Emotion in our life assignment

A Jacquard machine is constructed of three main parts: (a) the engine, (b) the harness tie, and (c) the Jacquard engine drive that is connected to the weaving machine main drive, to provide motion for the deferent parts of the Jacquard engine. 10. 7 Electronic Jacquard (Stable Corporation). Notes: a = pulleys b & c = hooks d & e = retaining hooks f & g = knives h = electromagnet = harness cord 10. 2. 1 Mechanical Jacquard In mechanical Jacquard, the essential parts of the engine that work in harmony to select hooks are the cylinder, pattern cards, needles, springs, and knives (Fig. 10. 6).

The cylinder Is a perforated square prism with a number of holes on each side equal to the number of needles. The centerline of each hole coincides with the centerline of a needle. Each needle Is In contact with a spring. The pattern cards are made of cardboard and formed into an endless chain. One pattern card corresponds to the formation of one weft yarn in the Jacquard weave repeat. The needles and hooks are arranged in short and long rows. A pattern card has locations that are also arranged In short and long rows, with each location dedicated to a needle or hook since each hook resides In the bent of a needle.

Location in the tatter cards Is punched or left unpunished, depending whether the corresponding hook (or warp yarn(s)) is to be raised or lowered respectively according to the weave design. After a weft yarn is woven, the cylinder moves away from the needles (left in Fig. 10. 6), turns a quarter revolution (clockwise in Fig. 10. 6), then moves toward the needles and press against them. Figure 10. 6, for clarity, shows only two needles and their corresponding hooks with a needle facing a punched hole In the active

pattern card and the other facing no hole. The first needle stays In place, while the other needle is pushed to the right.

The hook of the first needle is now against the knife and the hook of the second needle is pushed away from the knife. The knives are given upward and downward motions per cycle. Thus the hooks with holes in the pattern card will be raised and the other hooks will stay down to form the shed and insert the weft through the shed to form the weave design. The cylinder motions are repeated for each weft yarn. When all cards have gone through the active position Mechanical Jacquard systems have numerous mechanical parts and motions that hinder the weaving speed, which did not allow them to work with high-speed hatless weaving systems.

The electronic Jacquard was developed for this reason. In a Jacquard shedding system, each hook is connected to a harness cord (in the case of individual control of warp yarns, I. E. Each hook controls one harness cord, which in turn controls one warp yarn) or a neck cord (in this case, each hook controls several harness cords/warp yarns). Each harness cord passes through a hole in the comber board that maintains the harness cords in position. The bottom end of the harness cord is connected to a huddle wire, which in turn is connected from its bottom to a bring or lassoer.

Each warp yarn is threaded through an eye of a huddle wire. The function of the spring is to return the hook and its corresponding harness cord and warp yarn to the bottom shed if the warp end is required to be lowered after it was raised up. Earlier Jacquard systems used small weights (or lingoes) attached to the end of the harness cord, rather than a spring, to return raised warp

ends/hooks to the bottom shed. The use of lingoes was stopped owing to the time taken to return a warp yarn to the bottom shed since the lingoes are under free fall.

High-speed weaving squires much a faster return of raised warp yarns to the bottom shed, which can be realized by the use of spring or lassoer. 10. 2. 2 Electronic Jacquard In the electronic Jacquard system, the pattern cards are in an electronic file stored digitally in a computer and known as a punch file. Thus physical pattern cards, the cylinder and the needles are eliminated. Figure 10. 7 shows the main parts of the electronic Jacquard. Only a group of parts that control a harness cord (I) is shown for clarity. These are pulleys (a), hooks (b & c), retaining hooks (d & e), knives (f & g), and an electromagnet (h).

The figure shows how the harness cord (I) is selected to be raised or lowered. Figure 10. 7, position 1 indicates the electromagnet (h) is activated and the top part of the retaining hook (d) is attracted to the magnet. Since the retaining hook (d) is fixed in its middle and allowed to rotate around its centre, its bottom moves to the right and does not engage to the hook (b). Thus hooks (a & b) will remain in contact with the knives (f & g) and the pulleys (a) and the harness cord (I) remain in their down position as seen from position 2.

Positions 3 and 4 indicate how the harness cord is raised by not activating the electromagnet (h). The retaining hook (e) engages with hook (c), knife (f) raises hook (b), which causes the pulleys (a) and the harness cord (I) to rise. 10. 2. 3 Conversion of mechanical Jacquard to electronic needle/hook

selection Even though electronic Jacquard systems are on the rise, there are still many mechanical Jacquard machines in companies around the world. Machine manufacturers saw the opportunity of developing systems that converted mechanical Jacquard to electronic Jacquard systems. Figure 10. 8 shows one of such conversion 10. . It consists of electronically activated small parts (needle selectors). Each needle selector coincides with a needle and has a dent to accommodate the needle end. Like an electronic Jacquard system, the needle selectors are activated by an 10. 8 Electronic needle selector for converting a mechanical Jacquard to an electronic Jacquard machine. Electronic punch file. If a needle selector is activated, it moves toward the needle and pushes it along with the corresponding hook and this will cause the hook to stay down (since it misses the knife) along with the warp yarn(s) connected to it.

Needle and hooks that are not selected by the needle selectors are kept stationary and the kooks are raised since they are against the knives. 10. 2. 4 Jacquard size The Jacquard size, capacity, or power is defined as maximum number of hooks in the Jacquard machine. There are two common standards, known as British, which is coarse gauge, and Continental, which is fine gauge. The British standard Jacquard size range is 100 to 900 (or 104 to 924 kooks) as shown in Table 10. 1 . In the British system the size is lower than the total number of hooks.

For example in machine size 100 there are four extra hooks (or one short row) and in machine size 900 there are 24 extra hooks (or two short rows). The extra rows are provided for selvage motions, harnesses for formation of ground weave, and/or filling selection motions. Table 10. 2 shows the

standard sizes of continental Jacquard. The size range is 448 to 1792. The size and total number of hooks are identical in the continental standard. These sizes allow the weaving of large weave designs made of fine-warp yarns. Table 10. Standard British Jacquard sizes (coarse gauge) Size, capacity, or power Number of hooks/ long row short row Total number of hooks 200 300 26 51 4 8 10 12 104 208 304 510 612 924 Table 10. 2 Standard Continental Jacquard sizes (fine gauge) Size, capacity, or rower 896 1344 1792 16 28 56 112 Recently, larger sizes of Jacquard machines were developed for the production of extremely large patterns. Numerous machines were developed to produce one large weave design repeat across the entire fabric width. Such Jacquard machines require to be extremely large and to possess individual control of warp yarns (I. . The total number of warp yarns equals the number of hooks). Examples of Jacquard sizes produced by stimuli for example are 1408, 2688, 3, 072, 4096, 5120, 6144, 8192, 10 240, 12288, 14 336 and 18 432 hooks. If required, two or more Jacquard machines may be placed side by side to obtain the squired number of hooks for large weave designs. For example two size 12 288 Jacquard machines can be placed on top of a weaving machine to obtain a combined size of 24 576 hooks. These large Jacquard Machines are referred to as ‘ Mega Jacquard’s’. 10. 2. Jacquard harness tie and types A harness tie in Jacquard weaving refers to the arrangement of harness cords, which are connected to hooks, in the comber board. It describes how the harness cords are threaded through the holes of the comber board. A harness tie in Jacquard weaving is similar to drawing-in in cam and dobby weaving. Harness ties are classified as ordinary ties and special ties. Ordinary ties are sub-classified as straight ties and center or pointed ties. Special ties are sub-

classified as mixed ties and ties for bordered fabrics. A straight harness tie is similar to a straight draw in cam and dobby weaving.

It is used for a weave pattern with each warp yarn interlaced differently. Figure 10. 9 shows such a weave design. It depicts an example of a straight harness tie on Jacquard with 448 hooks, which is arranged in 16 hooks/short row and 28 hooks/long row (Table 10. 2). For clarity only the first and last short rows of hooks, along with their arenas cords, appear in Figure 10. 9; and only hook numbers 1 and 16 of the first short row and hook numbers 433 and 488 of the last short row are shown. The comber board and the weave pattern are shown at the bottom.

The number of weave pattern repeats (which depends on the fabric width and repeat width) decides the number of harness cords per hook. In a straight tie, the number of weave pattern Figure 10. 9 shows only two repeats and a part of the third. The figure shows that hook 1 controls warp end 1 of each weave pattern repeat and hook number 448 controls warp end number 448 of each weave repeat. Assume there are 10 weave patterns across the fabric width. This will require 10 harness cords for each hook and a total number of 4480 harness cords (or warp yarns). This calculation is required to build the Jacquard tie.

A simpler method of presenting the harness tie or drawing-in of harness cords in the comber board is shown in Fig. 10. 10. This figure shows one repeat of a harness tie along with the number of repeats, as commonly practiced. 10. 9 Straight harness tie (Damasks pattern: courtesy of Manual Woodworkers and Weavers, Wonderingly, NC, USA). 10. 10 A simple

presentation of a straight harness tie. A centre or pointed tie is used for symmetrical weave patterns (Fig. 10. 11). The advantage of a centre harness tie is the ability to produce larger patterns (double the size) compared to a straight tie. Figure 10. 1 depicts a pointed harness tie on Jacquard size 448, which is the same size as the straight tie of Fig. 10. 9 for the purpose of comparison. The weave pattern of Fig. 10. 11 repeats on 896 ends (2 x 448). Ends number 1 and 896 weave exactly the same, as do ends 2 and 895, and so on. Harness cords 1 and 896 are connected to hook 1 and harness cords 2 and 895 are connected to hook 2, and so on. A correction must be made with pointed ties to avoid weaving two ends with the same interlacing at the centre of the pattern and at the start of new repeat. If left without correction the two yarns that weave the same way would show as a defect. 0. 11 Centre or pointed harness tie (pattern courtesy of Manual Woodworkers and The top of Fig. 10. 11 shows the incorrect tie and the bottom tie is shown with the correction made. The harness cords connected to hooks 1 and 448 are removed. Assume 10 repeats are woven, then the number of harness cords per hook is 20 with the exception of hook 1 and 448 with only 10 harness cords each. The total number of harness cords (or the total number of wrap ends) is 8940 (2 x 448 x 10 – 2 x 10). Mixed harness ties are used for weave design repeats with mixed symmetrical and straight parts in the pattern, such as the pattern in Fig. 10. 12.

The first part of the design is symmetrical and requires 160 hooks (hooks 1 to 160), the second part is repeated twice within the design and requires 160 hooks (hooks 161 to 320), the third part requires 128 hooks (hook 321 to 448). Table 10. 3 shows the calculation associated with the harness tie.

These calculations are needed to construct the Jacquard harness tie. Border harness ties are dedicated to woven fabrics with border. An example of a border tie is shown in Fig. 10. 13. Here the entire harness tie is shown along with the bordered fabric weave design. Usually the left and right sides of the border are Science, NC State University).

Table 10. 3 Harness tie calculations of mixed tie (Fig 10. 12) Hook # Number of hooks Number of harness cords/hooks/repeats 160 161-320 321 ? 448 159 2 128 Total harness cords (warp ends) repeats Sub-total number of harness cords 5 1 590 1600 3835 10. 13 Border harness tie (pattern courtesy of Tamer Hammond, PhD, Fiber and Table 10. Harness tie calculations of border tie (Fig. 10. 13) Hook # cords/hook 1-224 225-448 224 a symmetrical pattern or they may be basic twill or satin/sateen. Many of these fabrics combine two borders with a basic weave for the outer border and the inside border is a symmetrical pattern.

The Jacquard size used in the example shown in Fig. 10. 13 has 448 hooks. Half the hooks (hooks 1 to 224) are dedicated to forming the border and the other half of the hooks form the ground of the fabric (hooks 225 to 448). The associated harness tie calculations are shown in Table 10. 4. 10. 2. 6 Limitations of Jacquard harness ties The examples of harness ties in Figures 10. 9 to 10. 13 demonstrate the relationship between the harness tie and the weave pattern type. Each of the standard Jacquard sizes in Tables 10. 1 and 10. Provides a limited number of hooks that is usually lower than the number of total warp yarns needed to form the fabric: a matter that dictates the construction of harness tie as shown in Figures 10. 9 to 10. 13, in order to form fabrics with multiple repeats across the fabric width. A number of

disadvantages arise from this: 1 . The harness tie, which is made from expensive high-performance cords, takes a ears), and is thus limited to the formation of a fixed pattern size and its smaller multiples. For example, the harness tie of Fig. 10. 10 may be used to weave a pattern repeat size of 448 ends, 224 ends, or 112 ends, etc. . The distance occupied by the harness tie (that is parallel to the weft direction) is constant and equals to in-loom fabric width if all hooks are active. Reducing the in-loom fabric width is possible by reducing the number of warp ends and drawing-in the ends in the middle of the harness tie, which requires use of the correct harness cords. 3. Each hook controls several harness cords of different inclination. This is the reason why the Jacquard head has to be mounted at least two meters higher than the comber board and accounts for the need of the huge structure known as the ‘ gantry.

Lower heights cause drastic variation in the shed height at the centre compared to that at the selvages: a matter that requires a higher shed size to accommodate the filling insertion element at the selvages. This will lead to tension variation (with the highest tension at the centre and the lowest at the selvages) and excessive warp breaks due to this variation in tension. A geometrical analysis of the shed height striation and the distance of the Jacquard head from the comber board are given elsewhere (Seam 2000). 4. Another limitation arises from the rigid dimension of the comber board.

The harness cord density (and hence warp yarn density) is constant. The limitation addressed in point 1 above is resolved by developing of the larger Jacquard machines, stated in Section 10. 2. 4. As mentioned above, Jacquard machines using up to 24 576 hooks are available. In these mega Jacquard

shedding systems, the warp yarns are individually controlled and the harness tie is straight with one repeat (an example of this is the pattern in Fig. 10. 16). This allows the formation of extremely large weave patterns of any type (non-symmetrical, symmetrical, mixed or bordered patterns).

One large repeat or several smaller repeats across the fabric width can be formed. Assume that it is required to weave a fabric as illustrated in Fig. 10. 12. According to Table 10. 3, the total number of ends is 3835. A Jacquard head with straight tie and 4096 hooks can be used to produce the fabric. The extra hooks will be cast out (as idle). Of course the cost of large-capacity Jacquard machines is high but he flexibility in producing unlimited designs offsets the cost. The issue of harness cord inclination is also resolved by arranging each harness cord vertically.

Theoretically, such Jacquard machines can be directly mounted on the weaving machine frame and the need for a massive gantry is eliminated. A reduction in fabric width is thereby much easier to handle since the cords are vertical (no crossing) and the harness tie is one repeat with one harness cord (or warp end) per hook. 240 Specialist yarn and fabric structures The warp density may be reduced by deactivating some hooks and their associated arenas cords. At ITEM 1995, ITS showed a flexible comber board with a changeable reduce the width.

This is achieved by mounting or removing spacers between the sections of the comber board (Fig. 10. 14). It seems that this system did not make it commercially, and the industry is still employing the traditional comber board. This may be related to the complexity associated with changing the

density and adjusting the height of the harness cords and the shed. Moreover, to 10. 14 A variable density Jacquard harness by ITS. Meet the width standard, the increase in density requires more hooks, and drawing- n instead of tying-in of the warp. 10. Converting artwork to woven Jacquard patterns Numerous colors and color effects can be generated using weave structures combined with clouded warp and filling yarns. For example, the perceived color of a plain weave fabric from white warp and black weft yarns of the same yarn size and thread count is grey. If the weave changed to 2 x 1 twill the perceived color is darker grey and if the weave changed to 7 x 1 twill the perceived color is black. It is obvious then that these two colors could produce white, black, and many shades of grey colors.

With a higher number of colors of warp and weft yarns and weave structures the possibility of generating a number of colors increases dramatically. Finer yarns, a higher thread count and suitable weaves produce a better color mix and the fabric design that would show continuous well-blended colors even from a short distance. Intricate Jacquard woven fabrics are created by using clouded warp and/or weft yarns. The final visualized color of each part of the design is the result of assigning weaves to different parts of the design. The creation of a Jacquard woven pattern starts from the development of artwork.

The objective is to match the woven pattern to the target artwork. The artwork is then scanned and converted to an image file (a digital file) and stored in a computer with special hardware and software known as a CAD system. The CAD operator interfaces with the system through the monitor and commands in form of icons. The operator selects weaves from a weave

database stored in the CAD system based on pre-woven blanket or color gamut. Examples of a blanket with details of colors, yarns, and weaves used are published elsewhere (Matter 2006). The CAD creates a punch file that is transferred to an electronic

Jacquard machine in order to weave a sample of the fabric. A visual assessment of the woven sample is conducted by comparing the woven sample with the artwork. If the assessment reveals visual differences, the assignment of different weave(s) (which is a color(s)) is repeated and the second sample is woven and compared to the artwork again. Several trials may be conducted before the woven sample matches the target artwork. The procedure of creating Jacquard woven patterns is depicted in Fig. 10. 15, which shows that three trials were conducted to achieve a match between