Annotated Glossary for Practical Knot Tyers

The principles that guided the compilation of this glossary, given at the end, may also explain some perceived limitations. Special thanks are due to Maurice McPartlan and David Pepper: editors of IGKT "Knotting Matters" who made many valuable contributions to the published form. Any errors that remain are the sole responsibility of the author. To remain useful, a glossary must evolve with accepted usage, and IGKT is well-placed to guide such a process. Perhaps IGKT members will contribute companion glossaries in other languages or knotting traditions, or deal with the many areas that broadly may be described as "decorative knotting".

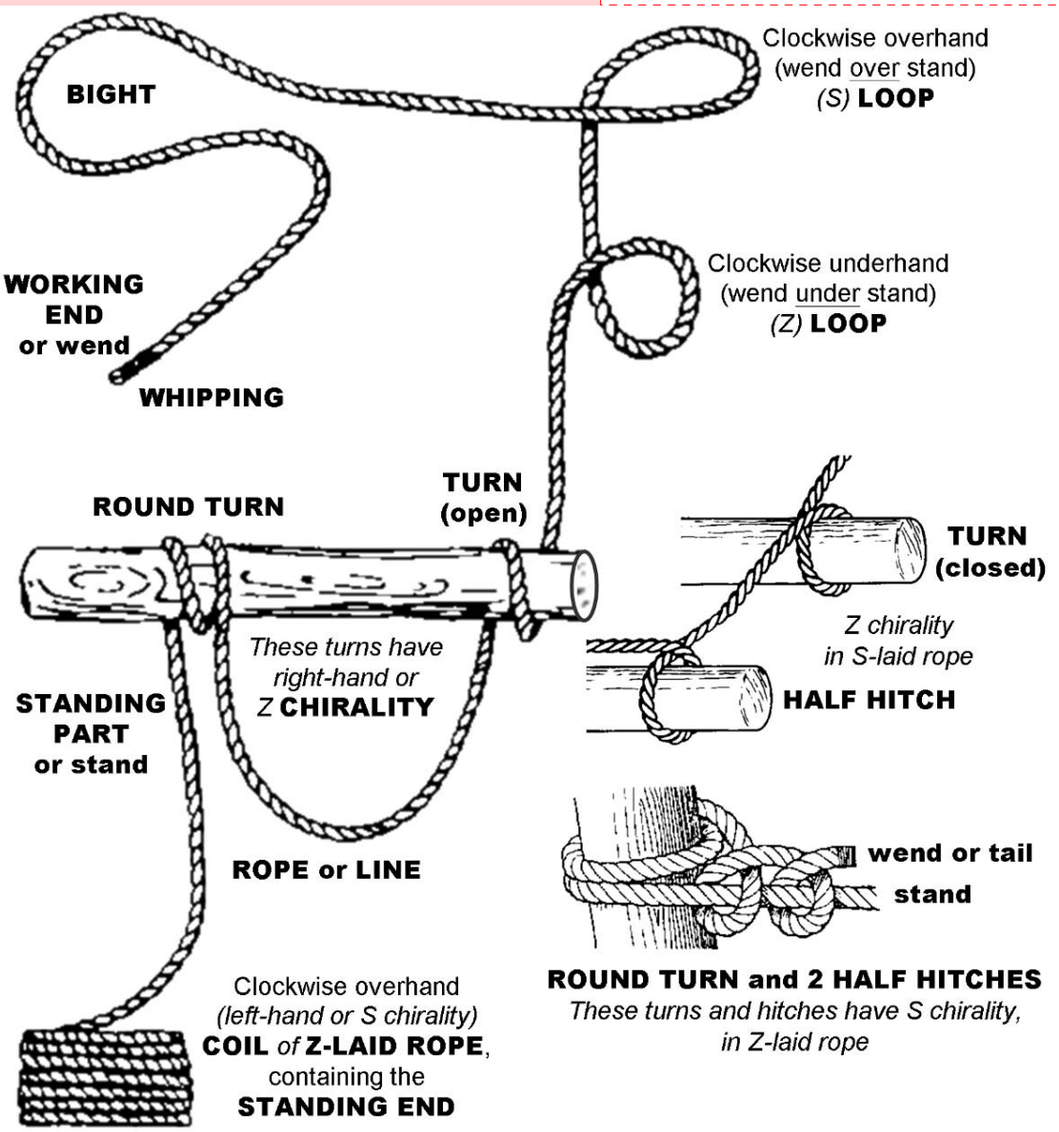
Typographic conventions applied in this glossary

Bold is used at first definition of a term.

Italic is used for a term defined elsewhere in the glossary. Italics are not used for such terms within common names for individual knots (which are generally followed by reference to an illustration number).

Greyed text is used for historical usage of a term with a different current use, or for a non-preferred synonym.

Underline is used for emphasis.



Comment [RGB1]: Most readers should use the Glossary as it appears on the IGKT web site. This commented version may assist those who seek more information about sources for information collated herein.

Comment [RGB2]: Tyers (as in the name of the Guild) is used here instead of tiers, which is more widely accepted and correct according to the rules for spelling in English (Peters 1995 pp 222-223, 359, 822). The word now tie was once tye (Emerson 1754). Des Pawson recalls that the IGKT founding meeting decided on tyer because "tier deck was an inferior place on board ship (KM 15, 6-7; Nares p 83). But meaning is usually clear in context: in ships there is a cable-tier, but is there a knot-tier? Similarly, there is usually no confusion whether a layer refers to a hen or a part of a cake; or between tyre, tire and tier.

Indeed, the two tiers may be homographs, but they are not homophones, so confusion is even less likely than with some other homonyms (like bear) in English.

Compared with drier (the person) vs dryer (the apparatus); or flier (the aircraft pilot) vs flyer (the brochure or the passenger); or crier (the guilded vocation) but not dyer (which reflects a dire need to distinguish between those engaged in dyeing vs dying vs dieing); it seems that members of IGKT, while by affiliation clearly tyers, are in their activities (when tying) properly *knot* tiers.

Or we could just consider it a tie.

Comment [RGB3]: The introductory figure is modified from images believed to be in the public domain and first depicted by Natural Disaster Organization, Australia (1984) and Ministry of Defence, Britain (1951). The NDO figure has been copied many times, sometimes with errors.

The 'Admiralty Manual of Seamanship' has depicted a *half hitch* as defined in this glossary since 1908. Since 1951, it has been in a figure titled 'Elements of bends and hitches'. Hopefully some old sea dog by now has reminded the Admiralty of the difference between a *turn* and a *round turn* in knotting, which differs from the use of the same term in describing a foul hawse.

But even Ashley (1944) gets *turn* vs *round turn* wrong at times (eg #183, 336, 515, 534, 727, 1168, 1176, 1251, 1317, 1732 etc).

Canadian Armed Forces made this correction long ago in their 'Seaman's Handbook CFP 152' (1972, Figure 10-20); and their 'Seaman's Handbook BRCN 3029' (1960 Figure 7-27) provides clear guidance on *half hitch*.

Historical terminologies had indistinct boundaries between knotting terms (Day, 1947) whereas the modern uses of *bight, loop, turn* and *half-hitch* as structural elements in knots, along with *eye knot* as a structural class, and *bend* and *hitch* as functional classes of knots, have very clear distinctions as presented here.

A **bend** is a *knot* that joins two or more *lines*, or that joins parts of one *line*; provided that it requires a structure such as a *bight* or *loop* in each of the *lines* or parts so joined. *Bends* are usually, but not necessarily, made near the *working ends* of the *lines*.

In historical usage the term bend has been applied more broadly, as (noun) a *knot* used to secure or bind a *line* to anything, or even a round *seizing* in an anchor clinch (Lever, 1808), or (verb) the act of securing a *line* to anything. The narrower usage is recommended, to distinguish *bends* from *hitches* as functional classes of *knots*. Two *lines* may be **bent** together; or one *line* may be *hitched* to another; but by the recommended usage these terms are mutually exclusive.

This definition of *bend* as a functional class of *knots* implies that confusing names applied historically (in English) to a few *knots* should be corrected. The *knot* used to join *working ends* by a pair of overhand knots, each made around the opposing *standing part*, (sometimes called the fisherman's knot, *ABOK* #496, #1414) is better called the fisherman's *bend*. The *knot* modified from a round turn and two half hitches, by *tucking* the first *half hitch* under a *turn*, (sometimes called the anchor or fisherman's bend, *ABOK* #1723) is better called the anchor or fisherman's *hitch*. Similarly, the *hitches* that are historically called the studding-sail bend (*ABOK* #1678), and the topsail halyard bends (*ABOK* #1677, #1679) should be named as *hitches*. In some languages, these *hitches* have long been called just that.

The usage in knotting probably originated from the fact that a *line* must be bent (in the wider sense used outside of knotting) in order to form any *knot*. Bend and bind have shared derivation.

A **bight** is a curved length of *line*. It may be a **closed bight** (if the two arms of the *bight* touch each other without crossing), or an **open bight** (if the two arms of the *bight* do not touch each other). If the *line* crosses itself, the *bight* becomes a *loop*.

Historical usages of bight include: (a) any part of a *line* between the *standing end* and the *working end* (*ABOK* #29); and (b) an analogy in *cordage* to a geographic use of the term (a bay no narrower than a semicircle, *ABOK* #30). These historical usages are superseded in common current use by: (a) the *stand*; and (b) a widely open *bight*.

Some *knots* can be "**tied in the bight**", meaning without access to the *ends* (eg *ABOK* #1034-#1059, #1773, #1815). This usage is derived from deprecated usage (b) of bight, and it might be argued that a change should be urged to "tied in the *stand*". However, "*tied in the bight*" is part of the current widespread jargon of *knotting*, and the tying of *knots* in the bight does commonly involve the use of a *bight* in the sense recommended here (in *TIB* methods for the clove hitch, the *bight* very quickly becomes a *loop*). "**Tied with a bight**" has a different meaning: forming a doubled version of a *knot*, with the end of the *bight* emerging as the *tail*.

Bights are very important in *knotting*. For example, a reef knot (*ABOK* #1402) comprises two interlocking *bights* (*collars*).

A **block** is a device with an aperture, used to change the *lead* of a *rope*. *Blocks* may be compounded to increase the mechanical advantage of a **tackle** (a combination of *rope* and *blocks*). The simplest durable *blocks* are hard wooden thimbles or "fiddles". To decrease both friction and wear on the *rope* (also called a **fall**), most *blocks* include grooved wheels (pulleys, sheaves or shivs) which can rotate on an axle or bearing. *Blocks* and their wheels should be sized to suit the *rope*.

Comment [RGB4]: pp 12, 14 in the 4th edn: "*knots*, *bends* and *hitches* have never been systematically differentiated in the minds of the people who have used them."

Comment [RGB5]: American edition p 94; also Steel (1794).

Comment [RGB6]: The distinction can be subtle. For example, when the *bight* for a sheet bend structure is provided by any solid other than a flexed *rope* (eg the becket on a *block* or even the reinforced clew on a sail), the structure is better classified as a becket *hitch* rather than a sheet *bend*, though the structural similarity is obvious. The grey area is exemplified when the *bight* is provided by an *eye splice*. If the *eye* is long, it may be impossible to tell from inspection of the vicinity of the *nub* whether a becket *hitch* or a sheet *bend* is being examined.

Comment [RGB7]: For an example of the confusion that can arise from naming a fisherman's *knot/bend* vs *bend/hitch*, see Compton 2013, p 25. Parts of the rescue community already commonly refer to the DF as a double fisherman's or double overhand *bend* (eg Holton 2009, Seattle Fire Department Training Division 2009). It has also been called the grapevine *knot*, to emphasise that the double thumb *knots* are dressed in the grapevine form rather than the open form.

Comment [RGB8]: Saxon: binden

Comment [RGB9]: Tied "on, in, or upon" are generally synonyms (eg *ABOK* #1080) but beware common names that do not follow this convention (eg *ABOK* #1057, # 1058).

Comment [RGB10]: *Knots* tied "with a *bight*" are commonly tied "in the *bight*", even if they are used at the *end* of a *line*, in which case the *tail-bight* may be a functional *eye*. eg Ashley 1944, pp 188-192.

Comment [RGB11]: The terminology of *standing*, running and hauling parts; and the need to flip a *rope coil* formed in a belayed fall in anticipation of a change from a *standing* to a running role, when the rope runs back through the *block*; are peculiar to the use of *tackles* (eg 'Admiralty Manual of Seamanship' 1951). They differ from the common use of some of the same terms and concepts in knotting as applied elsewhere in this glossary.

Blood knot is widely used for *knots* with multiple *turns* around a *standing part,* especially in fishing *line*. In the USA, these are commonly called **clinch knots** (when used to attach a *line* to an eye in a fishing hook or swivel as in *ABOK* #300; Day #140) by analogy to the starting structure in *ABOK* #1131, #1496; Day #87; or **barrel knots** in reference to their shape (*ABOK* #295, #1413; Day #45, #138). However, Platts (1938) clearly illustrates: (i) as the barrel *knot*, what today is often called the grapevine or double fisherman's *knot* (or *bend*) (*ABOK* #294, #1415); and (ii) as the blood *knot*, what Ashley calls the barrel *knot* (*ABOK* #295). Published use of (double) blood *knot* for *ABOK* #295 goes back at least to Chaytor (1910), who describes learning it in 1892. Ashley also gives a morose historical use of blood *knot* for a double overhand *knot* (*ABOK* #508). This is a reminder that the same *knot* is sometimes known by very different common names, and the same common name is sometimes applied to very different *knots*. Generally, any doubts about a structure can be resolved with the aid of clear illustrations.

Comment [RGB12]: Some American climbers call the triple fisherman's *knot* the barrel *knot*, whereas some English climbers use this name for a double-overhand slip-*eye* (*noose*) cf: 'On Rope' vs 'Life on a Line'. Barnes ('Angler's Knots' 1951) agrees that the name 'blood *knot*' probably originated with *knots* used in whips, then was applied to fishing *knots* with a resemblance to some of them in final form. He provides lengthy analysis of 'Chaytor blood *knots*' (= 'Ashley barrel *knots*') used in fishing; and notes both the convenience and complications of communication using common names for *knots*. He reminds us that many elements of terminology may vary between fields (eg, Barnes' definitions of coil, collar, draw, loop, point, whipping, etc).

Braiding or **plaiting** (historically also platting) is the process of folding strands over each other, or of *tucking* successive *loops* in a single strand, to produce *cordage*, mats or other practical or decorative items. The product is a **sinnet** (sennit). The term *braid* was formerly applied primarily to flat *sinnets* (Ashley, 1944), or to crown *sinnets* with parallel surface strands (Warner, 1992); with *plait* sometimes restricted to variations on the round *sinnet* with crossed surface strands (Warner, 1992). However, this distinction has not been maintained, and the terms *braid* and *plait* commonly now are used interchangeably. While *braids* were greatly elaborated by past seamen (*ABOK* Chapters 37-39), their use as *cordage* was far less than spiral-*laid ropes* because *natural fibres* needed to be twisted together for *strength* of the resulting *cordage*. Following the advent of long *synthetic fibres*, machine-*braided cordage* predominates for many applications, particularly where either torsion or stretch under tension is undesirable, and where expense is not a primary consideration. Modern *cordage* commonly has several layers (as in double *braids*) and may have hybrid construction (as in some *kernmantle ropes*).

Comment [RGB13]: pp 3-4

Comment [RGB14]: pp 185-191

Comment [RGB15]: p 471

Comment [RGB16]: p 8

To **capsize** (or flip) a *knot* is to alter its structure substantially, by pulling on one or more of the *lines* emerging from the *nub* of the *knot*. Sometimes *knot* elements are deliberately *capsized* as part of a way of tying, using, or *opening* a *knot*. In other cases, *capsize* results from inappropriate loading of the *knot*, and it is problematic if the *capsized* form is less *secure* or if it has less *strength* than the intended form of the *knot*.

Comment [RGB17]: The only English word of more than one syllable in which *ize* can not be substituted by *ise*. This is because the *ize* is not a suffix but it is rather derived from an integral part of the root word – the Spanish *cabezar* "sink by the head" according to Peters 1995, p 116.

Chirality is the property of a structure that can not be superimposed on its mirror image. *Laid ropes* and *loops* are *chiral*, as are human hands, feet, gloves and shoes. In physics, the *chirality* of a spiral or helix is designated according to the hand which, when grasping the helix with the fingers following the coils, points the thumb in the direction of progression of the helix. Thus a common bolt or screw thread has right-handed *chirality* (but bolts and screws with left-hand threads are made for special purposes). Spiral-*laid ropes* commonly have right-handed *chirality* in the final arrangement of twisted strands in the *rope*. This is also referred to as *Z-laid rope* because of the slant of the strands when the *rope* is held vertically. But left-hand (*S-laid*) *ropes* are also made for special purposes.

Because *loops* (and their derivatives including *coils*, *turns* and *half hitches*) have *chirality*, *knots* with a single *loop*, *turn* or *half hitch* (such as a common sheet bend or a bowline knot) can be made in right-hand or left-hand *chirality*.

This is not the same as a confusing usage of "left-handed" to indicate a "perverted knot, tied contrary to the prevailing practice" (Ashley, 1944) as in a "left-hand sheet bend" (*ABOK* #67)

Comment [RGB18]: p 601

which has oblique *tails* or a "left-hand bowline" (*ABOK* #1034½) which has the *tail* outside of the *eye*. Indeed, views about what constitutes prevailing practice vary between *knot* tyers. The confusing usage is not recommended.

There is commonly a mixture of *chiralities* in multi-*loop knots*. The reef knot (*ABOK* #1402), cow hitch (*ABOK* #1673), and figure eight knot (*ABOK* #520) are among the simplest amphichiral *knots*; but even these exist in S/Z and Z/S forms if one is able to distinguish the order in which *loops* were tied (Chisnall, 2016).

It is generally agreed that in achiral or amphichiral *cordage*, *loop chirality* will have no substantial effect on *knot strength*, *knot security* or *rope* life. In spiral-*laid rope*, a particular *loop chirality* can increase friction and *security*, eg in a timber hitch (*ABOK* #1665, #1733) *dogged with the lay*. But there is little published evidence, and experts disagree, on any advantage in the *chirality* of single *loops* made in *knots* used in *chiral ropes* (reviewed in Warner, 1996). It is likely that any effect depends on the *rope* material, and the extent of tightening the *lay* during manufacture. Deep-water sailors in the age of tall ships were perhaps most alert to effects on the longevity of *rope* subject to frequent re-knotting, because at that time *rope* was relatively expensive and in limited supply on long voyages. They wove hide strips into *rope* to address chaffing in *nipped* areas of rigging (Alston, 1860). There is some evidence that they preferred S *chirality loops*, *turns* and *half hitches* in simple *knots* made in *Z-laid ropes* (Svensson, 1940); but this was evidently over-ridden by speed or convenience in casting a *knot*, eg by a right-handed sailor making the common bowline knot with Z *chirality nipping turn*.

Although some illustrators depict *knots* with seemingly random *chirality*, many *knot* tyers tend to stick with the same tying method (and thus the same *loop chirality*) for the *knots* familiar to them. This has some forensic applications (Chisnall, 2016).

The *chirality* of a *rope* also affects the optimal method for *coiling* that *rope*.

Classification of *knots*, or sorting into groups, is done in many ways according to the interest of the classifier. For the *knot* tyer to avoid confusion, it is most useful to consider whether a particular grouping is based on function, structure, or both. In this glossary, *bend*, *hitch* and *stopper knot* are the main functional classes, but some structural features have been used to make these classes mutually exclusive. Other common functional groupings are generally self-explanatory: eg binding *knots*, button *knots*, occupational *knots,* decorative *knots* etc. By comparison, *eye knot, splice* and *sinnet* are defined in this glossary in structural terms. Other common structural groupings are generally self-explanatory: eg crossing *knots*, single-strand *knots*, multi-strand *knots* etc. As many *knots* have multiple structural elements and multiple potential uses, it is common for the same *knot* to fall into several such groups (exemplified by Ashley, 1944). Warner (1992) attempted a classification based on the distribution of *nip*, but admitted the difficulties and provided alternative groupings of knots in his compilation. Unlike the classification of organisms by biologists, based on the underlying principle of evolutionary relatedness; no dominant principle for the classification of *knots* has emerged to satisfy the diverse purposes of *knot* tyers.

A **coil** is a series of *loops*, which need not lie around a solid, and may be formed in hand or on a surface. *Coils* in *Z-laid rope* are commonly laid down clockwise (with S *chirality*) because in this direction the *lay* of the *rope* is best able to absorb the *kinks* that result when *line* is drawn off the *coil*. *Kernmantle rope* may have an achiral core (parallel untwisted strands), or an amphichiral core (a mixture of *S-laid* and *Z-laid* components, or a braid). *Braided ropes* are typically amphichiral (with an equal number of *braids* or *plaits* in each direction). Such *ropes* are best laid down in a way that does not introduce *kinks*: by **flaking** in a figure eight or in a

Comment [RGB19]: Also Chisnall (2010) cited therein.

Comment [RGB20]: The 'Admiralty Manual of Seamanship 1951' states that the granny *knot* is more prone to slip when made with the *lay*, or *jam* when made against the *lay*. Chisnall 1995 (*KM* 51, 40-49) gives data-free observations on effects of *chirality* in reef, water, fisherman's and sheet *bends*, along with result-free claims of effects in clove and girth *hitches*.

Comment [RGB21]: p 102 "a strip of soaked hide is worked between each strand of the *rope* where the *nip* takes". See also Bushby (1902-26) p 26 for effect of padding on *knot strength*.

Comment [RGB22]: See p 52, interpreted in context of material on pp 22, 26, and 53-113. Bushby (1902-26) pp 27, 31 etc is unequivocal that *stability* is higher in *knots* tied against the *lay* (even *dogging* timber hitches against the *lay*, which is unusual).

Comment [RGB23]: Ashley (1944) and Warner (1992) use "crossing *knot*" to mean fastening a *rope* at about a right angle to an object of round cross section, leaving two free *rope ends*; though they phrase it differently.

Comment [RGB24]: As pointed out in 'The Admiralty Manual' (1951), Toss (1984), and Asher (1989), it is necessary to give the *rope* a slight twist with each *loop* to make it sit flat. These twists are in the direction that opens the *lay*. When line is drawn off the *coil* (without twisting each *loop*) the *rope* is able to absorb some opening of the *lay* without kinking. This has 3 consequences: (i) the twisting puts kinks in the *rope* yet to be *coiled*, and these have to be shaken off the *end*; (ii) thus *coiling* must progress away from the belay so that the kinks can be shaken off the free *end*; and (iii) the *coil* must be flipped on completion if it is later required to run from the belay (first-coiled *end*). Even so, there is a limit to the twists that can be absorbed, so kinking will be apparent especially with: hard-*laid* ropes, numerous *loops* in the *coil*, repeated *coiling*, and uses that restrain the *ends* from twisting to shed the kinks. To minimise the problem of kinking: (i) make *loops* as large as possible, and/or (ii) put up with an untidy *coil* which does not require twisting to make the *loops* sit flat (this is the effect in the figure 8 *coil*). Unfortunately these solutions bring other problems such as increased risk of tangling which are over-riding concerns for rescue throws etc.

zig-zag pattern (*ABOK* #3110-#3113), or by alternating overhand and underhand *loops* to yield an **alternating or kink-free coil** (Warner 1992, #23). Historically, the term flaking (or faking) was used for any kind of *coiling* (Ashley, 1944). *Coils* of *rope* may be left untied so that *line* can be drawn off, or they may be secured by various means for transport or storage.

> **Flemish coiling** or **cheesing** is laying down a *rope* such that that the *line* never crosses itself to form a *loop*, but instead forms a spiral of ever-increasing diameter. If there are several stacked layers commencing alternately at the centre and the outside, the structure may be called a **French coil** (*ABOK* #3012-#3014). In either case it is a decorative form, less suited than either *flaking* or an *alternating coil* if *line* is to be drawn off quickly through a *block*.

A **collar** is a *bight* (usually a *closed bight* or a narrowly *open bight*) that passes around a solid, usually another part of the same *knot*. The term is sometimes used in a related sense for the region of a *bight* that is in contact with a solid around which the *bight* passes, or for the region where a *bight* (or even a *loop* or an *eye*) makes a *U-turn* around a solid. Then the *collar* may be distinguished from the arms (or legs) of the *bight* (or *loop*). For example, the *nub* of a common sheet bend (*ABOK* #1431) comprises a *half hitch* around the arms of a *bight*, with the *collar* of the *bight* around the *standing part* of the *half hitch*.

All of these uses are analogous to the meaning of collar outside of *knotting*, for a band that passes at least part of the way around a neck. Indeed, the part of a *knot* enclosed by a *collar* is sometimes called the neck (Warner 1992, #400). For other examples of uses of *collar* in *knotting*, see *ABOK* #2768 and Warner (1992, #38).

A *collar* is an important structure in many *knots* because: (a) it prevents the *knot* from being collapsed by a pull on both arms of the *bight*; (b) it adds to the friction that keeps the *knot* together in its intended use; and (c) it provides a structure that can be rolled over the *line* around which it passes to assist with *opening* of many *knots*.

Cordage is a collective term for elongated materials including *rope*, *small stuff*, and narrow webbing *tape.* Historically, before the common use of *braided* and *kernmantle ropes*, the term referred to *ropes* that were twisted or "corded" in construction (Ashley, 1944). The term is now generally restricted to materials of *fibrous* construction, to distinguish *cordage* from straps, hoses, "*wire ropes*" and other elongated structures that are less pliable and therefore less suitable for *knotting*. To be useful in *knotting*, *cordage* must be much longer than it is wide. In this sense, *cordage* is sometimes regarded as essentially linear, whereas *knots* are made in three spatial dimensions (or more dimensions in theory). The composition and construction of *cordage* can greatly affect its properties, including the *security* of particular *knots* tied therein.

Dogging means taking one or more *turns* of a *line* around a solid, usually one to which it is *hitched*, in order to provide additional friction and prevent the line from slipping when there is a pull along the underlying solid. To maximise friction when the underlying solid is a *laid fibre rope*, the *line* is always *dogged with the lay* of the underlying *rope*. In other words, the *line* is wrapped in the same direction as a worming (*ABOK* #3337) would be applied to fill the grooves between strands of an underlying *laid* (twisted) *rope*. *Dogging turns* are perhaps best known in the timber hitch (*ABOK* #1665, #1733) and the tail block hitch (*ABOK* #1464, #1751).

Dressing a *knot* is working it into the desired shape. After the passages of *cordage* necessary to form any *knot* have been made, it is generally necessary to **dress** the *knot* and **pack** (or **snug**) the *knot* (hand tighten it after it is in the desired shape), to obtain the greatest *security*, *strength* and/or resistance to *jamming* in use of the *knot*. The term set has been used variously as a

Comment [RGB25]: The alternating twists cancel each other out, so there is no kinking when the *coil* is made or when *rope* is drawn off. It can be made towards the belay. It can be drawn off from either *end*. But it is a bit slower to perform. If time permits, and with the caution below, it is the best method for all *ropes*. Caution: it is essential to avoid either *end* falling through the centre of the *coil*, anytime before rope is drawn off. Otherwise a series of thumb *knots* will be formed in the rope as it is drawn off.

Comment [RGB26]: pp 516, 517, 599

Comment [RGB27]: Ashley (1944) provides wry commentary on the strange use of anatomical terms within *eye splices*, in #2729 and #2733.

Comment [RGB28]: Other meanings include: a bifurcation in *rope* (Knight 1901 Plate 18 and p 21); and short strands of gut *knotted* together (Haslope 1905 pp 13 et seqq). I do not think these are widely used.

Comment [RGB29]: pp 24, 598

Comment [RGB30]: See *KM* 115, 12-13

Comment [RGB31]: In contrast, a chain stopper on *wire rope* (which has more strands in a hard lay) may be *dogged* against the *lay*. There are also applications where a 'double stopper' is *dogged* in both directions, in a series of cross-overs, to provide the desired amount of friction with the underlying solid; eg *ABOK* #1767.

Comment [RGB32]: *Dogging* is also used on some ship's hawser stoppers (see *stoppering*) and to haul or anchor lines in some rescue applications (*KM* 147, 44-46; Merchant 2007).
The term dogging has also been used as a synonym for a *whipping* applied to adjoining half-strands to complete a *splice* (as an alternative to tapering and/or serving the *splice* (Admiralty Manual of Seamanship 1951-2009). To avoid confusion, this use of the word is not recommended. It may have arisen as an abbreviation of dogknotting (Warner 1992, #254E). Ashley (1944) says to "cross whip" half strands emerging from hawser and cable *eyes* (#2760-61). Earlier editions of the 'Admiralty Manual' say to "sieze" half strands together.

synonym for *pack*, or for both *dressing* and *packing*, and is therefore not recommended. *Knots* of more complex structure generally require more careful *dressing* and *packing*. Failure to complete this process may leave a *knot* that is prone to slip, *capsize* or *jam* under load. Therefore, careful *dressing* and *packing* are often as important in practical *knot* tying as the correct weaving of *cordage* to form the *knot*.

Comment [RGB33]: Ashley 1944 pp 18, 28 says that "*knots* must first be tied (formed) and then worked (drawn up into shape)".

An **end** is either extremity of a *line*. Commonly, one *end* is fixed or distant from the *knot* tyer and is called the *standing end*, whereas an *end* engaged in the tying of a *knot* is called a *working end*. Some *knots* can be *tied in the bight*, without involving either *end*.

An **eye knot** is one which provides a *bight* of *cordage* (the **eye**) outside the *nub* of the *knot*. The *eye* may be **fixed** as in an angler's loop (*ABOK* #1017) or eye splice (*ABOK* #2725); or it may slip as in a **noose** or running *knot* (eg *ABOK* #1114). Some *knots*, like the crabber's eye knot *ABOK* #1987 may be *capsized* from a *noose* to a *fixed eye* by a sharp pull on the *tail*. More worryingly for some applications, some *fixed eye knots* (like the bowline *ABOK* #1010) can be *capsized* by inappropriate loading into *nooses*. Cyclic adverse loading may be most problematic.

Comment [RGB34]: Some references differentiate between *eyes* formed when both arms emerge through the same aperture (as *bights*) vs *eyes* formed with each arm entering the *nub* through a different aperture (held not to be *bights*). However, nothing in the definition of *bight* requires the arms to emerge from one (or any) aperture. Thus, while the differences between structures of *eye knots* are interesting, this restriction on *bight* terminology is not recommended.

Note that *eye knot* is a structural definition, and such *knots* may be used as *hitches* or to form *bends* (eg a bowline knot may be used as a *hitch* around a bollard *ABOK* #1783, #1787; and two bowline knots may be interlocked to make a hawser bend *ABOK* #1455).

The term "loop knot" or merely "loop" historically has been used for such structures (*ABOK* #33). To avoid confusion with other uses of the term *loop*, it is preferable to use *eye knot*.

Comment [RGB35]: Even Ashley (1944 pp 44, 114) uses "loop or eye". The term "eye knot" was preferred by Haslope (1891 p 137). Burgess (1884, p 32) also refers to the "loop or eye" of a bowline *knot*. The term may have arisen by analogy to "eye splice" which is recorded in written English before 1770 (OED cites Falconer 1769).

Manwayring (1623) describes the legs of the martnets: "either end being ſpliſed into themſelves, they have a little eye". He writes (under Splice) "alſo when we would make an eye at the end of a rope, we take the end of the rope and undo the ſtrands, and ſo opening the ſtrands, where we would have the ſplice, with a ſide, we draw in the ends of the ſtrands, and ſo weaving of them orderly, make the ſplice. He uses eye in many other ways (eg dead-man-eyes, slings, straps and voills).

Harriot (before 1620) mentions in relation to "mision bowlinges": "... ropes fast to the lower end of the yard (with a button of wood and an eye) ...".

To **fair** a *knot* (particularly a *splice*) is to make it smooth or even in order to improve its appearance or function.

Fibres (or fibers) are the smallest components used in the manufacture of *cordage*.

> **Natural fibres** used in *rope* making have been mostly from plants (grass, palm, hemp, jute, sisal, flax, cotton, manila or abaca *etc.*), but *fibres* of animal origin (hair, silk, tendons, leather strips) have also been used. The *rope fibres* (slivers) obtained by rotting or drying and combing plant stems were generally vascular bundles comprising multiple "**ultimate fibres**" (elongated plant cells). *Natural fibres* have limited length, and must therefore be twisted together to obtain *cordage* of useful length and *strength*. In some plant species traditionally used for *rope* making the *ultimate fibres* have spiral thickening of the cell walls, with left-hand or S *chirality*. Although these cellulosic coils are only visible by microscopy, they can affect the direction in which *rope fibres* tend to *coil* or provide maximum *strength*. This may help to explain the traditional preference to spin the *fibres* into yarns with Z *chirality*, then form the yarns into strands with S *chirality*, and *lay* the strands into *ropes* with Z *chirality* (as alternating *chirality* at each level of construction results in a stronger and more stable *laid rope*).
>
> **Synthetic fibres** are solid but flexible man-made polymeric chemicals, first developed in the 1930s and now the major components for industrial *rope* making. These polymers can be extruded in very long filaments, so they need not be twisted if they can be held together by other means, such as a *braided* cover around parallel *synthetic fibres* in some *kernmantle ropes*. *Synthetic fibres* may also be chopped into convenient lengths (staple fibres) for the manufacture of *laid ropes*, where the *fibre* ends make an important contribution to the feel and surface friction of the *rope*. Sheets of synthetic materials have also been cut into thin strips (split film) for use in the manufacture of *cordage*.

The properties of *rope fibres* and the method of *rope* manufacture have profound impacts on *rope* characteristics that are relevant to *knot* tyers and users: including hand feel, *rope strength*, elasticity, stiffness, specific gravity, temperature (melting) resistance, surface friction, shrinkage when wet; and resistance to damage through tight turns, chaffing, sunlight and rot. Some *synthetic-fibre ropes* (eg unjacketed braids of high modulus polyethelene, HMPE, sold as spectra or dyneema) are so strong and have such low surface friction that most well-known *knots* will slip apart under tension far below the nominal breaking *strength* of the *line*. Special *splices* developed for such *ropes* are generally used instead of other *knots*.

Comment [RGB36]: Many *synthetic fibres* are weakened at a critical temperature well below their melting point.

Comment [RGB37]: In contrast, *splicing* is not recommended in *kernmantle* climbing or rescue *rope* (Padgett & Smith 1987).

The terminology of **hitches** (***stek*** in Dutch and Swedish, ***stik*** in Danish and Norwegian, ***stich*** in German and ***clé*** or ***clef*** in French) has been chaotic, despite efforts at clarification by several authors. The confusion stems from the use of the same term to describe a structure used in *knots* and a functional class of *knots*. This confusion with a structural element of the *nub* that is neither necessary nor sufficient to define the functional class does not arise in other functional classes of *knots*. Here is recommended a terminology for *hitches* that separates those purposes. It is intended to be logical and unambiguous while preserving insofar as possible the useful distinctions of the past.

Comment [RGB38]: But note that *steek* and its variants commonly were used in a broader sense for *knot*, *bend*, or *hitch*.

In the functional sense, the term **hitch** has been applied to any *knot* that secures a *line* to a solid (and in this sense it includes many *knots* comprising multiple *bights, loops*, *turns* and/or *half hitches* as structural elements). It is recommended that this functional use of *hitch* be retained.

Comment [RGB39]: cf Manwayring (1623): "To Hitch. Is to catch hold of any thing with a rope, to hold it fast, ..."

It is generally agreed that in this functional use, when the solid is another *line*, the *hitch* should be made entirely by one *line*, with the other serving only as a solid around which the *hitch* is made. This helps to distinguish *bends* from *hitches* as functional classes of *knots*.

The term hitch has sometimes been taken to exclude *knots* in which the solid is another part of the same *line*, or any *line*; and it has sometimes been restricted to those *knots* that fall apart on removal of the solid around which the hitch was made; but these restrictions are not implied in the recommended usage.

In the structural sense, the term hitch has been applied to a *turn* of *cordage* around a solid, with the *line* arranged to confer some *nip* or pressure on itself. It may be useful to note that just as a *turn* is a special class of *loop*, in this structural sense a hitch is a special class of *turn*. It is recommended that the term *half hitch* be used for this structure. The term *half hitch* is widely used at the time of writing in this recommended structural sense.

Comment [RGB40]: eg the 'Admiralty Manual of Seamanship' has depicted a *half hitch* as defined in this glossary since 1908 (p 59 in the 1915-1941 printings). Since 1951 (p 114) it has been depicted as defined here in a figure titled 'Elements of bends and hitches'.

The Royal Canadian Navy 'Seaman's Handbook' (1960) provides unambiguous guidance (in Figure 7-27) that the same name applies to the same structure used in various ways.

In this context:

(i) A **half hitch** is a *turn* of *cordage* around a solid, with the *turn* arranged to confer some *nip* on itself. The underlying solid may eg be a spar, a *line* (including another part of the same *line*), or several *lines*. This is a structural term. Commonly, the *stand* nips the *wend* onto an underlying solid, trapping the *wend* so that the *half-hitch* structure remains (at least temporarily) when tension is taken off the *wend*. Exceptions include the first *half hitch* formed when tying an isolated clove hitch (*ABOK* #1176, #1777) or a buntline hitch (*ABOK* #1711) with the *end*. In such cases, the *wend* passes over the *stand*. This structure will slip instantly under any tension on the *stand* if the *wend* is released before it is trapped in the second *half hitch*.

A *half hitch* used alone is rarely *secure* as a functional *hitch* (which may explain the traditional qualification "half"). However, the *half hitch* is a very important structure in *knotting*, because *half hitches* are combined with other structures to form many *secure knots*. For example, the *nub* of a common sheet bend (*ABOK* #1431) comprises a *half hitch* around the arms of a *bight*, with the *collar* of the *bight* around the *standing part* of the *half hitch*.

Comment [RGB41]: Bushby (1902-26) had a different idea about origin of the term. He noted that the length of rope for a U turn with *half hitch* (which in total he called a *half hitch*, though he later noted the ambiguity with the usage recommended here) was roughly half that of a U-turn with equal arms (which he called a *hitch*).

(ii) The term single hitch has been used in various ways, sometimes for a version of a *half hitch*, comprising a single *turn* with the *working end nipped* against another body by the *standing part*.

For reasons detailed in the box below, it is recommended that **single hitch** be reserved as a functional term: for variants on the *half hitch* structure under circumstances in which the *nip* that is caused by the *stand* pressing the *wend* against an underlying solid is sufficient to hold against a substantial pull on the *standing part*, in the absence of other complications involving the *stand* or the *wend*.

In all other circumstances it is better to use a structural description such as "a *half hitch* around the spar", "a *half hitch* around the intersecting *rope*", "a *half hitch* around the arms of the *bight*", "a *half hitch* around the *stand*", or "a *U-turn* around the spar and a *half hitch* around the *stand*".

Historical caution: In early publications, a structure is typically described by illustration or instructions for tying of the simplest or common use; with other versions shown later, if at all. A "half hitch" is described in some seamanship manuals of the 1800s as "the *end* of a *rope* taken around the *standing part* and passed through the bight", with only the illustrations to distinguish this from identical wording in the description of an overhand knot. Some of these manuals also use the term "*half hitch*" in a broader sense, eg in description of a timber hitch with a half hitch, or a sheepshank (eg Luce, 1863).

The term is defined in two ways by Ashley (1944): with (p 14), or without (p 283), a pass around another object. On p 283, Ashley proposes that a *turn* around the *stand* distinguishes "half hitches" (eg *ABOK* #50, #1662, #1663) as a class of "single hitches" (eg *ABOK* #49, #1594). Ashley cites Luce (1863) as the origin of "single hitch", but Luce neither defines nor illustrates a "single hitch". Texts by ship commanders in the 1800s gave no instruction on knots considered to be impractical, but such terms or structures may well have been known in the forecastle (Alston, 1860).

Subsequently, Ashley's proposal has not always been found useful (eg Warner 1992, #10). Even in *ABOK*, "half hitch" is widely used for the structure without a pass around another object, or without a *turn* by the *line* around its own *stand*. When Ashley describes a *half hitch* used in square knotting (*ABOK* #2490); or added to a clove hitch (*ABOK* #1671), backhanded hitch (*ABOK* #1725), water bowline (*ABOK* #1012), or timber hitch (*ABOK* #271); or when he describes two half hitches (*ABOK* #1781), a seized half hitch prepared in hand (*ABOK* #1780), bell ringer's knot (*ABOK* #1147), sheepshank (*ABOK* #1152), rope stopped to chain (*ABOK* #1516), or reeving-line bend (*ABOK* #1459); he uses the sense recommended here.

Ashley's proposal for "single hitch" as a new structural term to be distinguished from "half hitch" met with three serious problems: (i) it was not always possible to discern the distinguishing structural feature (Day #13); (ii) it required a change to long-used knot names that have persisted to the current day (eg *ABOK* #1733, #1748, #3114); and (iii) even Ashley failed to apply it consistently. However, the proposal was accompanied by an important functional insight: a *half hitch*, in a rope with sufficient surface friction, can be useful as a functional *hitch*, if the *stand* presses the *wend* into a shoulder-like structure such as (a) a fork, peg, edge, groove or hole; or (b) other ropework on the solid. This function also usually requires that sufficient tension is maintained to lock the *wend* under the *stand*. Therefore, it is recommended that *single hitch* be reserved as a functional term, as defined above.

Although Day (1947) attributes the demarcation to Ashley (1944), there were earlier flirtations with "a single hitch" to mean something other than one *half hitch*. For example, Haslope (1891) says of "two half hitches" cast in hand (Fig #25, like a clove hitch tied in hand *ABOK* #1773), that the first half of the structure is "a single hitch: it is merely a loop formed in a rope". Of the killick hitch, Haslope (1891) says "After making a timber hitch and hauling it taut, a single hitch is made, and slipped over the end of the stone alongside of it" (Fig #28). The same structure slipped over the bights to form sheepshanks, he calls a "*half hitch*" (Fig #60). Ashley also describes the first half of a clove hitch as a single hitch, although it does not comply with the definition given for that term in *ABOK*.

Budworth (who edited the corrected edition of *ABOK* in 1993) shows in 2015 as a "single hitch" the structure distinguished in *ABOK* as a "half hitch". There is similar inconsistency between authorities in naming of the structure added to a timber hitch to yield a killick hitch (*ABOK* #271, #1733). Adding to the potential for confusion, the *half hitch* structure, with or without the functional quality of a *single hitch*, is sometimes referred to as "a simple hitch" or simply as "a hitch". Even a narrow *bight* has been called a "simple hitch" (Burgess, 1884) and a *round turn* has been called "a single hitch" (*ABOK* #2019). To avoid confusion, these usages are not recommended in naming of knots or knot structures. The current Glossary recommends definitions that avoid such confusion.

Comment [RGB42]: In French a distinction is sometimes made between *barbouquet* (around a spar) and *demi-clé* (around the stand); but a clove hitch is (*deux*) *demi-clés à capeler* (two half hitches reeved), so the distinction is not maintained. See the Canadian Armed Forces 'Seaman's Handbook, (1977 Chapter 10).

Comment [RGB43]: eg: Steel 1794 pp 182-183 and Rigging Plate I after p 180; Dana 1841 p 39 (although he illustrates the overhand *knot* incorrectly in Plate V before p 33); Brady 1841 p 29 (although he *illustrates two half hitches* incorrectly in Plate I before p 35); Russell 1883 pp 64, 99.

Comment [RGB44]: eg pp 11-12; see also Lever 1808 p 2 (Fig 4E).

Comment [RGB45]: the phrase is used only once, in the sense of "one hitch" on p 513 of the 1863 edition and it disappears entirely by the 1891 edition.

Comment [RGB46]: p 112, where incidentally Alston illustrates the sheet *bend* incorrectly.
Ashley 1944 makes a similar point on p 11: "Unfortunately a man is apt to forget in the cabin the things he learned at the forecastle".

Comment [RGB47]: *ABOK* #2490 is essentially as in the introductory figure for this glossary.

Comment [RGB48]: p 36

Comment [RGB49]: Day does not specify which page numbers in Ashley he is referencing, but it is reasonable to think he refers to those I have listed above.

Comment [RGB50]: For Haslope references, Fig #s are given rather than page numbers. Unfortunately, both differ in "Hasluck editions", but they can be searched by text. I have given the original Fig #s from 1891.

Comment [RGB51]: eg in *ABOK* #1773, but not in *ABOK* #1176.

Comment [RGB52]: p 33

Comment [RGB53]: p 24

(iii) A clove hitch **(***ABOK* #1670) comprises two *half hitches* made with the same *chirality* (ends emerge at about 180º). For enhanced *security*, the *tail* should be *locked*.

(iv) A bale, bight, bucket, cow, girth, lanyard, ring, sling, strap or tag hitch; or lark's head / foot (*ABOK* #5, #1673, #1694, #1759, #1859, #1871, #1894, #2018, #2163) is two *half hitches* of opposite *chirality* (ends emerge at about 360º). It is *secure* if pull comes equally on both ends.

(v) A round turn and two half hitches (*ABOK* #1720) comprises a *line* that forms a *round turn* around any solid, followed by a clove hitch around its own *stand*, where the stand enters the *round turn*. The clove hitch must progress away from the solid, or result will be a form of buntline hitch (*ABOK* #1711), which is more liable to *jam* unless the final half hitch is *slipped*.

(vi) By analogy, the structure in *ABOK* #50, #1662, #1663 might be called a "U-turn and half hitch": it comprises a *line* that forms a *U-turn* around any solid, followed by a *half hitch* around its own *stand*, where the stand enters the *U-turn*. To remain in place, the *half hitch* must be formed with the *wend* toward the solid. This *knot* is insecure unless the *tail* is *seized* or otherwise *locked.*

There are many other functional *hitches*.

When a *line* is formed directly into a *half hitch* around its own *standing part*, the *half hitch* structure can be *capsized* to yield a thumb knot or overhand knot **(***ABOK* #46, #514-#515), which is the simplest *stopper knot* .When a *line* is first passed around a solid then formed into a *half hitch* around its own *standing part*, the *half hitch* structure can be *capsized*: (a) with the ends parallel to the *turn*, as a half knot (*ABOK* #47) which is the first half of a reef knot (*ABOK* #1402); or (b) with the ends at right angles to the *turn*, as a marling (marline) hitch used in some *lashings* (*ABOK* #2075, #3115, #3128). Of course, the converse also applies. For example, a thumb knot can be capsized to yield a *half hitch*. A *half hitch* (or indeed a *turn* that exerts no *nip* on itself) can be transferred (with the same *chirality*) between *lines* of similar diameter that are so connected, by changing which *line* is placed under tension (Day #13 C-D).

A *knot* is said to **jam** if it becomes difficult to *open* (untie) after loading. The difficulty in *opening* often increases with the load to which the *knot* has been subjected. **Jamming** (jambing in some older references) can be a desired feature to enhance *security* in a *knot* which is not intended to be heavily loaded, or not intended to be *opened* once made. *Jamming* tends to increase with decreasing diameter and stiffness of the *line*. *Small stuff* is generally cheap and disposable so it is cut rather than *opening* the *knots*, and *jamming* is not then an issue. However *ropes* are more expensive and *knots* made in them commonly need to be *opened* rather than cut out. Then resistance to *jamming* may become a very important feature in the selection of an appropriate *knot*. The susceptibility of any *knot* to *jamming* also depends on the composition of the *cordage*. In potentially tri-loaded *eye knots* such as the lineman's loop or alpine butterfly (*ABOK* #1053), it also depends on the direction of loading.

A *line* or part thereof is sometimes said to jam another that it holds in place temporarily when under load (eg the *stand* is intended to jam the *wend* in a blackwall hitch *ABOK* #1875). This use of the term is not recommended as the boundary is so vague that it may be considered a synonym of *nip*.

Kernmantle (core and sheath) *ropes* have a *braided* sheath around a core which may comprise either parallel or braided *fibres* or a mixture of *Z-laid* and *S-laid* components. The term is sometimes restricted to specialized *ropes* used in climbing, caving and rescue work; to differentiate them from utility *ropes* which are not rated for life-support though they may have a similar cover-*braided* construction. In many kernmantle *ropes*, the core contributes most to *strength* and stretch characteristics; while the cover determines wear resistance and surface

Comment [RGB54]: A *knot* whose many names outweigh its general merits, though it is without peer for use with a closed *eye* on a ring, eg to attach a luggage tag.

The 'Admiralty Manual of Seamanship 1951' had a different meaning for "cow hitch": viz. a reef *knot* structure formed between two *eye splices*, or between a *rope eye* and a hide becket (pp. 98, 228). This use was discontinued in later editions.

Comment [RGB55]: Another possible origin of the term *half hitch.*

Comment [RGB56]: Manwayring (1623) "*Marling*. Is a ſmall line of untwiſted hemp ... Alſo ... to make ſaſt the ſail to the bolt-rope with marling through the eyelot-holes is called marling the ſail."

Toss (2016) p 8 attributes the term to Vikings whose ships were held together substantially by tightened *lashings*.

Modern use tends to favour marline or even marlin, for the small stuff, the *hitch* and/or the spike.

Comment [RGB57]: No secure and non-*toggled knot* may be *jam*-proof after sufficient loading of stretchy *cordage*.

Comment [RGB58]: Early editions (1908-1941) of the 'Admiralty Manual of Seamanship' used the term in this sense, later editions continue the use for marling; and Ashley 1944 used it for *riding hitches* as defined here. Day (1947) observed the synonymy between *nip* and jam used in this sense.

Comment [RGB59]: Also spelled kernmantel by those who stand by the original German form (eg Merchant 2007). Both Edelrid and Edelweiss claim to have invented the construction in 1953. Edelrid coined the word *kernmantelsiel* in the 1960s and uses the anglicised form *kernmantle* in English-speaking markets.

friction. Both parts may contribute to other properties such as *rope* firmness and specific gravity. The outer layer typically contributes more to the overall *strength* of double-*braid ropes*.

As an example of the ways that *rope* construction can alter important practical properties, *kernmantle* rescue *ropes* are typically much less weakened than *laid ropes* by tight turns (eg over a carabiner) but *knots* that were long considered *secure* in *laid ropes* may prove less *secure* in similar applications with stiff *kernmantle* (eg the common bowline without added *locks*).

A **kink** is a small *loop* or tight change of *lead* in a *rope* that prevents it from passing through a *block*, and that may weaken the *rope* by damaging its structure, eg by causing a **hockle** or unintended displacement of the strands.

A **knot** is any useful complication in a length of *cordage*. A complication that is useless, especially if formed unintentionally, is commonly called a **tangle** or **snarl**. In historical usage, the word *knot* is sometimes reserved for button-like knobs, sometimes for structures made in small *cordage* that is liable to *jam*, and sometimes for functions other than *bends* and *hitches*. In present common usage, it is a generic term including all of these things.

Laid (or spiral-*laid*) *rope* is typically constructed from *fibres* (either natural or synthetic), which are twisted (spun) into yarns, which are twisted (formed) into strands, which are twisted (*laid*) into *rope*. In some cases, additional stages are employed (eg *rope* yarns may comprise multiple threads or twines, each comprising multiple *fibres*). The direction of twisting typically reverses at each stage for maximum stability of the *rope*, and in most current 3-strand (plain- or hawser-*laid*) *ropes* the final direction is a clockwise (or right-hand) helix of strands. This is also referred to as **Z-laid** *rope* because of the slant of the strands when the *rope* is held vertically. Left-hand (**S-laid**) *ropes* and 4-strand *ropes* are made for special purposes. Larger (cable-*laid*) *ropes* may comprise three hawser-*laid ropes* that are *laid* up together in the direction opposite to their own *lay*. **Hard-laid** *ropes* have tightly spiralled strands, whereas **soft-laid** *ropes* have gentler spirals; which can affect *rope* feel, *strength* and durability. All *laid ropes* show *chirality*. The direction in which an apparatus is twisted during *rope*-making can be ambiguous, unless it is specified whether the view is from the front or rear of a bobbin or *rope*-crank. However, the *chirality* of the resulting *rope* is unambiguous, and the same when viewed from either *end*.

> "**With the lay**" should mean with the same *chirality* as the *rope* (in the same direction as a worming (*ABOK* #3337) would be applied to fill the grooves between strands of an underlying *laid rope*). Unfortunately, the phrase has not always been used this way (Warner, 1996). It is open to further confusion if *ropes* with different *chirality* are used together, or when used in reference to multiple *loops* which differ in *chirality*. The phrase is not recommended where ambiguity may arise; in which case it is generally clearer to specify the desired *chirality*.

Many *ropes* constructed from *synthetic fibres* are of either *braided* or *kernmantle* rather than *laid* construction. These construction methods as well as the properties of the *fibres* affect many important properties, including the elasticity and surface friction of the *rope*. Modern *ropes* are constructed differently for various applications. Such *ropes* are typically amphichiral, so they are less likely to twist under load. Ideally, they should also be *coiled* differently from *laid ropes*.

A **lashing** is a binding made with *rope*. *Lashings* commonly involve multiple wraps of the *rope* (sometimes tightened by *fraps*). A distinction is commonly made between a *seizing*, made in *small stuff* around *cordage*, and a *lashing* made in *rope* around other objects such as spars. In a related usage, an object may be **lashed** down (by means of either *ropes* or straps passed across the object and secured to some underlying surface) to prevent movement (*ABOK* Chapter 28).

Comment [RGB60]: Warner 1992 makes this point, but modern *kernmantle ropes* vary in suitability for tight *turns*. *Kernmantle ropes* tend to (reversibly) flatten more than *laid ropes* in low-radius *turns*, so there is less force on the part of the *rope* on the outside of the *turn*. Tapes may be better than *ropes* because they have much less difference between the inner and outer diameter. When in doubt, assume ~50% *strength* loss at 1:1 ratio of *turn* : *rope* diameter. In testing of synthetic ropes, smaller diameter pins mostly give rope failure where it crosses the pin. At 1:1, failure is more often at the *eye knot* or the *splice* junction than in the region where the *eye* crosses the pin. See Hartter (2004) & www.treebuzz.com/forum/threads/bend-radius-for-ropes.7494/

The concern may be greater if the *rope* moves over the small diameter pin (like a pulley) for two reasons (i) the sliding of *fibres* across each other during *rope* movement and (ii) the full load on the *rope* on each side of a pulley (cf half load on each rope in a fixed *eye* around a pin). Most manufacturers specify at least a 3:1 or 4:1 ratio for pulleys.

Comment [RGB61]: Mathematicians interested in "*knot* theory" have different meanings from those used here for both "*knot*" and "*tangle*". Practical *knot* tyers work with (linear) *cordage*, and teach the importance of *dressing* and *packing* each knot. In contrast, "theoretical *knots*" exist in dimensionless closed curves (bands without *ends*) and generally they are kept loose to explore various "projections".

Comment [RGB62]: 4-strand *rope* with an additional centre-strand or heart is "shroud laid".

Comment [RGB63]: In a related, but sometimes conflicting usage, "a cable" may refer to a strong chain, *wire rope* or *fibre rope* used for purposes such as anchoring or mooring to a buoy; and "a hawser" may refer to a *rope* of a size and composition suitable for towing or mooring to a dock (berthing). Thus "hawse pipes" in a ship provide passages for anchor cables or hawsers, and a "foul hawse" is any tangling of multiple anchor cables or hawsers. Such uses varied over time (technologies changed) and with the type and size of the vessel being managed. A cable was also a unit of length: about 100 fathoms or 1/10 of a nautical mile. See also the comment under the entry for *rope*.

Comment [RGB64]: pp 188-189

The distinction between a *lashing* and a *knot* with multiple *turns* can be vague. For example, the "Hennessy hammock knot" uses multiple passes like a figure eight *lashing* around the *stand* to produce a result that does not *jam*, slip, or cause excessive wear under substantial loads in slippery *rope*. A "wedding knot" (*ABOK* #1513) is an elaborate *lashing* to join two *eyes*. A "loop lashing" (*ABOK* #1514, #2124) is a rope *tackle* commonly used with a single pass and also known as a trucker's *hitch*.

Lead is a reference to the direction of a *line*, often the *stand* or sometimes the *wend* where they exit the *nub* of a *knot*. This may be important in applications where the *knot* is required to pass, without snagging or undue resistance, through an aperture, through water, or over an obstacle (possibly in both directions). Reference to a *knot* having either a good or a poor *lead* is to be taken in the context of particular applications, though these are not always made explicit.

A **line** is a length of *cordage* (typically *rope*) that has some designated purpose.

A **lock** is a structure added to a *knot* in order to increase its *security*. Common *locks* include added *tucks*, *half hitches*, overhand *knots* or *seizings* that involve the *tail* of the underlying *knot*. Like their underlying *knots*, *locks* are a compromise between ease of making, ease of *opening* after a load, and duration of *security* against the conditions that threatened to loosen the underlying *knot*. The *knot* tyer must select which *knot*, and if appropriate which *lock*, to employ; depending on the characteristics of the *cordage* and the environmental conditions under which the *knot* is required to be *secure*.

Comment [RGB65]: The word '*lock*' has been criticised for a potential false implication of *security*. Synonyms in knotting include 'safety knot', 'backup knot', 'security knot' or (in some contexts) 'stopper knot' . These terms are open to similar criticism, and they lack the advantage of brevity. Whatever they are called, *locks* can come loose, especially with shaking while they are not loaded, so they need to be checked, frequently.

Some *locks* that *tuck* the *tail* through the *nub* of the underlying *knot* may give an added advantage through gentler curves of *bights* or *turns* within the *nub*, which may increase breaking *strength*, reduce wear on the *line*, or improve resistance to *jamming*. On the other hand, ill-considered *tucks* through the *nub* can compromise the beneficial structure of a *knot* or render it more susceptible to unintended *capsizing*.

A **loop** is a structure in which a *line* crosses once over itself. It may be argued that a *loop* is a special form of *bight*, but the terms are generally considered to be mutually exclusive (based on the absence or presence of a cross over). *Loops* are usually, but not necessarily, approximately circular. They can be clockwise or counter-clockwise, and they can be underhand (with the *wend* passing under the *stand*), or overhand (with the *wend* passing over the *stand*). As the start of a helix, a *loop* has *chirality*. A clockwise overhand *loop* (or a counter-clockwise underhand *loop*) has left-hand (S) *chirality*. A clockwise underhand *loop* (or a counter-clockwise overhand *loop*) has right-hand (Z) *chirality*. *Knots* with a single *loop* (such as a common sheet bend or a bowline) can be made in right-hand or left-hand *chirality*. There is commonly a mixture of *chiralities* in multi-*loop knots*. Structures that are initially cast as *loops* can be the basis for *coils*, *turns* or *half hitches*. In such forms, they are fundamental to the structure of many *knots*.

In *knotting*, *loops* are generally closed: with the arms in contact with each other at the point of crossing. A *loop* may be open: if a projection of the structure shows the *line* crossing even though the arms are not in contact with each other at the projected cross-over. This open state exists eg while a *turn* or *half hitch* is *capsized* to transfer it between *lines*. It may be a dangerous condition as an early stage in the process of *loop*, *turn* or *half hitch* straightening, which can eg convert the *fixed-eye* bowline knot (*ABOK* #1010) into a *noose*.

The term "loop knot" or simply "loop" historically has been used for *knots* that provide a useful bight of *cordage*, including *nooses* and fixed *eye knots* (*ABOK* #33). This historical usage is superseded in common current use by the term *eye knot*.

The term "loop" historically has been applied to any curve narrower than a semi-circle in *cordage* (*ABOK* #31, #32), or to a curve in which the ends neither touch nor cross (Warner 1992, #5D). These historical usages are superseded in common current use by the term *bight*.

It is important to make the correct "translation" from these differing historical uses of "loop", to avoid confusion between them and the current structural definition. Fortunately, the meaning is usually obvious from the context of usage, especially if illustrated.

Nip is pressure exerted by a *line* on itself or on another solid with which the *line* intersects. There is historical use of the nip as "the spot within a knot where the end is gripped and is thereby made secure" (Ashley, 1944), which helps to explain some discussion of *knots* with "good nip" vs "poor nip". But in most *knots*, *nip* is exerted over a considerable distance; which varies depending on the characteristics of the *cordage*, the *dressing* of the *knot*, and the force on the *line*. The wider definition best fits this reality.

In this context, a **nipping turn** is a *turn* that exerts pressure on a *line* (or *lines*) that it encloses, thus creating friction that is relevant to the *security* of the *knot*. *Nipping turns* are often *half hitches*. They may be uni-loaded (as typically experienced during use of a sheet bend *ABOK* #1431); or bi-loaded (as typically experienced during use of a bowline *ABOK* #1010, or a reeving-line bend *ABOK* #1459). When a *nipping turn* is bi-loaded, tensions on the arms may be equal (as often experienced in reeving-line bends), or unequal (as often experienced in bowlines). Because they are so important in *knotting*, *nipping turns* have been given various names such as TurNips or cuckold's necks, particularly in relation to bowlines. "Nipping loop" has also been used, but is not recommended because the function always requires a *turn*. The term is sometimes restricted to *turns* that are bi-loaded, but this restriction is not recommended because the type of loading commonly varies depending on the characteristics of the *cordage*, the *dressing* of the *knot*, and variable environmental conditions that cause various directions and magnitudes of force within the *knot*.

The **nub** or **core** of a *knot* is the region in which friction exists that is relevant to the *security* of the *knot*. In many cases, this is the entire *knot*; but in *eye knots* the *nub* may be distinguished from the *eye* which emerges from it.

To **open** or **loose** or draw a *knot* is to untie it. A *knot* that unties completely is said to **spill**. Sometimes this is done by deliberately *capsizing* the *knot*.

An *eye knot* is **PET (post eye tiable)** if it can be made with the *eye* around a post, without accessing either end of the post and without needing to form a preliminary *knot* before passing the *line* around the post. For example, a common bowline (*ABOK* #1010) is PET whereas an angler's loop (*ABOK* #1038) and a figure eight loop (*ABOK* #1047) are not. *Eye knots* that are not *PET* can still be tied around a post (or through a closed ring in a climbing harness) by weaving the *wend* through a preliminary *knot* (eg a thumb knot or figure eight knot made in the *stand*).

Reeving is the passage of a *line* through an aperture in a solid, eg a pulley *block*, a thimble, a grommet in a tarpaulin, or a cringle on a sail. The term is often used to imply multiple passages, such as passage over multiple pulleys in a *block*. It is sometimes used to refer to the passage of a *line* through an aperture between other parts of the same *knot*, during the making of the *knot*.

Comment [RGB66]: Some historical references distinguish *loops* from *turns* (around solids) as recommended here.

Comment [RGB67]: *Nip* sometimes is used instead of *nub* as defined below.

Comment [RGB68]: p 601

Comment [RGB69]: Day 1947 calls it that, though 1800s seaman-ship manuals sometimes use cuckold's neck for the *bight* within the *nipping turn* of a bowline. Warner 1992 p161 oscillates between these two meanings for "gooseneck". In *ABOK* #3406 a "cuckold's neck" is a form of *seized eye*.

Comment [RGB70]: Asher (1989) sometimes used 'break' for untie, but this is not recommended as the word is commonly used in other contexts eg breaking *strength.*

Comment [RGB71]: Tiable is correct according to the rules for spelling in English, although tieable is also in use. Robert Chisnall (*KM* 48, 29-34 in 1995) used "pre-bight "versus "post-bight" to distinguish *knots* (like the rewoven Fig. 8) requiring a structure to be formed before making the functional *loop*, *eye* or *turn* (eg before passing the *wend* through a climbing harness) versus those (like bowlines and rolling *hitches*) that can be tied entirely after the functional *eye* is made. The concept was further clarified, with particular reference to tie-ins, in *KM* 90, 14-20 and *KM* 91, 18-21 in 2006. Chisnall argued that to maximise *security* there should be a knot in the *stand*, before passing the *wend* through the harness, after which the *wend* must be *knotted* (more than a *bight*) and sufficient-ly entangled with the *knot* in the *stand*. Later, Constant Xarax in the IGKT forum argued that it can be dangerous to necessitate untying of a separate *knot* after releasing the *eye*. White-water boaters certainly are particular about the absence of *knots* in anything that might become a trailing *line*.

A **riding hitch** is formed when one *turn* of a *line* lies in the groove or notch created between an underlying *turn* (usually a *half hitch*) and a solid around which it is cast. This creates enhanced friction, and a stabilising inflection if the underlying solid is a similar *line*, as in the form of the rolling hitch illustrated as *ABOK* #1735, #1799, #1993. This may be distinguished from **riding turns** that can be added as a second layer in *whippings* or *seizings* (*ABOK* #3364), and that should never be pulled through the primary *turns* to contact the underlying solid.

Ring loading, or pulling the arms of an *eye knot* apart at the *nub*, is potentially dangerous in many *eye knots* unless they are appropriately *locked*. It can cause a common bowline (*ABOK* #1010) to *spill* through tail slippage; or a figure eight loop (*ABOK* #1047) to flip, potentially repeatedly until the knot *spills* at the end of the *tail*. Note that the angle between the arms increases as an eye is tightened down onto a ring, and this also increases the force on each arm. For eye splices, manufacturers specify that for dimensions within the eye, L should be at least 3W, and thimbles are generally manufactured to comply with this ratio.

A **rope** is a type of *cordage* that is constructed by twisting or plaiting *fibres*, often in several stages, so that they will remain together in use (provided the *ends* are *whipped* or otherwise secured against raveling). The *fibres* may be either natural or synthetic. Typically *rope* is approximately round in cross section, in contrast to straps of webbing **tape,** or to sheets of woven **fabric**. To be called *rope*, the *cordage* must generally be at least 6 mm in diameter (much larger in some professions). *Cordage* of smaller diameter has been called **small stuff**, cord, string, twine, yarn, or thread. **Wire cable** is constructed primarily from continuous wires that are twisted into strands, then laid into larger sizes of "wire rope". Steel *wire cable* (or "wire rope") is strong, low-stretch and durable, but generally too stiff to be useful for *knotting*, other than *spliced* terminations. In some applications it has been substituted by *synthetic-fibre rope*.

Security of a *knot* is the resistance of the *knot* to slippage under load, to changing shape (*capsizing*) into a form more prone to slippage, and to loosening (or eventually coming apart) under adverse conditions that may be encountered in the intended use of the *knot*. Adverse conditions include eg cyclic loading, *tail* loading, or ring loading of *eye knots*. *Security* of any *knot* depends on the material in which the *knot* is tied as well as the conditions in which the *knot* is used. The term stability is sometimes used as a synonym for *security*, or for some components of *security* as defined here. Related concepts include the amount of variability between multiple tests of a knot, the ease with which a knot flips into a less secure form, and even the existence of similar-looking knots that are insecure. Any of these concepts may be found bundled under a reference to 'reliability' or 'trustworthiness' of a knot.

A **seizing** is a binding made of *small stuff* and holding together multiple *lines* or parts of the same *line*. This can be an excellent, though sometimes too slow, method to increase the *security* of a *knot* by holding the *tail* to another part of the *knot* (eg *ABOK* #1011); as an alternative to a *lock* made from the *tail*. *Seizing* may also improve the *lead* of a *line* as it enters a *knot*.

A *knot* is **slippery** (or a slip/slipped *knot*) when the *tail* is passed back through the *nub* in such a way that a pull on the *tail* will cause the *knot* to *spill* (come undone). The simplest example is a slippery overhand knot (*ABOK* #529). Note that if *the standing part* rather than the *tail* is pulled into the *knot* to yield a *bight*, the result will be a *noose* or running *eye knot*. Some *nooses* will *spill* if the *standing part* is pulled (eg *ABOK* #1114), but others will not (eg *ABOK* #1124). In either case, it is important to consider whether an object might be trapped in the sliding *bight*, as in a snare.

Comment [RGB72]: Ashley 1944 says the 2nd turn of a rolling hitch is "jammed" (#1730), though it is not *jammed* in the usual sense. He has the 2nd *turn* "crossing" the 1st in grapevine-like structures (#1233); "crossing turns" for "frapping turns" in *seizings* & hanks (#147, 3089-90, 3365 vs 3371, p 598); and "cross turn" for intersections at various angles (#2083, 3305). Warner 1992 shows no *seizings* with more than one layer of *turns*. He uses "riding turn" for both of the 1st two above (#9D & pp 174-5); "frapping turns" (#11) for *lashings* & *seizings*. He does not use "cross / crossing turn". Toss (1990) uses "crossed round turn" for what Warner calls a "riding turn".

Comment [RGB73]: As in a traverse or an anchor attachment.

Comment [RGB74]: Raveling is correct according to rules for spelling in English (Peters 1995 p 430), although ravelling is also in common use (especially in the UK recently). Unravel & unloosen are unusual as words with a zero-value "un" prefix. Smith 1627 "to sease the ends of ropes from raveling out". Manwayring 1623 has "farsing". Ashley 1944 discusses stopper *knots* vs raveling (#514) and notes that both ravel & unravel mean fray. Bram Stoker 1902 *The Mystery of the Sea* uses "ravelled".

Comment [RGB75]: "Cable" has also been used for various constructions of strong *ropes* or chains (eg anchor cables) & for insulated conductors of electricity. The distinction between "*rope*" for fibrous *cordage* & "chain, cable or wire" for constructions of metal is not universally maintained.

Comment [RGB76]: Galvanized steel is common, but other metals are used to suit the purpose of the resulting cable. Fibrous cores within and between strands may serve for internal cushioning and lubrication of wires.

Comment [RGB77]: Stability is sometimes distinguished as resistance to undesirably changing shape vs security as resistance to slipping. One may lead to the other. It may be dangerous for a fixed *eye* to *capsize* into a sliding *noose*, even if it does not *open*.

Comment [RGB78]: eg granny vs reef data in table S2 of Patil 2020; whatnot variants near *ABOK* #1407; evil imposters.

Comment [RGB79]: *Slippery* is probably the better term. Slip (p.t. slipped) is also used for other meanings including slide and *spill*, and its intended meaning is not always clear from the context.

A **splice** is a kind of *knot* in which a part of a *rope* (such as a strand from a *laid rope*) is *tucked* into the structure of the same or another *rope*. Very strong and *secure* joins can be made through *splices* that include a sufficient length or number of *tucks*. Common examples in *laid ropes* are eye splices (*ABOK* #2725), short splices (*ABOK* #2635) and long splices (*ABOK* #2692). The proliferation of *braided* constructions in *synthetic-fibre ropes* has been matched by a proliferation of *splices*, each designed to function best in a particular *rope* type.

The **standing end** of a *line* being *knotted* is the *end* which need not be accessed to make the *knot*. It may be fixed to some large structure, or distant from the *knot* tyer.

The **standing part** (**stand** or SPart) is the part of a *line* between the *standing end* and a *knot*. The term is commonly used in reference to the region just before the *line* enters the *knot*, and in this sense there are as many *stands* as there are *knots* in the *line*. A distinction is sometimes made that the *stand* is worked on, while the *wend* is worked with, during the making of a *knot*. However, some *knots* (including most *eye knots*) cannot be made while a load exists on the *stand*. Moreover, the *stand* is sometimes worked with (eg in casting *half hitches* after making a timber hitch *ABOK* #1733). Another distinction is that after the *knot* is made the *stand* is intended to bear a load, whereas the *wend* or *tail* may not be intended to bear a load without *capsizing* or *spilling* the *knot*. In this sense, *knots* that are *tied in the bight* then loaded from both ends may have two *stands* and no *wend*.

To **stop** is to apply a temporary *seizing* or *whipping*, eg a constrictor knot (*ABOK* #3441), or several rounds of adhesive tape (*ABOK* #3402).

A **stopper** or **knob knot** may be tied in the *end* of a *line*, eg to prevent it from raveling; or it may be tied in any part of a *line*, eg to prevent passage of the *line* through a *block*, *eye* or other opening. *Stopper knots* may be single-stranded *knots* such as the overhand knot (*ABOK* #514) or the figure eight knot (*ABOK* #520). In *laid ropes* they may be multi-stranded *knots* such as the Matthew Walker (*ABOK* #681). Sometimes such *knots* are tied with a largely or purely decorative function, for which they have been elaborated to a great extent.

Strength of cordage is generally taken as the minimum strain under which the *cordage* will rupture or break. Because it is very difficult to be sure of a minimum (given variations of uncertain location that are unavoidable in the manufacture of the *cordage*), the *strength* is sometimes specified statistically, as two or three standard deviations below the average breaking strain from a considerable number of tests conducted on the same batch of *cordage*. *Cordage* should always be used well within a *safe working load* which will only be a fraction of its nominal breaking strain (see below).

Strength of a knot can be expressed as a percentage of the breaking strain of the *cordage* in which it is made. It is generally agreed that all *knots* weaken the *cordage* in which they are made, and well-made *splices* weaken the *cordage* least. Sometimes *knots* are tested in pairs, to see which will break first as tension on the *line* is increased. Difficulties arise because the results depend on the precise conditions of the test. For example, there can be profound differences at different temperatures or humidities, with tensions applied in different ways (notably static or dynamic loading), and with age or diameter of the same type of *cordage*.

Different types of *cordage* respond differently to key breakage risks: eg heat from friction during *knot* slippage, or tight curves in a *line* under load. There may be variation in twists

Comment [RGB80]: The original user seems to be Desmond Mandeville, in relation to trambles, detailed in 1987 (*KM* 19, 13). He must have used it before 1985 (see *KM* 11, 22). Later, Mandeville uses both terms for *ends* (*KM* 24,11), as does Budworth (pp 306, 315 in Turner & van de Griend 1996), perhaps because trambles are generally practised with short lengths of *rope*. van der Griend uses "stend" perhaps to distinguish *standing end* from *part*, or perhaps from misreading of "*stand*" (*KM* 50, 16-18 and p 139 in Turner & van de Griend 1996). Chisnall 2010 states that according to norms established by IGKT: A '*wend*' is a working end employed to tie a knot. The '*stand*' is the *standing part* or long, unknotted portion of the *rope* or cord. See the caution / comment on **Wend**.

Comment [RGB81]: SPart was probably first suggested by Dan Lehmann in the IGKT Forum. It has the disadvantage of a peculiar capitalisation, and spart is the transliteration of a Greek word for rope (Williams 2005). Other Greek words for rope include stroph and tethrios; and those for knot include hamma, helos and strangalis. In Latin, it might be chorda, linum, funis or sirilium for rope; and nodus or ligare for knot. It is curious that the French "nœud" contains what linguists call a ligature (œ). "Rope" descends from Proto-Indo-Euro "roypnós", along with cognate words such as old Dutch "roop", Scots "raip" and Swedish "rep".

Comment [RGB82]: Curiously in such cases, the *stand* does stand (still) while the *wend* ... wends its way around the *stand*.

Comment [RGB83]: eg, it is open to interpretation (while tying) whether a sheepshank has (a) two *wends* (with the *bights* providing the *stands*) or (b) two *stands* that are used in the casting of *half hitches* over the *bights*. I agree with Lever 1808 that (b) is the better description.

Comment [RGB84]: The 'Admiralty Manual of Seamanship' has an unrelated use: '**stoppering** a hawser' meaning (temporarily) relieving the load. Similar to **jiggering (**with a tail jigger *tackle*); or **nippering** (to a messenger *line*, once mostly undertaken by boys). See also *lock*, and *ABOK* #1464, 1751-1758, 1765-1770 (*dogged stoppers* that can be *stopped*); 3229-3230 (jiggers); 3118-3121 (nipper men and boys). '**Jigger**' has also been used for an arrangement of *tackle* and *rope* clamps used in modern rescue rigging (Merchant 2007).

imparted as the *knot* is tied, even with attention to *dressing* (Long et al, 2001). As discussed by Warner (1996), it is expensive to make enough tests to obtain a reliable measure of variability, under even one specified set of conditions. To deal with these problems in practice, *cordage* is generally used well within its **safe working load**, which for new *cordage* is commonly taken to be between 1/5 and 1/10 of the minimum breaking strain. When used this way in the field, it is very rare for *cordage* of quality manufacture to break at a properly-made *knot* that is well suited to the particular application. It is much more common for failure to occur at a *knot* that is poorly made, or used outside of its design parameters; or for *cordage* to fail if it becomes chaffed (eg by rubbing over a sharp edge), or excessively heated (eg by friction in some *synthetic-fibre ropes*), or it has been weakened by prior stress or chemical exposure. Because of these issues, *security* is generally a more important consideration than *strength* in selection of *knots* by climbers using appropriately certified ropes. In contrast, *strength* may be as important as *security* in selection of *knots* by anglers engaged in light-weight fishing.

A **tail** is a *working end* that protrudes on completion of a *knot*. Because many *knots* can slip a little during tightening or under load, *knot* tyers are commonly urged to make the *tails* long enough to obtain reasonable *security*. How long this should be is moot, but one "rule of thumb" is that *tails* should at least be long enough to make a thumb knot. *Tails* are generally shown much shorter than this in illustrations of *knots*, in order to show as much detail as possible in the *nub* of the *knot* while distinguishing the *stand* from the *wend*. *Hitches* typically have only one *stand* and one *tail*, whereas *bends* typically have two *stands* and two *tails* on completion; but there are exceptions in more complicated members of these functional *knot* classes.

When two parts of a line emerging from a *knot* are not readily distinguished by length, the part which receives, or is designed to receive, the greater load is called the *standing part* and the other part may be designated as the *tail*. Some *knots* are not designed to receive any substantial load, or particular directions of load, on the *tail*; and may *capsize* if inappropriately **tail loaded**. If a knot is *secure* with a load on either the *stand* or the *wend* (as distinct from an equal load on both), it is said to be **either end loadable** (**EEL**). For example, a ring hitch (*ABOK* #1859) is *secure* when equally loaded on both ends, but it is not *EEL*. A figure eight loop (*ABOK* #1047) is EEL; though the knot *strength* may differ with the end loaded, depending on the *dressing*.

The *tail* is sometimes referred to as the end, the tag end (especially in fishing *line*), the fag end, the bare end, or the bitter end. The latter term is sometimes said to be derived from the experience of holding the *end* of a *line* under load without being able to secure it, or having an *end* slip back through a *knot* to release the load prematurely; but according to Ashley (1944) it applies to the inboard *end* of a (mooring, towing or anchor) cable abaft the bitts (*ABOK* #1660). These latter terms are not recommended as synonyms for *tail*, because they are also used in other contexts that may cause ambiguity.

A *knot* is **TIB (tiable in the bight** or on the bight**)** if it can be made without use of the *ends* (it can be tied even if the *line* stretches to infinity). This is sometimes important if a *knot* is to be made in a *line* of great length, or if the *ends* are already secured to a large structure that it is impractical to move the *line* around. It sometimes provides a fast way to cast a *knot* (eg a clove hitch over a bollard). As a general rule, any *knot* which can be *opened* (untied) fully without involving the *ends* is also *TIB*. But discovering the manoeuvres to form the *knot in the bight* can be quite difficult, as in some complex bowline derivatives.

Very few *knots* are simultaneously *PET* and *TIB*. A possible example is the triple bowline (Warner 1992, #435), if the 3rd *eye* is used to form a *lock* and not required to enclose the "post". It is sometimes used this way by mountaineers wishing to secure the middle of a climbing *rope* directly to a harness. It may be argued that this knot is tied *with a bight*, rather than *in the bight*.

Comment [RGB85]: p 187 et seqq. See also Chisnall, *KM* 49, 13-17.

Comment [RGB86]: Climbers (and rescue workers) are also generally interested in the ease with which a *knot* can be unambiguously distinguished, by quick visual inspection or feel, from a mis-tied *knot* which might fail with lethal consequences. Sport climbers may also be interested in the ease with which a *knot* can be *opened* (untied) after severe loading from one or more falls. Other groups of users, such as racing yachtsmen, arborists or cave rescue personnel, all have priorities that reflect their different needs and conditions of use.

Comment [RGB87]: *Knot strength* is an issue for rescue workers in situations that put lines under very high tension: eg traverses, and when hauling a rescue load (200 kg) with a winch or high mechanical advantage over high-friction deviations. In these situations they will prefer a tensionless hitch or a figure 9 *end loop(eye)* to the load and anchors, and a triple grapevine *bend* if *ropes* must be joined, even if it will *jam*.

Comment [RGB88]: See also Manwayring (1623) p 9.

Comment [RGB89]: eg Seattle Fire Department Training Division (2009) uses bitter *end* as a synonym of *standing end*. Merchant (2007) uses it for 'the end of a rope tied to an anchor', and opines that the term arose from a dockside bollard. Leslie (1890) gives other figurative uses in *Old Sea ... Words*.

Comment [RGB90]: Acronyms *EEL*, *PET* and *TIB*, and even some of the underlying terms or concepts, may have arisen in the IGKT forum. It is difficult to be certain of first usage. Eg Ashley (1944) writes of *knots* that "are suitable for pull exerted at either or both ends" (p 188) and *knots* "tied in the bight" (pp 12, 32, 87 etc).
The *PET* abbreviation is often attributed to Dan Lehman. He attributes the concept to Robert Chisnall (https://igkt.net/sm/index.php?topic=5254.msg34859#msg34859). Probably this refers to Chisnall's differentiation of "post-bight" (bowline) versus "pre-bight" (figure 8) *loop/eye knots* based on the first required knotting action: *KM* 48, 29-34 in 1995; or *KM* 90, 14-20 and *KM* 91, 18-21 in 2006. The concept was later explored at great length in the IGKT forum.

Comment [RGB91]: Cox & Fulsaas (2003) p 144

A **toggle** is a short length of a rigid solid. The material is commonly a hard wood, although suitable plastics or metals may be used. The *toggle* is generally approximately round in cross section, about the same diameter as the *cordage* with which it is used, and of a length in the order of ten times that diameter. A *toggle* may be secured to the *end* of a *line* so that it can be passed through an *eye* as a quick and reversible way of securing two *lines* or other materials (eg *ABOK* #1929, #1936). Alternatively, a *toggle* may be inserted into a *hitch* or *bend* that includes an *eye* or a *bight*, to provide an attachment that is *secure* under load, but able to be *spilled* quickly by removal of the *toggle* (eg *ABOK* #1521, #1524, #1914, #1919, #1921). In some cases, a *toggle* is used to reduce the risk of *jamming*, rather than as a way to quickly *spill* the *knot* (eg *ABOK* #1522). *Toggles* are sometimes grooved, tapered, and/or attached to lanyards or trip *lines*, according to their applications. A marlingspike (marlinespike), fid or carabiner is sometimes used as an improvised *toggle*.

Topology is in part the study of interconvertible structures. It can be a complex mathematical problem to determine whether structures are topologically equivalent, but it is fairly easy to work *knots* into interconvertible forms. At one extreme, all *TIB knots* are interconvertible without using the *ends*, but most *knot* tyers would not argue that they are all the same *knot*. Ashley (1944) argued that even identical structures that are tied in a different way or used for a different purpose are different *knots*. Most *knot* tyers would not go that far. But if the same passage of *cordage*, with different *dressings* yields structures that have different useful properties (such as different *security* in their intended uses) these structures are generally regarded as different finished *knots*. *ABOK* #488 vs #1434 is an interesting example: the former *dressing* is rarely shown for a double sheet bend, but its structure is more *secure* in some testing.

Finding a term to describe *knots* of equivalent finished form is challenging, because words like 'equivalent' and 'similar' have other meanings in *topology*, geometry or general use. Similitude is a term used in geometry for shapes that can be obtained from one other by uniform scaling; allowing also for translation, rotation and reflection. If we add in knotting an allowance for different degrees of tightening; and for differing sizes and shapes of lines, eyes, and underlying solids; we might use the term '**similitudinous *knots***', though it is a bit of a mouthful. Equivalent '***knot* structure**' has also been used in a general sense for this concept.

A **tuck** is a passage of one strand or part of a *rope* under another (as in a *splice*), or one section of a *line* under another in any *knot*. *Tucks* confer *nip*. Extra *tucks* are sometimes added within or outside the *nub* of underlying *knots*, as *locks*. Ill-considered *tucks* can compromise the structure of a knot. The *tail* of a *knot* or a *lashing* is sometimes *tucked* to reduce the risk of it becoming snagged, or loosening through flapping in the wind.

A **turn** is a single *loop* of *cordage* around a solid. The solid may include eg a pole, a spar, a ring, a hook, or a *line*; even the same *line*. The *stand* and the *wend* of a *line* that forms a *turn* around a solid will lie opposite each other (at about 180º). A **round turn** comprises between 1.5 and 2 consecutive *turns*, so that the *stand* and the *wend* of a *line* around a solid are alongside each other (at about 360º). *Turns* are frequently used to create friction between a *line* and a solid, in order to control a load on the *stand* of the *line*. This usage in *knotting* is a sub-set of the meaning of turn outside of *knotting,* which can refer to any change of direction. A *turn* can be open (with no contact between the arms), or closed (with contact between the arms at the point of crossing). A closed *turn* with *nip* between the crossed arms is a *half hitch*. **Crossing turns** pass over one or more underlying *turns* at an angle, as in the grapevine form of multiple thumb knots. **Frapping turns** or **fraps** pass at an angle close to 90º; over multiple *lines*, or *turns* in a *seizing*, or wraps in a *lashing*; which they serve to tighten.

Comment [RGB92]: Manway-ring: "*Marling-ſpeek*. Is a ſmall ſpeek of Iron, made of purpoſe for the ſpliſing together of ſmall ropes, and alſo to open the bolt ropes when they ſew in the ſail." Smith: "The marling spike, is but a small peece of iron to splice ropes together, or open the bolt rope when you sew the saile."

Comment [RGB93]: Also spelled karabiner, especially in Europe. The German (karabiner-haken) and Italian (carabiner) terms derive from devices on straps of rifles (including short rifles known as carbines) around 1900. Light cavalrymen have been called carabiniers or equivalent since the 17th century. Climbing use and innovation followed WWI.

Comment [RGB94]: pp 9, 10, 18

Comment [RGB95]: Seaworthy in the IGKT forum, https://igkt.net/sm/index.php?topic=4937.0

Comment [RGB96]: This is what we mean when we say that we have learned to tie a particular *knot* (which we can then tie in *cordage* of any size).

Sheet *bends* joining *lines* of the same or different diameters are *similitudinous*. Common bowlines tied in hand, over a pile or through a ring are *similitudinous*. Some *knots* change in shape as they are tightened: eg in a direct sheet bend the *tail* of the *bight* moves across the *stand* under load. All stages of tightening a finished knot are *similitudinous* but they may not have the same contact geometry.

In contrast, some *knots* have alternative shapes conferred by *dressing*, eg by crossing of *turns* in a rolling vs tautline *hitch*. Some *knots capsize* into different shapes under aberrant loadings. Such alternative shapes are incidentally likely to differ in useful properties. They are *topologically* equivalent but not *similitudinous*.

Hydraulic and aerospace model engineers and some philosophers use the word in a slightly different sense.

Comment [RGB97]: These are the angles between the directions of the *stand* and *wend*. They are not the degrees of rotation through which the *rope* has passed to form the *turns*, which are larger by 180º (ie *turn* = 360º and *round turn* = 540º of rotation by the *rope*). Although the difference is clear and the terms are long-established, even respected authorities sometimes mistakenly refer to a *turn* as a *round turn*. See the comment with the introductory fig.

Comment [RGB98]: See also *riding hitch*.

Passing a *line* in a **U-turn** behind a solid has been called a turn (*ABOK* #1595; Warner 1992, #9A), but this usage is not recommended (it is a fraction of a *turn* in the recommended use; a *bight* rather than a *loop* of *cordage* around a solid). Thus *ABOK* #1595, #1613, #1614 may be described as a *U-turn* and *half hitch* on a cleat or pin.

Although the distinction between *loop* and a *turn* is clear-cut (based on the presence or absence of a solid), there is a continuum of angles from a slight deviation over an anchor point to a tensionless hitch with multiple *turns* around a solid. Rather than argue over the angles at which a deviation in *cordage* becomes a *U-turn,* or a *turn* becomes a *round turn*, it seems best to use a few extra words to describe the structure if it is important.

The term turn has sometimes been applied to any a structure in which a *line* crosses over itself (*ABOK* #40-#42; Warner 1992, #5E). This is superseded in common use by the term *loop*.

A **whipping** is a *seizing* (or for temporary purposes a *stop*) applied at the *end* of a *line* to prevent it from raveling (*ABOK* #3442-#3462).

The **working end** (**wend**) or running end is the *end* of a *line* used during the making of a *knot*. On completion of the *knot*, the *working end*, unless hidden by *tucking* in the *knot*, becomes the *tail*. Caution: some arborists, climbers, cavers and rescue workers use these terms with different meanings; notably working (anchored) and running (free) ends when ascending or abseiling.

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The introductory figure is modified from images believed to be in the public domain and first depicted by Natural Disaster Organization, Australia (1984) and Ministry of Defence, Britain (1908-2015).

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Comment [RGB99]: A *round turn* plus *turn* (900º of rotation by the *rope*) has been called "two round turns", contradicting simple interpretation. Fortunately that structure is rarely encountered now, except as an intermediate (followed by further *turns*) in forming a tensionless *hitch* (Warner 1992 p 227).

Comment [RGB100]: To confuse matters further, when anchor cables cross (a foul hawse), then form an elbow, then a *turn*, the latter is called a *round turn* (Falconer 1815 p 187 & Plate XI). The next level of complication is called a *round turn* and elbow. Ideally, for consistency with knotting, these would be called a cross, elbow (or U-turn), *turn* and *round turn*. But it looks different when equal cables are both involved in a foul hawse, so probably the best we can hope is that context makes the usage clear.

Comment [RGB101]: *ABOK* #1938 attributes the derivation to the protection against raveling of reef points (*lines*) subject to whipping (flapping with a whip-like action) in the wind. For pointing, see *ABOK* #3548-#3570.

Comment [RGB102]: eg Jepson (2000) pp 25, 40, 53, 69. The distinction seems most important in dynamic double *rope* climbing systems, but it is also used with static and single *rope* systems; eg Padgett & Smith (1987) p 36; Phillips (2014) pp 41, 85 (on p 41 "standing end" seems to be used as a synonym of "running end" in rappelling); NFPA (2014) Chapter 9 & Glossary. In another use with ropes: *standing*, running, and hauling parts are sometimes distinguished in **tackles** eg in the 'Admiralty Manual'. Barnes ('Anglers' Knots ...' 1951) makes different use of many terms.

Comment [RGB103]: The use of "#____" seems to commence with Mandeville in *KM* 24 (1998), though there was inconsistency in use of a space after #. Previously, use of "Ashley's No. ____" was most common in *KM*. First use of ABOK seems to be by Lehman as "Ashley's ABOK" in *KM* 66 (2000), then Smith as "*The ABOK*" in *KM* 73 (2001). "ABOK #____" was used along with just #____ by both Chapman and Lehman in *KM* 74 (2002). ABOK #____ was used consistently by Dickey in *KM* 87 (2005), but not by others: eg Butterworth used A#1208 and ABOK◇1208 in *KM* 98 (2008). Most contributors to *KM* settled on ABOK #____, until the italicised *ABOK* #____ was used from *KM* 133 (likely an innovation of Maurice McPartlan in his 3rd issue as editor-in-chief).

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Principles that guided the compilation of this glossary

1. The primary purpose is to allow concise communication about practical knot tying, without creating ambiguity for readers.
2. (a) Traditional meanings are preserved unless there is a compelling benefit in overall clarity, including the removal of ambiguity, from refinement or alteration of a traditional usage.

   (b) Some "traditional meanings" vary depending on the tradition and time period to which one refers. Sometimes the traditional boundaries are unclear (as discussed by Day, 1947). Sometimes they are inconsistent even within the same authoritative work (eg the uses of "bight" in the tying instructions for "loop knots", compared with definitions elsewhere in *ABOK*). In such cases a clear, logical and unambiguous terminology is paramount.
3. The meanings of terms should not conflict with simple interpretation of the words comprising those terms. Any exceptions are long-used traditional terms with widely-accepted meaning to knot tyers (established jargon of the art).
4. Where usage has changed over time, the glossary indicates important historical meanings, in cases where this is likely to reduce confusion or ambiguity in usage moving forward.
5. While remaining concise, the glossary includes examples or elaborations that seem necessary to provide clarity of intended usage for practical knot tyers.
6. Terminologies used in decorative knotting, Turk's heads, trambles and knot-related areas such as netting, macramé, lace work, weaving and mathematical theory are covered only to the extent that they overlap with the terminology of "practical knot tying".