



## The Principles of Motion economy

So far this year we've looked at the Macro side of LEAN manufacturing and dealt with Layouts, Kanbans, SMED and 5S's.

On this occasion we're going to look at the Micro side since the New Year would be a good starting point for productivity resolutions. So, why not identify an operation needing attention, one that exhibits one or more of the following symptoms.

- The operator is frequently absent from work or the workstation and/or complains of muscular fatigue.
- The workplace is unsafe.
- Work is queuing up behind the operation indicating a constraint in flow.
- The work place is visibly untidy and cluttered with personal items and foreign objects not related to product or process.

These are all warning lights telling indicating the work discipline needs attention. Back in the 30's and 40's (before my time!) Ralph M. Barnes gave the subject of Motion Economy high-level importance because many nations were under severe labour strain due to two World Wars. Labour had to be deployed in the most economical way in munitions factories, assembly plants and so on because of its scarcity. Then, in the 60's we were given the computer, which promised respite from all those labour pains. True enough, this did materialize. However, we lost sight of the need to keep focus on work place economies in between these times until Japanese artists like Shigeo Shinko and Taiichi Ohno reminded us through TPS and Lean Manufacturing.

We need reminding that although management decides on technology, plant and equipment, we incorrectly allow the operator to be the sole decider as to how these will be used and this does not always produce the most effective method. Management must be leaders in setting down deployment methods.

To assist with this, we have the benefit of three really good principles to draw on. The first is the Use of the Human body, then The Classification of Movements and thirdly, the Design of tools and equipment. They are as valuable now as they were back then.

1. The use of the Human Body. (Acknowledgement to Ralph M. Barnes)
  - Both hands should begin and end their movement at the same time.
  - Hands should not be idle at the same time except when resting.
  - Motions of the arms should be made in opposite and symmetrical directions and should be made simultaneously.
  - Hand motions should be confined to the lowest classification with which to perform the work satisfactorily. (See table)
  - Momentum should be deployed to assist the worker whenever possible.

## 2. The Classification of Movements.

This principle directs work design to restrict movements to the lowest possible classification (Number 1 in the table) in order to reduce muscular fatigue especially in highly repetitive activities.

<b>Class of Movement</b>	<b>Pivot Point</b>	<b>Body Member</b>
5	Trunk	Torso, Upper arm, forearm, wrist and fingers.
4	Shoulder	Upper Arm, forearm, wrist and fingers.
3	Elbow	Forearm, wrist and fingers.
2	Wrist	Hand and fingers
1	Knuckle	Fingers

The highest class (5) will use all body members to achieve the result. So, to pick up an object at floor level will need the most costly movement in terms of fatigue.

## 3. Design of tools and equipment.

- Relieve hands of work that can be done more advantageously with a Jig or fixture or foot operated device.
- Combine tools wherever possible.
- Pre-position tools and materials.
- Where each finger performs some specific movement, such as keyboard typing, the load should be distributed in accordance with the inherent capabilities of the fingers.
- Cranks and handles should permit as much surface of the hand to come into contact with grip as possible.
- Levers, crossbars and hand wheels should be located such that the operator can manipulate them with the least change in body posture.

As I walk about factory floors I see the need to revisit this subject, which we would ordinarily pass off as common sense. But that's the odd thing about common sense; it's just so uncommon.

Best wishes for a productive year.

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