used” means that color changes.

D. Claims 4 and 9

134. Claims 4 and 9 are directed to displaying a warning sign in response to the difference value exceeding a third reference. The “difference value” refers to the difference between first length of the first segment and the second length of the second segment. (Elements [1.8] and [6.8].)

135. It is my understanding that Petitioner relies on Niterra’s “equal wiring length indicator” and argues that it reads on the claimed “warning sign.” Petition,

pp.77-78. This is improper. Claims 4 and 9 require the warning sign to be displayed “*in response to*” the difference value exceeding the third reference. Niterra does not teach that any part of its “equal wiring length indicator” would appear in response to anything, let alone a length difference exceeding a threshold. Instead, by all accounts, the equal wiring length indicator is displayed *at all times* so that “the differences in length can easily be compared” on a scale of 1-100%. EX1009, [0016].

X. CONCLUSION

136. I currently hold the opinions that I have expressed in this declaration. However, my analysis may continue, and I may acquire or receive additional information or insights that may result in revised or supplemental observations or opinions.

137. I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 or Title 18 of the United State Code, and that such willful false statements may jeopardize the validity of the '355 Patent.

Executed: September 13, 2024.


Dr. Muthu Govindaraj

APPENDIX A

PROFILE

Dr. Muthu Govindaraj obtained his PhD in Mechanical Engineering from the Technical University of Liberec in the Czech Republic in 1982. Earlier he completed his B.Tech., and M.Tech., degrees in textile engineering from the University of Madras, India. After working for Machinery Manufacturers Corporation in India as Deputy Manager of Research and Development, Dr. Govindaraj joined NC State University as a Research Associate in 1986. Later he joined Cornell University as an assistant professor in the Fiber Science Division. At Cornell Dr. Govindaraj was the Director of Industrial Extension in Textiles and Apparel. He was an executive committee member of the Center for Manufacturing Enterprise at Cornell and an Advisory Board member of the Cornell Theory Center. In 1995 Dr. Govindaraj joined Philadelphia University as an associate professor, was tenured in 2001 and promoted to full professor in 2003. He is the recipient of the Lindback Distinguished teaching award in 2001.

Dr. Govindaraj was one of the pioneers in the use of finite element modeling to simulate textile fabric deformations. His work was featured in Supercomputing '95 and American Scientist carried a news item on the work in addition to publications in the Textile Research Journal. The National Science Foundation funded Dr. Govindaraj's research for four years from 2002-2006 in a collaborative Information Technology Research project with Stanford, Rutgers and Rice universities. Dr. Govindaraj's research in haptics (sense of touch) was presented at the MIT Media Lab conference and was funded by the National Textile Center. Dr. Govindaraj's expertise includes the design and development of multiple layer woven fabric systems for composites, electronics and biomedical applications and holds two US patents. His work has been featured in the Smart Textiles Conference in Boras, Sweden in 2008 and in Techtextil conference in Atlanta, GA in 2004. Dr. Govindaraj has several years of experience in the design and development of robotics and control systems for handling flexible materials (textiles). He has served as a consultant for several companies including 3M, Voith Fabrics, Cook Inc. Confluent Medical, and others.

EDUCATION

PhD Mechanical Engineering, Technical University of Liberec, Czech Republic, 1982

M.Tech Textile Engineering, University of Madras, India 1975

B.Tech Textile Technology, University of Madras, India 1973

EXPERIENCE

PROFESSOR (TENURED) SCHOOL OF DESIGN AND ENGINEERING,
KANBAR COLLEGE OF DESIGN, ENGINEERING AND COMMERCE,
PHILADELPHIA UNIVERSITY 2001-PRESENT

DIRECTOR OF ENGINEERING PROGRAMS, SCHOOL OF ENGINEERING
AND TEXTILES, PHILADELPHIA UNIVERSITY 2010-2011

DIRECTOR, BIOMEDICAL TEXTILE STRUCTURES LAB 2010-2012
(Funded by The Pennsylvania Department of Community and Economic Development, DCED and

ASSOCIATE PROFESSOR, DEPARTMENT OF TEXTILES AND APPAREL,
PHILADELPHIA UNIVERSITY 1995-2001

DIRECTOR GRADUATE PROGRAMS, DEPARTMENT OF TEXTILES AND
APPAREL, PHILADELPHIA UNIVERSITY 1995-2004

ASSISTANT PROFESSOR, DEPARTMENT OF TEXTILES AND APPAREL,
CORNELL UNIVERSITY, ITHACA, NY 1989-1995

DIRECTOR, INDUSTRIAL EXTENSION PROGRAMS, DEPARTMENT OF
TEXTILES AND APPAREL, CORNELL UNIVERSITY, ITHACA, NY 1989-
1995

RESEARCH ASSOCIATE, DEPARTMENT OF TEXTILE ENGINEERING,
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC 1986-1989

DEPUTY MANAGER, RESEARCH AND DEVELOPMENT, MMC LTD.
MYSORE, INDIA 1982-1986

DEVELOPMENT ENGINEER, RESEARCH AND DEVELOPMENT, MMC
LTD. CALCUTTA, INDIA 1976-1978

DEVELOPMENT ENGINEER, FELTS DIVISION, SHRI DINESH MILLS
BARODA, INDIA 1975-1976

FUNDED RESEARCH PROJECTS

Z2 Space Suit Cover, ILC, Dover, DE/NASA (2013) PI.

Nanofiber Based Tissue Engineering Award #: IT101AX1130001

Period: 04/01/2010 - 07/31/2012, Dept. of Commerce, Senior Personnel, (PI: Dr.
David Brookstein)

DoD U.S. ARMY NATICK SOLDIER RESEARCH, DEVELOPMENT &
ENGINEERING CENTER Natick, Massachusetts, USA 01760-5020 Under
W911QY-04-1-0001 Sept. 2004-May 2008. Senior Personnel (PI: Dr. David
Brookstein)

PV Fabrics Contract No. C000036369 between NSF SBIR STTR and Illuminex
Corp. July 1, 2009-June 30, 2010. PI.

ITR: Representations and Algorithms for Deformable Objects, National Science
Foundation, 2002-2006. Co-PI with Guibas (Stanford), Metaxas (Rutgers), Latombe
(Stanford), and Kavraki (Rice). Project completed August 2008. \$ 2,809,668

Integration of Fabric Formation and Coloration Processes. National Textile Center. Co-PI. 2002-2005, \$280,000

Haptic Simulation of Fabric Hand, National Textile Center. PI. 2000-2003, \$320,000

On-line Fabric Defect Evaluation, Summer Project 2001, Philadelphia University, PI

Physically Based Fabric Drape Models as Tools for Computer Aided design of Apparel and Other Textile Structures, National Textile Center, 1997-2000. PI \$ 270,000.

Physically Based Model of Fabric Drape, National Science Foundation, Supercomputing Grant, 1996-97. PI

Apparel Research Network, Defense Logistics Agency, Co-PI (with Prof. Mel Wiener) 1995-98.

A Physically Based Model of Fabric Drape, Cornell Theory Center (NSF supported center) Supercomputing Service Units, 1995-96. PI

Application of Robots in Garment Assembly, USDA Experiment Station Hatch Project, 1990-95, PI \$45,000

Application of Robots in Garment Assembly, College of Human Ecology Grant, Cornell University 1990. PI

Industry Grants

Novel weaves and materials for paper making machines, Voith Fabrics, 2002.

Development of Textile Applications for a Multi-layer Film, the 3M Company 1998-2001

Computer Modeling of Limp Materials, Digital Equipment Corporation Education Incentive Program (Equipment Grant) 1992.

Equipment Grant, Investronica, (Software and Hardware Grant) for Apparel CAD Systems. 1993.

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Sodomka, L. and Govindraj, M Optical Measurement of Vibration of Rotating Systems (in Czech) Journal of Fine Mechanics and Optics, 1982, No. 9.

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PHILA-LEHP-TE-TR-08-02 USING COMPUTER MODELING FOR OBJECTIVE EVALUATION OF GARMENT DRAPE, FIT, AND PRESSURE Prepared for U.S. ARMY NATICK SOLDIER RESEARCH, DEVELOPMENT & ENGINEERING CENTER Natick, Massachusetts, USA 01760-5020 Under W911QY-04-1-0001 For the Period May 2005 to May 2008 Submitted by Muthu Govindaraj, Shefali Agarwal, Vikram Vijayakumar, Rachel Geschwindner, Alicia Ruthrauff, and Brianne Whitt

Apparel Production Technology, Forum, Journal of College of Human Ecology, Cornell University, 1991

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P R E S E N T A T I O N S

Invited lectures

Integrated Fashion Education for the New Millennium, Invited Speaker, Conference of the International Foundation of Fashion Technology Institutes, New Delhi, India Nov. 9, 1998.

Textile Research in the United States, Invited Speaker, Yuengnam University-Regional Research Center, S. Korea 2000.

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Oral and poster presentations

Woven fabrics and techniques to produce multilayer and complex structures, Bally Ribbon Mills, Bally, PA. September 25, 2013.

Fabric Haptic Device, International Non-wovens Technical Conference Houston,

Texas, Sep. 2006

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Conference, Nov. 11-13, 1995, Philadelphia, PA

Mechanical Property Based Model of Fabric Drape. Fiber Society Technical Conference, Fall 1993 Ithaca, NY.

A Physically-based Model of Fabric Drape, HIGHTEX 1994, 24th Canadian Textile Seminar International, May 1994.

Automatic Ratch Control on a Drawframe, Fiber Society Technical Conference, New Orleans, LA fall 1990.

Fabric Property as Control factors for Flexible Apparel Production Systems. Third Annual Academic Apparel Research Conference, Defense Logistics Agency, Atlanta, GA Feb. 1992.

THESIS GUIDANCE

Have guided two PhD candidates, Dr. Ashish Garg at Philadelphia University and Dr. Bijian Chen at Cornell University.

Have guided eight Masters thesis candidates (two at Cornell and six at Philadelphia University)

PROFESSIONAL ORGANIZATIONS

Member, Am. Soc. of Mechanical Engineers, American Soc. of Engineering Educators.

Honorary member, Phi Psi Fraternity

PATENTS

Plural Layer Woven Electronic Textile, Article and Method.
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US Patent application US20220100071A1
Dynamic Wall for Augmented Reality

CONSULTANCY

Member (2000-2002) Committee of Experts, KEMA Registered Quality Inc.

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