"Billiard University (BU) – Part IV: Table Difficulty"   ILLUSTRATED PRINCIPLES
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Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, technical proofs (TP), and all of my past articles can be accessed and viewed online at billiards.colostate.edu. The reference numbers used in the articles help you locate the resources on the website. If you have a slow or inconvenient Internet connection, you might want to view the resources from a CD-ROM or DVD. Details can be found online at: dr-dave-billiards.com.

This is the fourth in a series of articles dealing with the Billiard University (BU). The mission of the BU is to provide assessment tools, a rating system, and learning resources to help pool players strive for and achieve excellence, and to officially acknowledge excellence through the awarding of diplomas (Bachelors, Masters, or Doctorate of Pool). The BU was cofounded by me and Randy Russell, with support from a "dream team" of well-known and respected instructors and instructional authors: Jerry Briesath, Mark Finkelstein, Randy Goettlicher, Bob Jewett, Mike Page, Tom Simpson, and Mark Wilson. Online videos **NV D.1-D.6** explain every step of the BU process and demonstrate the BU playing-ability exams, which are available for free on the BU website: *BilliardUniversity.org*. **NV D.7-D.14** include excerpts from the 3-DVD BU Instructional series that provides advice for improving your fundamentals, teaches useful aiming systems for various types of shots, and offers "hot tips" for how to do well on the exams. In the last few months, we've looked at the BU exams and how to determine your player rating. This month, we'll look at how to take table difficulty into consideration.

Have you ever wondered how "tough" a table is, and why? There are many factors that affect how difficult a table plays. They include:

- table size
- pocket size, facing angles, and shelf depth
- pocket facing and shim properties and condition
- cloth and ball type and condition
- rail and cushion conditions
- table levelness
- temperature and humidity
- etc!!!!

Table toughness also depends on a particular player, their style of play, and the game being played. For example for 8-ball, a top player would probably prefer a larger table with less clustering and traffic, and the size of the pockets is probably less a concern (as long as they are not too small). And for a mediocre player, 9-ball would be much easier on a smaller table; although, the size of the pockets can be a huge effect.

Recently, I developed a **Table Difficulty Factor (TDF)** to characterize table "toughness." The TDF is a percentage measure of how difficult or easy a particular table plays based on table size and three simple corner-pocket measurements: mouth size, throat size, and shelf depth (see **Diagram 1**). These factors were chosen because they are most responsible for how difficult a table plays, they depend only on the table design and construction, they are relatively easy to measure and characterize in a non-subjective way, and they don't vary with conditions (which can sometimes change on a daily basis). I'm not implying by this choice that other effects are not important. For example, a slow, non-level table with draggy cloth, dead rails, and pockets that spit out almost everything due to dirtiness, humidity and weird facings is no picnic. However, I wanted to keep things as simple as possible while still providing a meaningful and non-subjective comparison of tables, independent of "conditions."
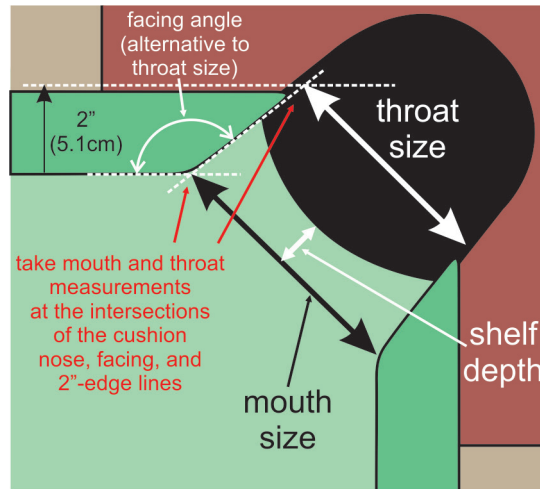
Diagram 1 Pocket Measurments

As shown in **Diagram 1**, if the cushion is not 2" (5.1cm) thick, the throat size is measured 2" (5.1 cm) back from the cushion noses. You can lay down Post-It Notes or masking tape to better define the lines and intersection points to help with the mouth and throat measurements. If you have an angle-measurement device, you can measure the facing angle directly instead of measuring the throat size (see **TP B.15** to see how facing angle and throat size are related). The shelf depth should be measured from the pocket mouth line to the slate top lip edge (where the pocket opening first starts).

The table difficulty factor (TDF) is calculated based on four factors: table size factor (TSF), pocket size factor (PSF), pocket angle factor (PAF), and pocket shelf factor (PLF). Each factor is a number less than, equal to, or greater than 1, where 1 indicates average or standard (based on the WPA equipment spec standards). By multiplying the four factors, you get the TDF which is a good measure of table "toughness." If TDF=1, the table has an average level of difficulty; if TDF>1, the table plays more difficult than average; and if TDF<1, the table plays easier than average. The values used for the four factors are summarized in **Tables 1-4**. All of the numbers were chosen carefully based on how each factor affects the margin of error for a wide range of shots (per the analyses in **TP 3.4** and **TP 3.6**). Some judgment based on experience and discussions with others (mostly Mark Finkelstein Mike Page, and Bob Jewett) also came into play. I want to thank everybody who contributed insight and provided feedback, especially the many AZB online forum users who offered useful input. If you want to learn more about the rationale and logic used to determine the factor values, search for and read through the Table Difficulty thread on the AZB online forum.

Table 1 Table Size Factor (TSF)

table size	playing area dimensions (cushion nose to nose)	table size factor (TSF)
12 ft (gigantic)	140" x 70" (355.6cm x 177.8cm)	1.25
10 ft (oversized)	112" x 56" (284.5cm x 142.2cm)	1.10
9 ft (regulation size)	100" x 50" (254.0cm x 127.0cm)	**1.00**
8 ft+ (pro 8)	92" x 46" (233.7cm x 116.8cm)	0.95
8 ft (home table)	88" x 44" (223.5cm x 111.7cm)	0.90
6 ft or 7 ft ("bar box")	72-84" x 36-42" (182.9-213.4cm x 91.4-106.7cm)	0.85

Table 2 Pocket Size Factor (PSF)

pocket mouth size	≤ 3 3/8" (8.6cm)	> 3 3/8" (8.6cm) and ≤ 3 1/2" (8.9cm)	> 3 1/2" (8.9cm) and ≤ 3 5/8" (9.2cm)	> 3 5/8" (9.2cm) and ≤ 3 3/4" (9.5cm)	> 3 3/4" (9.5cm) and ≤ 3 7/8" (9.8cm)	> 3 7/8" (9.8cm) and ≤ 4" (10.2cm)	> 4" (10.2cm) and ≤ 4 1/8" (10.5cm)	> 4 1/8" (10.5cm) and ≤ 4 1/4" (10.8cm)	> 4 1/4" (10.8cm) and ≤ 4 3/8" (11.1cm)	> 4 3/8" (11.1cm) and ≤ 4 1/2" (11.4cm)	> 4 1/2" (11.4cm) and ≤ 4 3/4" (12.1cm)	> 4 3/4" (12.1cm) and ≤ 5" (12.7cm)	> 5" (12.7cm) and ≤ 5 1/4" (13.3cm)	> 5 1/4" (13.3cm)
pocket size factor (PSF)	1.55	1.46	1.38	1.31	1.25	1.20	1.15	1.10	1.05	**1.00**	0.95	0.91	0.88	0.85

Table 3 Pocket Angle Factor (PAF)

pocket mouth-throat difference 2" (5.1cm) back from the cushion noses		> 1 1/4" (32mm)	> 1" (25mm) and ≤ 1 1/4" (32mm)	> 7/8" (22mm) and ≤ 1" (25mm)	> 3/4" (19mm) and ≤ 7/8" (22mm)	> 5/8" (16mm) and ≤ 3/4" (19mm)	> 1/2" (13mm) and ≤ 5/8" (16mm)	> 3/8" (9mm) and ≤ 1/2" (13mm)	> 1/4" (6mm) and ≤ 3/8" (9mm)	≤ 1/4" (6mm)
pocket facing angle (can measure directly instead of using the mouth-throat difference)		> 145.3°	> 143.5° and ≤ 145.3°	> 142.6° and ≤ 143.5°	> 141.7° and ≤ 142.6°	> 140.7° and ≤ 141.7°	> 139.6° and ≤ 140.7°	> 138.6° and ≤ 139.6°	> 137.0° and ≤ 138.6°	≤ 137.0°
pocket angle factor (PAF)	PSF≤0.90	1.09	1.07	1.05	1.03	1.01	**1.00**	0.98	0.96	0.94
	0.90<PSF<1.10	1.14	1.10	1.07	1.04	1.02	**1.00**	0.98	0.97	0.95
	PSF≥1.10	1.20	1.14	1.09	1.05	1.02	**1.00**	0.99	0.98	0.97

Table 4 Pocket Shelf Factor (PSF)

pocket shelf depth		> 2 1/4" (57mm)	>2" (51mm) and ≤ 2 1/4" (57mm)	>1 3/4" (44mm) and ≤ 2" (51mm)	> 1 1/2" (38mm) and ≤ 1 3/4" (44mm)	> 1 1/4" (32mm) and ≤ 1 1/2" (38mm)	≤ 1 1/4" (32mm)
pocket shelf factor (PLF)	PSF≤0.90 or PAF≤0.90	1.07	1.03	1.01	**1.00**	0.97	0.93
	0.90<PSF<1.10 and 0.90<PAF<1.10	1.10	1.05	1.03	**1.00**	0.98	0.95
	PSF≥1.10 or PAF≥1.10	1.15	1.07	1.03	**1.00**	0.99	0.98

Again, the table difficulty factor is calculated by multiplying each of the measured factors:

$$TDF = TSF \times PSF \times PAF \times PLF$$

Table 5 lists typical measurements and TDF values for a wide range of common tables. For example, for a Bonus Ball table, the table size is 9' (TSF = 1.00 from **Table 1**), the pocket mouth size is 3 7/8" (PSF = 1.25 from **Table 2**), the throat size is 3 3/4" giving a mouth-throat difference (3 7/8" – 3 3/4") of 1/8" (PAF = 0.97 from **Table 3**), and the shelf depth is 3/4" (PLF = 0.98 from **Table 4**). This gives a table difficulty factor of: 1.00 x 1.25 x 0.97 x 0.98 = 1.19. This implies that a Bonus Ball table plays about 19% tougher than a WPA-spec "standard" table. Based on the numbers in **Table 5**, a Pro-Cut Diamond (TDF=1.07) is about 7% tougher and a typical 8' home table (0.84) is about 16% easier than a WPA-spec table.

Table 5 Table Difficulty Factor (TDF) Examples

table type	table size: TSF	pocket mouth size: PSF	mouth-throat difference: PAF	shelf depth: PLF	table difficulty factor (TDF)
tough 10' table	10': 1.10	4": 1.20	3/4": 1.02	1 7/8": 1.03	**1.39**
Bonus Ball table	9': 1.00	3 7/8": 1.25	1/8": 0.97	3/4": 0.98	**1.19**
Pro-Cut Diamond	9': 1.00	4 1/2": 1.00	1": 1.07	1 3/4": 1.00	**1.07**
WPA-spec "standard"	9': 1.00	4 7/16": 1.00	9/16": 1.00	1 5/8": 1.00	**1.00**
Brunswick Gold Crown	9': 1.00	4 7/8": 0.91	3/4": 1.02	1 1/2": 0.98	**0.91**
8' home table	8': 0.90	4 3/4": 0.95	5/8": 1.00	1 3/8": 0.98	**0.84**
Valley/Dynamo "bar box"	7': 0.85	4 1/2": 1.00	0": 0.95	3/4": 0.95	**0.77**

One way the TDF can be used is to adjust numbers from any scoring or rating system like the BU Exams, "playing the ghost" drills, the Hopkins Q Skills drill, or the Fargo rating drill (for detailed descriptions of each, see the "rating systems resource page" in the FAQ section at *billiards.colostate.edu*). An effective score, taking table difficulty into consideration, can be calculated with:

(effective score) = (raw score) x TDF

An alternative is to just determine a qualitative descriptor for the table based on the TDF ranges in **Table 6**. These descriptors can help put a score or rating in better perspective. For example, a BU score of 160 on a "very tough" table is much more impressive than a 160 on a "very easy" table. Applying the **Table 6** descriptors to the tables in **Table 5**, a Bonus Ball table would be classified as "very tough" and a Valley/Dynamo "bar box" would be classified as "very easy." And a Pro-Cut Diamond is "tough" compared to "easy" for a Gold Crown."

Table 6 TDF qualitative descriptors

TDF	< 0.70	0.70-0.85	0.85-0.95	0.95-1.05	1.05-1.15	1.15-1.30	> 1.30
table difficulty	too easy	very easy	easy	average	tough	very tough	too tough

Where does the table you usually play on fall on the TDF scale? When you get a chance, take some measurements and calculate the TDF and see how it compares to some of the typical tables in **Table 5**. Also, if you haven't taken the BU playing-ability and rating exams yet, give them a try. Everything you need to prepare for and take the exams is available for free on the BU website (*BilliardUniversity.org*). It's time to see where

you rank and work to graduate your game to the next level. Just don't try to boost your ego by taking the exams on a table that is "too easy."

Good luck with your game,
Dean Dave

NV D.1 – BU - Part 1: Introduction - overview of the BU process for earning a pool diploma
NV D.2 – BU - Part 2: Table Setup - preparing to practice and take the BU exams
NV D.3 – BU - Part 3: Video Recording - recording official exam runs for online submittal
NV D.4 – BU - Part 4: Exam I Overview - demonstrations and scoring of the Fundamentals Exam
NV D.5 – BU - Part 5: Exam II Overview - demonstrations and scoring of the Skills Exam
NV D.6 – BU - Part 6: Submittal and Wrap Up - applying for a BU diploma online
NV D.7 – Pool Fundamentals - The Stance - from Vol-I of the BU instructional DVD series
NV D.8 – Stun Shot Drill - from Vol-II of the Billiard University instructional DVD series
NV D.9 – How to Aim Pool Shots - from Vol-II of the BU instructional DVD series
NV D.10 – Draw Shot Trisect Aiming System - from Vol-II of the BU instructional DVD series
NV D.11 – Cue Ball Control Target Pool Drill - from Vol-II of the BU instructional DVD series
NV D.12 – Safety Drill - from Vol-III of the BU instructional DVD series
NV D.13 – Kick Shot Aiming Systems - from Vol-III of the BU instructional DVD series
NV D.14 – Pool Break Technique Advice - from Vol-III of the BU instructional DVD series

normal video

TP 3.4 – Margin of error based on distance and cut angle
TP 3.6 – Effective target sizes for slow shots into a corner pocket at different angles
TP B.15 – Pocket geometry calculations

technical proof

PS:

- I know other authors and I tend to use lots of terminology, and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you don't fully understand, please refer to the online glossary on my website.

Dr. Dave is author of "The Illustrated Principles of Pool and Billiards" book and DVD, and co-author of the "Video Encyclopedia of Pool Shots (VEPS)," "Video Encyclopedia of Pool Practice (VEPP)," and "Billiard University (BU)" instructional DVD series.